ATTACHMENT 1 2024 ASSET MANAGEMENT PLAN

Asset Management Plan 2024

Prepared by TRCA

September 2024

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Section 1:

EXECUTIVE SUMMARY

SECTION 1: EXECUTIVE SUMMARY

Toronto and Region Conservation Authority (TRCA) is undertaking an Asset Management Program to manage our assets effectively and efficiently. This will allow the organization to deliver satisfactory levels of service to the public, as well as our municipal and provincial partners. The Asset Management Program will also helping us make informed decisions and to work with our funding partners to ensure the sustainability of our land and infrastructure to meet the demands of the future.

TRCA owns and operates a substantial portfolio of assets across different service areas. These assets are essential to the well-being of the community and form an integral part of TRCA's long-term financial and service delivery planning.

In keeping with the direction from the Ontario Minister of Infrastructure to municipalities via O. Reg 588/17, TRCA prepared an Asset Management Policy to outline the principles that will inform TRCA's Asset Management Program. These principles will ensure that asset management will be customer focused, regulatory driven, sustainable, and based on all lifecycle activities required to keep our infrastructure in a state of good repair.

TRCA has developed its first Asset Management Plan in alignment with O. Reg 588/17 to ensure that infrastructure assets are managed based on a decision model that maintains current levels of service in the most cost-effective manner.

Additionally, under Mandatory Programs and Services Ontario Regulation 686/21, conservation authorities are required to have Asset Management Plans in place for all water and erosion control infrastructure by December 31, 2024. This Asset Management Plan will also meet the requirements of this regulation.

With respect to the structure of this Asset Management Plan, Sections 1 through 5 outline the foundations of general asset management planning, whereas Sections 6 – 12 outline TRCA's application of those foundations.

1.1 Component of the Asset Management Plan (AMP)

TRCA's Asset Management Plan is a strategic document that describes the state of TRCA's assets and the approach to managing assets over their lifecycle to achieve desired levels of service. This asset management plan incorporates the following asset management principles:

- Aligning with the Provincial regulatory landscape, meeting the requirements of O. Reg 588/17 and 686/21.
- Understanding the current state of the infrastructure systems and demonstrating responsible management of the asset portfolio.
- Measuring and monitoring Level of Service (LOS) metrics.
- Ensuring TRCA's infrastructure system meets expectations and demonstrates that Levels of Service are being met in an effective and efficient manner:

- Demonstrating that due regard is being given to the long-term stewardship and sustainability of the asset base via full life cycle costing and project planning.
- Determining the optimal costs of the asset lifecycle activities required to ensure the infrastructure systems provide service levels that meet community expectations.
- Establishing a financial strategy to fund the expenditures that are required to complete the optimal lifecycle activities and communicate and justify funding requirements.
- Demonstrating a Risk-Based Perspective; TRCA will prepare funding requests, direct resources and expenditures, and raise priorities for funding partners to achieve the agreed service outcomes, at acceptable levels of risk.
- Outline opportunities to include green infrastructure in asset management planning in cooperation with municipalities and other TRCA partners, where applicable.

1.2 Structure of the Asset Management Plan

In alignment with O. Reg. 588/17, the Asset Management Plan (AMP) is structured to provide consistency to stakeholders who are engaged with the document. The following sections provide a general overview of the key components of an asset management plan as required by the regulation and illustrated in Figure 1.1.

Figure 1.1 - Asset Management Plan Structure

1.3 Program Areas and Service Overview

In this first version of the AMP, the aim is to take a broad view of TRCA's objectives, initiatives and strategies and interpret these for some of the major service areas, thereby showing the linkage between corporate targets and individual service area targets.

The AMP will be drafted in phases to include all directly owned assets by TRCA. The first phase in 2024 focuses on core infrastructure including Flood Control Infrastructure (dams and channels), Erosion Control Infrastructure, Buildings (Administration and Residential buildings), and Fleet. Subsequent phases of the AMP will include integration of Green Infrastructure as well as Information Technology assets.

The Program Areas and Services that are included in the scope of the AMP are listed in Figure 1.2.

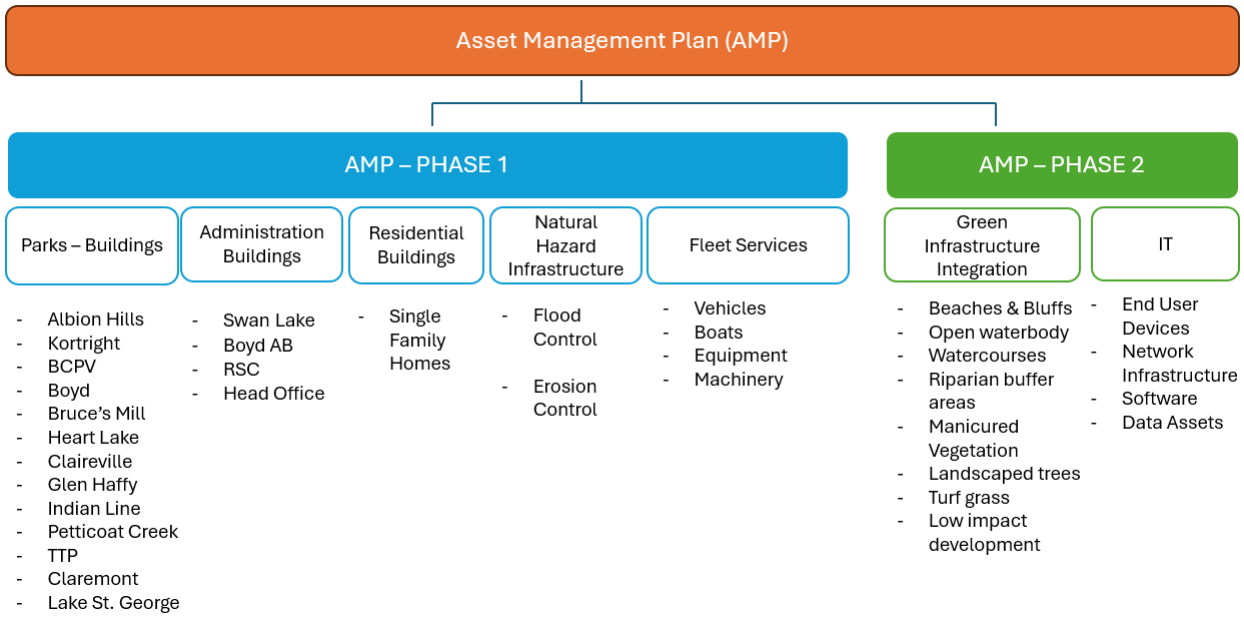


Figure 1.2 - Asset Management Plan Program Areas and Services

1.4 State of Local Infrastructure

TRCA has a tangible asset portfolio that includes land, erosion protection works and flood control infrastructure; trails and park amenities; recreational and educational centers; staff administration offices; vehicles and equipment, as well as tenanted homes and historic buildings. These assets protect life, property, and public infrastructure, and contribute to quality of life in the TRCA jurisdiction. The sizable portfolio of assets varies significantly in terms of their function, age, durability, and many other factors.

The assets considered as part of this AMP have a total replacement cost of **$788,667,910 i**n 2023 dollars. This value excludes land.

Table 1.1 – Asset Replacement Cost

Service Area	Replacement Cost	Percentage of Total Replacement Cost
Flood Control Infrastructure	$197,746,505	25%
Erosion Control Systems	$ 376,469,600	48%
Administration Buildings	$ 87,635,430	11%
Residential Buildings	$ 33,360,876	4%
Parks Public Facilities	$76,177,498	10%
Fleet Vehicles and Equipment	$ 17,278,000	2%
Total	**$788,667,910**	**100%**

As outlined below in Figures 1.3 and 1.4, the condition of the tangible capital assets is overall in **Good to Fair** condition meaning that the infrastructure is adequate with some elements showing general signs of deterioration that require attention and a few elements exhibiting significant deficiencies.

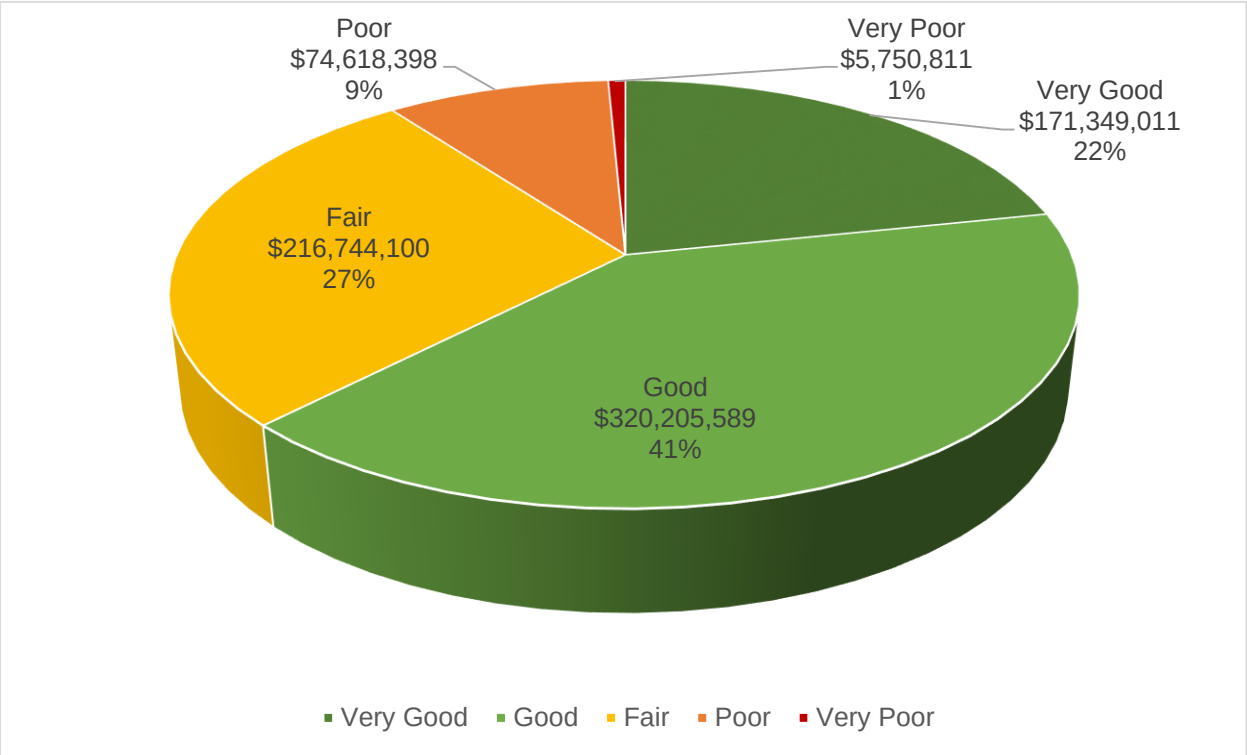


Figure 1.3 - Overall Assets Condition

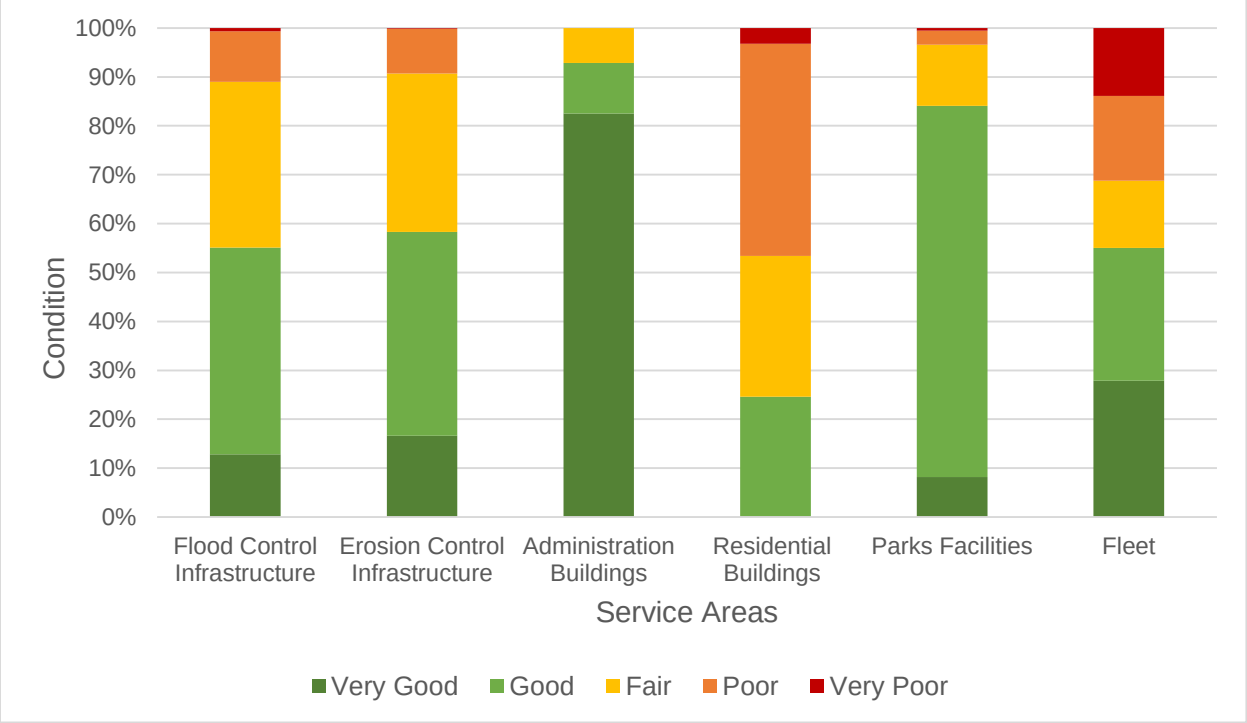


Figure 1.4 - Asset Condition by service area

1.5 Levels of Service

Levels of service (LOS) are vital determinants that impact asset management decisions. These statements define the desired service quality provided to customers and stakeholders, covering aspects like availability, reliability, safety, affordability, sustainability, responsiveness, and timeliness. To gauge performance and ensure compliance, performance indicators and targets are utilized to quantify expected services. Effective asset management necessitates formalizing LOS with performance metrics, targets, and associated timeframes while comprehending the associated costs.

The LOS at TRCA are summarized as below:

- **Corporate LOS**: Corporate statements that describe what services TRCA intends to deliver, and how it will align with customer expectations, operation efficiencies, and organizational goals and objectives.
- **Customer LOS**: Understanding TRCA's customers and other stakeholders and their expectations is a key input into LOS. Customer LOS are typically balanced against legislative requirements and the customer's ability/willingness to pay.
- **Technical LOS**: TRCA must translate customer expectations and legislative requirements into technical objectives, performance measures, and targets. Technical levels of service define what TRCA must do to deliver services that meet customer and legislated LOS.

The LOS measures include mandatory metrics that are prescribed by O. Reg. 588/17. The customer and technical performance measures include both the current performance, as well as the proposed future performance target. Each service area section also discusses any external trends or issues that may affect expected levels of service or our ability to meet them (e.g., new accessibility standards, climate change impacts).

1.6 Asset Management Strategy (AMS)

The asset management strategy outlines specific planned actions and activities that enable the assets to provide desired levels of service in a sustainable way, while managing risk and at the lowest lifecycle cost. The asset management strategy outlines a plan for renewal/rehab activities, maintenance activities, replacements, disposals, and expansion to service. The strategy should also address actions or policies that can lower costs or extend asset life.

Figure 1.5 - General AMS Model

Primarily funded through the capital budget, the range of lifecycle activities of a particular asset or groups of assets are outlined in Table 1.2.

Table 1.2 - Typical Asset Lifecycle Activities

Life Cycle Activity	Description
Maintenance (Operating)	Regularly scheduled inspection and maintenance activities
Rehabilitation (Capital)	Significant treatments designed to extend the life of the asset
Replacement (Capital)	Activities scheduled once an asset reaches end of useful life, and rehabilitation is no longer financially feasible
Disposal (Capital)	Activities associated with disposing of an asset once an asset reaches its useful life, or is otherwise no longer operationally required
Service Improvement / Asset Expansion (Capital)	Planned activities required to extend service to meet demands

1.7 Financing Strategy

TRCA utilizes a variety of funding streams such as municipal levies, grants and reserves for the operation

and maintenance of its assets. The financing strategy sets out the approach to ensuring that the appropriate funds are available to support the delivery of infrastructure services. The financing strategy is predicated on the current financial state of TRCA including revenues, operating and capital expenditures, reserves/reserve funds, and forecasted future commitments. The importance of the assets along with their significant capital and operating budget implications are intended to inform TRCA's long-term financial and service delivery planning.

For the period from 2012 - 2021, TRCA has invested an average of $10 million each year to maintain buildings, flood, and erosion control infrastructure. This amount is expected to balloon in future years as assets deteriorate and/or reach their useful life. On average, across its core service lines reported in this document, TRCA's annual capital requirement would be $23.40 million annually over the next 10 years.

Individual asset management plans for each of TRCA's asset types indicate that current levels of financial contributions for capital repair and replacement are not sufficient to fully fund the forecasted financial need for TRCA's flood and erosion control infrastructure and parks and education facilities over the next ten years.

Findings in the Asset Management Program will be leveraged to inform requests to funding partners as part of future budgets and grant requests to prioritize investments, targeting service areas with asset bases that contribute significantly to the infrastructure gap or service levels.

1.8 Plan Improvement and Monitoring

To ensure that TRCA's Asset Management Plan is relevant and useful, the following Asset Management Plan monitoring and review activities will be carried out:

- Formal adoption of TRCA Asset Management Plan by the Board of Directors.
- Review and formally adopt levels of service as these become available.
- Continued work to standardize asset management practices across the corporation, connecting technical asset lifecycle strategies to customer-focused performance measures that quantify the levels of service being provided to the community in each service area.
- Annual Review of the State of Asset Management Updates of the State of Local Infrastructure.
- Quality assurance audits of asset management information to ensure the integrity and cost effectiveness of data collected.
- Continued work to explore opportunities to address the infrastructure funding gap through various financial means.
- Integrating Green Infrastructure into the Asset Management Plan

Furthermore, the asset management plan will be adjusted to meet the requirements, including reporting requirements, of O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure (formerly, Bill 6: Infrastructure for Jobs and Prosperity Act, 2015), within the prescribed timelines.

To summarize, the key deliverables of this Asset Management Plan are as follows:

- Continue to align the Asset Management Plan with the Strategic Plan.
- Continue to advance the Asset Management Program through ongoing learnings and asset management best practices.
- Continue to improve coordinated efforts between and among departments and funding partners as asset management matures across the organization. Continuing to improve coordination efforts can advance asset management in cost-effective, and efficient ways.
- Explore opportunities to address the infrastructure funding gap through various financial strategies including updated budget requests to funding partners.
- Continually review and revise the TRCA unfunded priorities list and update the Board of Directors and municipal funding partners annually on this list.

Section 2:

INTRODUCTION

SECTION 2: ASSET MANAGEMENT AT THE TRCA

TRCA is a watershed management organization with responsibility for managing a broad range of physical assets across various service areas throughout TRCA's jurisdiction. These assets directly and indirectly support delivery of many programs across the service areas.

TRCA's aim with its assets is to maintain, renew, and enhance its asset portfolio through best asset management practices as well as ensure effective allocation of resources supporting the delivery of services aligned with our Strategic Plan, now and into the future. To ensure TRCA's assets are safe, structurally sound and fit-for-purpose to support our programs, the services they provide, and the delivery of our Strategic Plan to fulfill its obligations, TRCA must ensure that the assets integral to these programs are managed in a way that balances service levels, risk, and costs.

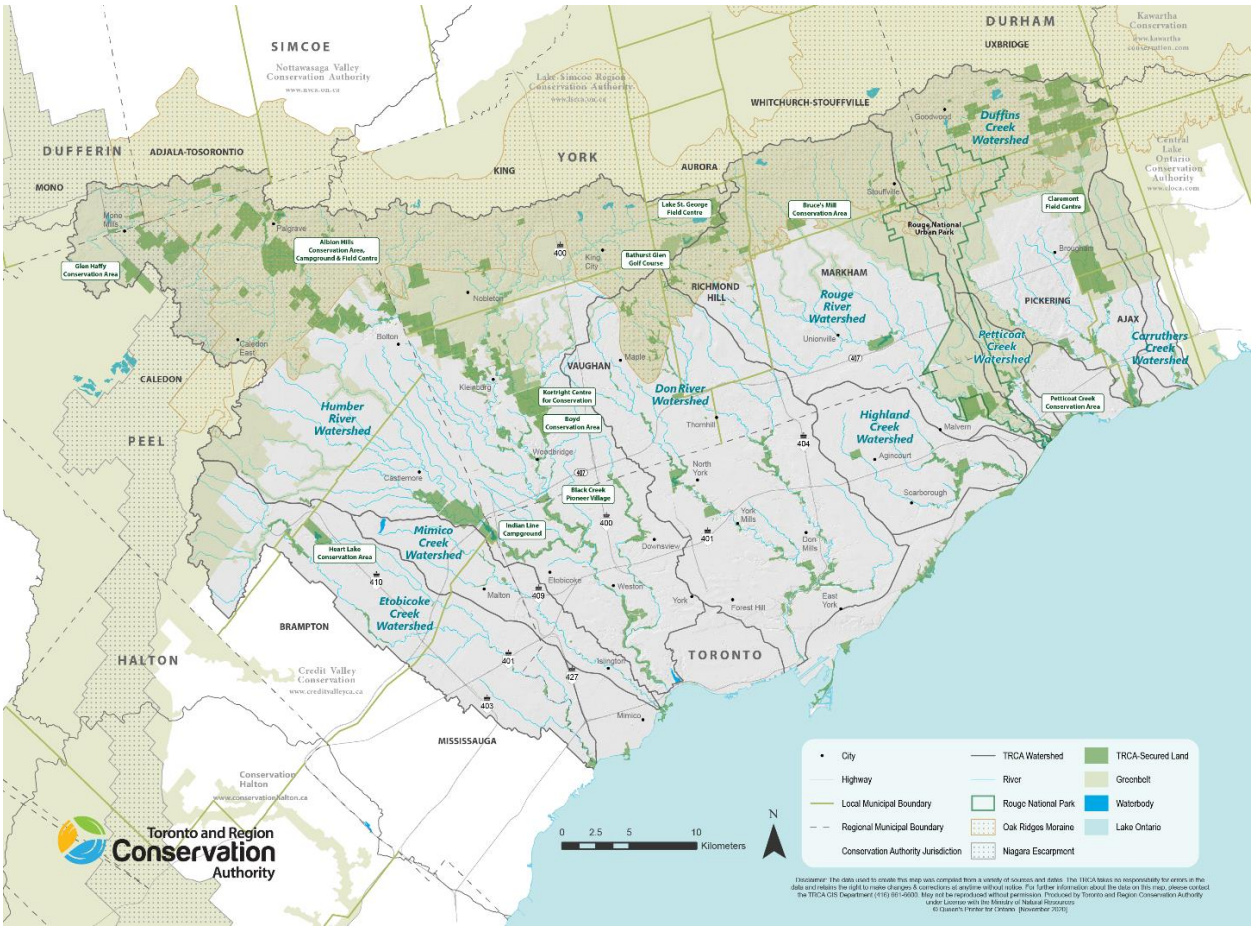


Figure 2.1 - TRCA's Jurisdiction

2.1 Reg 588/17 & Reg 686/21– Asset Management Plan Development

In 2015, the Ontario government introduced the Infrastructure for Jobs and Prosperity Act. Under this Act, the Ontario government also introduced O. Reg. 588/17 which requires that every municipality prepare an AMP in respect of its core municipal infrastructure assets by July 1, 2022. The Regulation further defines core municipal infrastructure assets to include roads, bridges, structural culverts, stormwater, water, and wastewater.

Although asset management planning is not a legislated requirement for conservation authorities, member municipalities are encouraging TRCA to undertake comprehensive asset management planning to support requests for municipal capital funding. The steps below outline key reporting requirements under O. Reg 588/17.

Phase 1: Update of asset management plan's core asset categories to add current level of service standard metrics, including the costs to maintain current levels of service.

Phase 2: Building upon Phase 1, update the asset management plan's remaining asset categories to include current level of service standard metrics, including the costs to maintain current levels of service.

Phase 3: Building upon Phases 1 and 2, update all of the asset management plan asset categories to include proposed levels of service, lifecycle management and a financial strategy.

In Section 5.1.2. of O. Reg. 686/21 Mandatory Programs and Services of the CA Act Regulation, it is outlined that conservation authorities with water and/or erosion control infrastructure are required to develop and implement an asset management plan by December 31, 2024. As the owner of flood and erosion control infrastructure, TRCA is legislatively required to have an Asset Management Plan in place for said infrastructure.

2.1.1 AMP Development Methodology

The first step in drafting this version of the AMP was to identify the current state of local infrastructure and identify gaps accordingly. All available 2023 data and information was used to predict the infrastructure gap over a 10-year window assuming current spending practices continue. TRCA intends to build upon this AMP through periodic updates of the individual departmental service area plans.

Figure 2.2 – AMP Development Methodology

2.1.2 Alignment with TRCA's Strategic Plans

TRCA 12-Year Strategic Plan sets out the directions we intend to pursue over the 12-year period from 2023 to 2034.

The aim of this Asset Management Plan (AMP) is to take a broad view of TRCA's objectives, initiatives, and strategies as they relate to the four strategic pillars (Figure 2.3) and interpret these for the various asset types across the organization, thereby, showing the linkage between corporate targets and individual service area targets.

Figure 2.3 - TRCA's Strategic Pillars

2.1.3 Relationship to Other TRCA Planning and Financial Documents

The AMP also integrates with other corporate planning documents such as:

- **TRCA Strategic Plan** – The AMP will use and influence policy directions for long-term growth and development as outlined in the TRCA 12 Year Strategic Plan.
- **Long Term Fiscal Impact Study** – The AMP will use and guide long-term financial forecasts.
- **Annual Budgets** – The AMP will identify construction, operation, maintenance, rehabilitation, replacement, expansion, and costs for disposal of assets, which will be considered in the development of annual capital and operating budgets.
- **Business Plans and Manuals** – The AMP is based on service levels, policies, and processes, as identified in various business plans and manuals; and will be used in the development of future business plans, performance measurements, and strategic decision making.

2.2 Supporting TRCA Goals Through Our Asset Management Program

TRCA Asset Management Program is designed to enable the management of our infrastructure assets in a way that connects our strategic community objectives to day-to-today decisions related to when, why and how we invest in our infrastructure systems.

There are five layers to our AMP which enable this connection as shown in Figure 2.4:

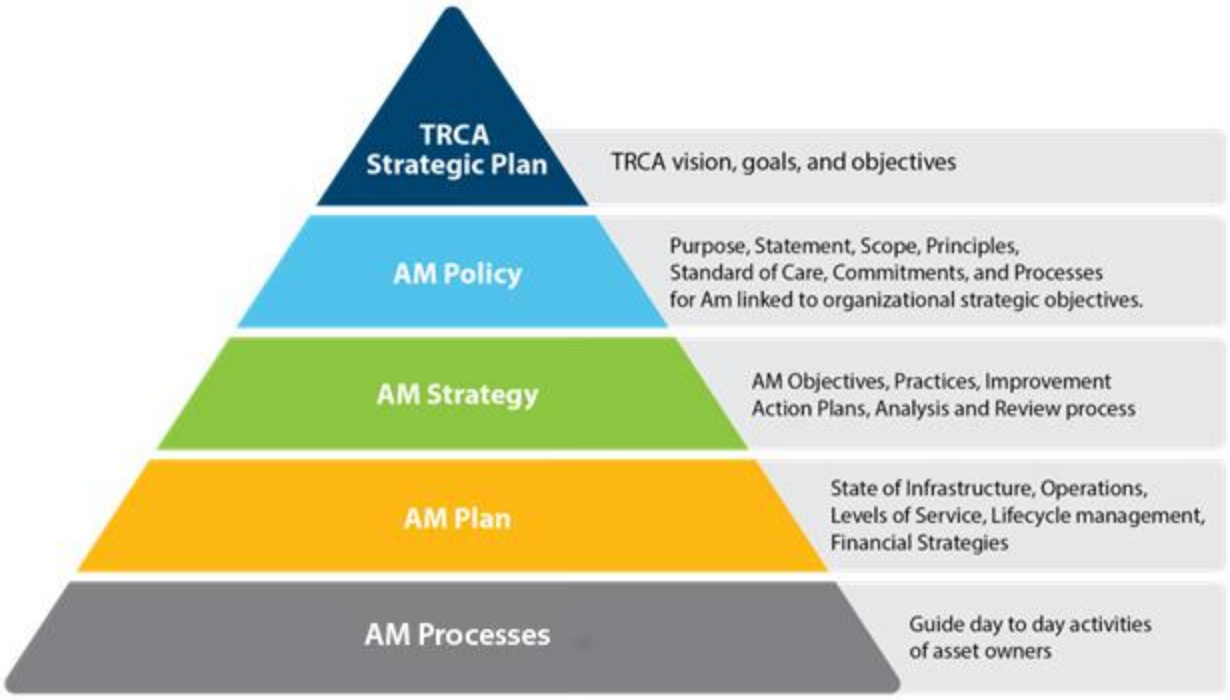


Figure 2.4 - Structure of the AMP

2.3 TRCA Asset Management Plan (AMP)

This AMP sets out how TRCA's infrastructure will be managed to ensure that it can provide the levels of service needed to support TRCA's key strategic outcomes, focusing on levels of service, lifecycle asset management planning, and the resulting long-term cash flow requirements.

This AMP meets the Ministry's guidelines for Development of AMP as follows:

1. Complies the key requirements as defined within the Ministry of Infrastructure's 'Guide for Municipal Asset Management Plans.'
2. Demonstrates that Levels of Service are being met in an effective and efficient manner.
3. Demonstrates that due regard is being given to the long-term stewardship and sustainability of the asset base to develop sustainable financial plans.
4. Demonstrates responsible management of the asset portfolio.
5. Communicates and justifies funding requirements.
6. Demonstrates the commitment that assets will be maintained in compliance with regulations.

2.3.1 Asset Management Plan Scope

This document outlines the first phase of TRCA's comprehensive AMP and includes all major infrastructure assets within the Flood Control as well as the Erosion Control Service Areas. These assets represent the largest category of amortized assets value and are also the largest area of risk. In addition to the Flood and Erosion control assets, this document includes TRCA's Buildings assets inclusive of rental, administration, education centers and parks buildings. These assets are key locations for the day-to-day operations for TRCA staff and for the delivery of our programs and services. Lastly, the first phase includes the asset management plan for TRCA's Fleet services.

Major service areas that are included within the current AMP:

The second phase of the AMP will include other TRCA assets with heavy emphasis on integration of Green Infrastructure and Information Technology assets.

Subsequent sections of this AMP will provide an overview of the following components from an asset management context:

- State of TRCA's Infrastructure
- Levels of Service
- Asset Management Strategy
- Financing Strategy
- Continuous Improvement

The above components will then be explored in detail for the Major Service Areas that are within the scope of this document.

2.4 Major Service Areas

Major service areas within scope of the first phase of the AMP comprise a significant portion of TRCA's asset portfolio, both in terms of size as well as the replacement value. The approach taken is a service-focused perspective to the Asset Management Program, and therefore the various infrastructure systems are described in terms of services and service areas rather than asset categories.

These Service Areas are outlined in table 2.1.

Table 2.1 – Assets Included in the Asset Management Plan

Service Area	Assets
 **Flood Control Infrastructure**	The flood control structures include a dam inventory that consists of 12 dams of which 5 provide flood protection. The other dams are historical mill and industrial dams. Also, there are 17 flood control structures that include channels, dikes, and flood walls.
 **Erosion Control Systems**	**Valley and River Structures** include Bank/Slope Treatments, Bed Protection structures, Buttresses, Channels, Retaining Walls, and Revetments
	Waterfront Structures include Beaches, Groynes, Headlands, Retaining Walls; and Revetments
 **Administration Buildings**	The New TRCA Head Office, Boyd Centre, Restoration Services Centre, Dave Barrow Centre for Conservation, Eastville Office
 **Residential Buildings**	Residential buildings include 50 rental homes.
 **Parks Facilities**	Parks Facilities include 173 vertical assets located throughout the 13 TRCA Conservation Parks, and Camps.
 **Fleet Vehicles and Equipment**	Fleet is generally comprised of Licensed Motor Vehicles, Highway Trailers, Off-Highway Equipment, Marine Vessels, and General Equipment. TRCA's Fleet includes 503 assets.

2.5 Future AMP updates and Timeframes

The AMP is a living document that will continue to reflect the evolution of asset management practices within TRCA.

TRCA has adopted a preliminary 10-year projection window for the first version of the AMP. Ideally the plan will reflect the asset lifecycles which vary from asset to asset, many lasting decades. Significant events may trigger the need for additional updates. Table 2.2 shows the targeted timelines for the review and, if needed, updates to the Asset Management Program.

Table 2.2 – Timeframes and Frequency for Review

Key Documents	Target Frequency (years)
Asset Management Policy	Every 5 Years
Asset Management Plan	2024- Every 5 Years
State of Asset Management	Every 2 Years

Section 3:

STATE OF LOCAL INFRASTRUCTURE

SECTION 3: STATE OF LOCAL INFRASTRUCTURE

The purpose of the State of Infrastructure is to provide a summary of the key physical attributes and current physical state of the asset portfolio; identifying asset types, accounting valuation and replacement cost valuation, asset age distribution and asset age as a proportion of expected useful life and asset condition.

This section seeks to establish an understanding of the current state of TRCA's infrastructure assets. The baseline snapshot of TRCA's assets will help decision-makers prioritize investments in the future; improving their ability to efficiently manage assets and deliver services. Also, it will lay the foundation for ongoing assessment, reporting, and benchmarking of our infrastructure assets.

The State of Local Infrastructure is a key building block for TRCA's future management of its infrastructure assets. The focus is on the "Major Service Areas", described generally as the infrastructure owned and internally managed by TRCA. This section is intended to provide the following information:

- Details of the Asset Inventory - What do we own?
- Valuation of the Asset Base (Replacement Value) - What is it worth?
- Condition of the Asset Base - What Condition is it in?
- What is their age and remaining service life?

This section includes summary information for all assets of the Major Service Areas within the scope of this AMP on:

- Asset Inventory
- Asset Valuation
- Asset Age Distribution and Average Expected Useful Life
- Asset Condition

State of Local Infrastructure Summary

The assets required to support TRCA’s services within the four Major Service Areas comprised of Flood Control Infrastructure, Erosion Control Infrastructure, TRCA Buildings (Corporate Administration, Residential, and Parks Facilities) and Fleet assets are estimated to cost **$788,667,910** to replace based on 2023 dollars.

68% of the assets within the scope of this Asset Management Plan are reported to be in **Fair to Good** condition.

Figure 3.1 provides a high-level overview of the inventory of various asset types, including replacement value, and the condition of TRCA's assets by service area. Detailed asset information under each service category can be found within the sections that follow.

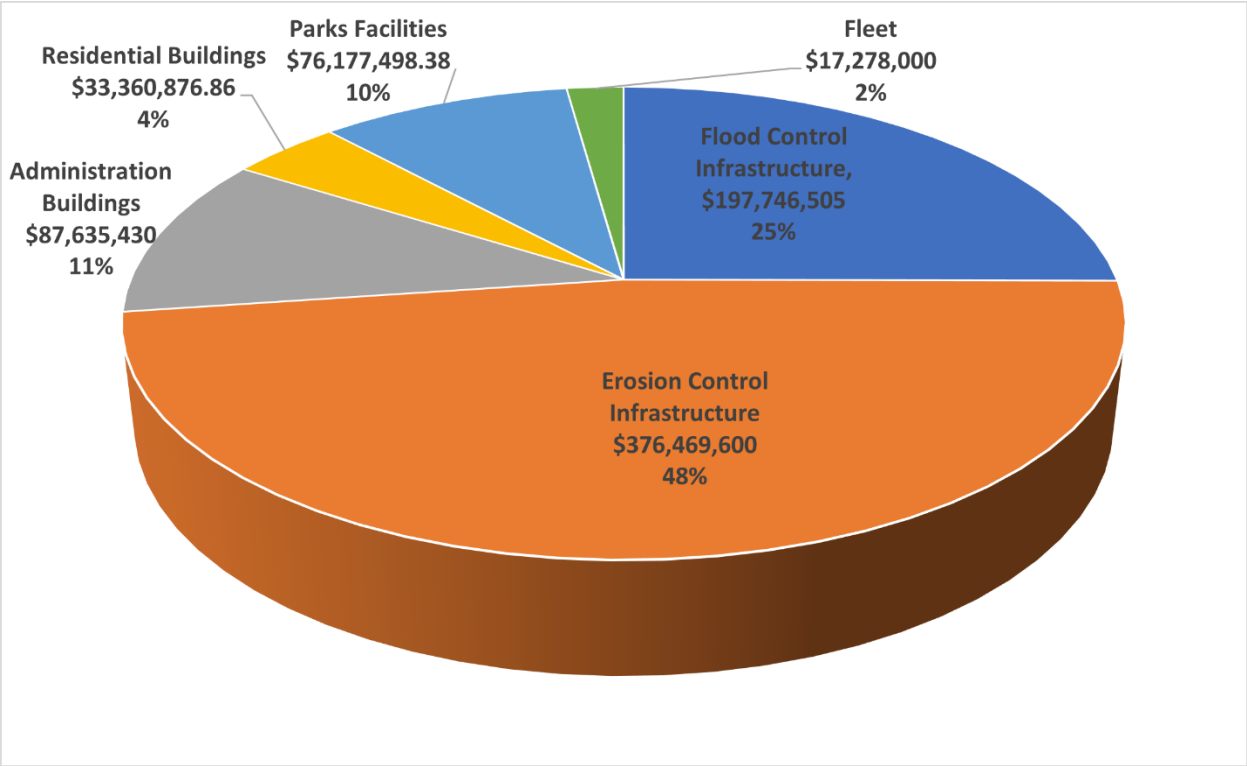


Figure 3.1- Total Replacement Value

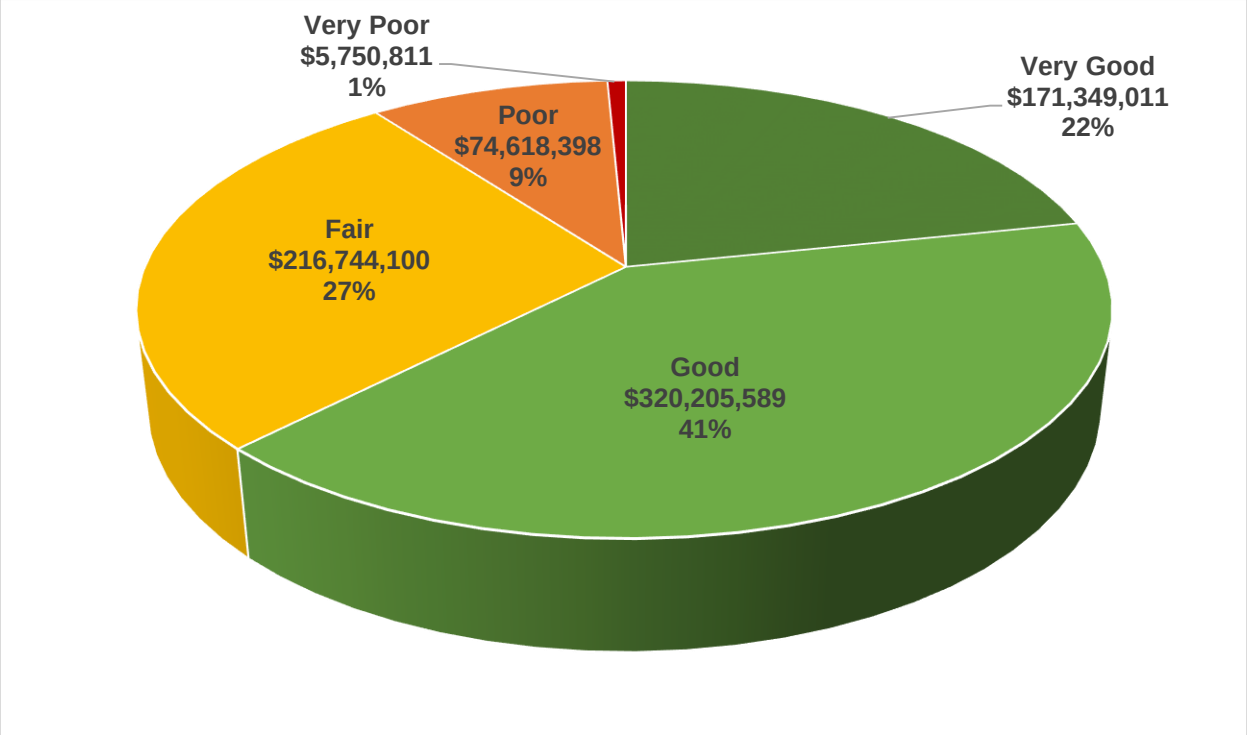


Figure 3.2 – Total Asset Condition

3.1 Asset Inventory and Valuation

The asset valuations within this AMP are based on data in TRCA's Tangible Capital Asset (TCA) system, which were a part of the PSAB financial reporting requirements. Under PSAB 3150, TRCA is required to summarize and present information regarding its TCA and amortization in financial statements based on historical costs. The valuation of assets differs based on their classification. Flood and Erosion control assets are valued using Non-Residential Building Construction Price Index data for Toronto as of Q1 1981. This index is updated quarterly by Stats Canada. However, to proactively manage assets, estimated replacement costs need to be calculated. The replacement value of Building assets is determined through a combination of periodic Building Condition Assessment (BCAs) as well as increases in the Non-Residential Building Construction Price Index data for Toronto. Fleet assets are relatively easier to value due to readily available acquisition costs and comparable market values of vehicles and equipment.

Not all of the assets are replaced (i.e., some are continually rehabilitated), but a replacement value estimate provides a foundational benchmark to understand the magnitude of the infrastructure that supports each service area. In the past, the starting point for replacement values was the historical cost of an asset, which was then increased by the rate of inflation since the asset was built or acquired. This approach provided a high-level estimate only.

This Asset Management Plan takes an engineering-based approach that considers cost factors in addition to inflation. For example, replacement values now incorporate current regulatory and design standards, as well as technological advances since the asset was originally put in place. Also, it typically costs significantly more to replace an asset than to put it in place for the first time because service has to be maintained during the replacement period.

Table 3.1 – Replacement Value Methods

Methodology	Description	Reliability
Recent Tenders	Recent tenders in neighboring municipalities and surrounding areas – cost to construct certain buildings, the acquisition cost of a new truck, vehicle or heavy equipment, cost to rehabilitate/replace roads and bridges.	Most Reliable
Local Price Index	Using local price indices for recently built or acquired assets to adjust to current value.	Reliable
Insurance Values	Insurance values, although often low, are a good benchmark or reasonability test.	Somewhat Reliable
Inflated Historical Costs	Historical cost inflated to current dollars. This approach is best used for assets recently acquired or for low value assets which represent a small share of a local government's total replacement value. A local government should look to move away from this approach and generate replacement costs based on the first two more credible methodologies.	Least Reliable

3.1.1 Detailed Asset Inventory and Replacement Values

TRCA applies a combination of the above-referenced valuation methodologies. A detailed summary of asset replacement cost by Major Service Areas is outlined in Tables 3.2– 3.7

Table 3.2 – Detailed Replacement Values – Flood Control Services

Service	Asset		Inventory	Unit	Total Replacement Value
Flood Control Infrastructure 	Dams	Flood Control Dams	5	Each	$99,328,934
		Recreation Dams	7	Each	$7,213,544
	Channels	Flood Control Channels	11,520	Meters	$60,988,820
	Dike	Flood Control	3,570	Meters	$28,548,641
	Flood Wall	Flood Control Wall	2	Each	$504,538
	Hydrometric Equipment		102	Each	$1,162,028
TOTAL					**$197,746,505**

Table 3.3 – Detailed Replacement Values – Erosion Control Services

Service	Asset		Inventory	Unit (m^3)	Total Replacement Value
Erosion Control Services 	Valley and River	Valley	51	121,030	$ 55,695,100
		Watercourse	202	176,200	$ 129,338,400
	Waterfront	Waterfront	29	3,361,670	$ 191,436,100
TOTAL					**$ 376,469,600**

Table 3.4 – Detailed Replacement Values – Administration Buildings

Service	Asset	Inventory	Unit	Total Replacement Value
Administration Buildings 	TRCA New Head Office	1	Each	$ 72,318,592
	TRCA Boyd Centre	3	Each	$ 5,802,032
	Restoration Services Centre	6	Each	$ 6,168,821
	Dave Barrow Centre for Conservation	2	Each	$3,345,985
TOTAL				**$ 87,635,430**

Table 3.5 – Detailed Replacement Values – Residential Building

Service	Asset	Inventory	Unit	Total Replacement Value
Residential Assets 	Residential Buildings	50	Each	$33,360,876.86
TOTAL				**$33,360,876.86**

Table 3.6 – Detailed Replacement Values – Parks Facilities

Service	Asset	Inventory	Unit	Total Replacement Value
Conservation Parks 	Parks Facilities	173	Each	$76,177,498.38
TOTAL				**$76,177,498.38**

Table 3.7 – Detailed Replacement Values – Fleet

Service	Asset	Inventory	Total Replacement Value
Fleet 	Agricultural Equipment	91	$ 2,381,000
	Construction Equipment	73	$ 2,712,000
	On-Highway Vehicles (Owned)	135	$ 343,000
	Highway Trailers	34	$ 1,608,000
	Off-Highway Equipment	90	$ 1,329,000
	Marine	38	$ 1,011,000
	Off-Road Vehicle	39	$ 7,511,000
	Snow and Ice Removal	41	$ 385,000
TOTAL		**502**	**$ 17,278,000**

3.2 Asset Age and Useful Life

TRCA primarily utilizes the assets' in-service date or year build data to determine the age of its assets. However, this information alone is not sufficient to build a holistic asset management plan. Therefore, it is important to understand how age has an impact on the useful life of the assets.

Expected Useful Life (EUL) of an asset is the period of time the asset is expected to provide service. The use of an asset ultimately impacts the life of an asset and its ability to provide service. Knowing the expected life of an asset and how much of it has already been used up gives some guidance on when it might fail and needs to be renewed. Asset Age by itself generally does not provide the same quality of information as assessing physical condition.

The distribution of average age and EUL for assets within the four Major Service Areas are outlined in Figure 3.3

In many cases, the service life of an asset can be extended well beyond the original expected useful life with proactive lifecycle management, but the cost of ownership generally increases as condition worsens and the frequency and costs of repairs increases. Understanding this concept of age-based asset performance and its interplay with asset condition and risk is key to addressing asset state of good repair (SOGR) backlog.

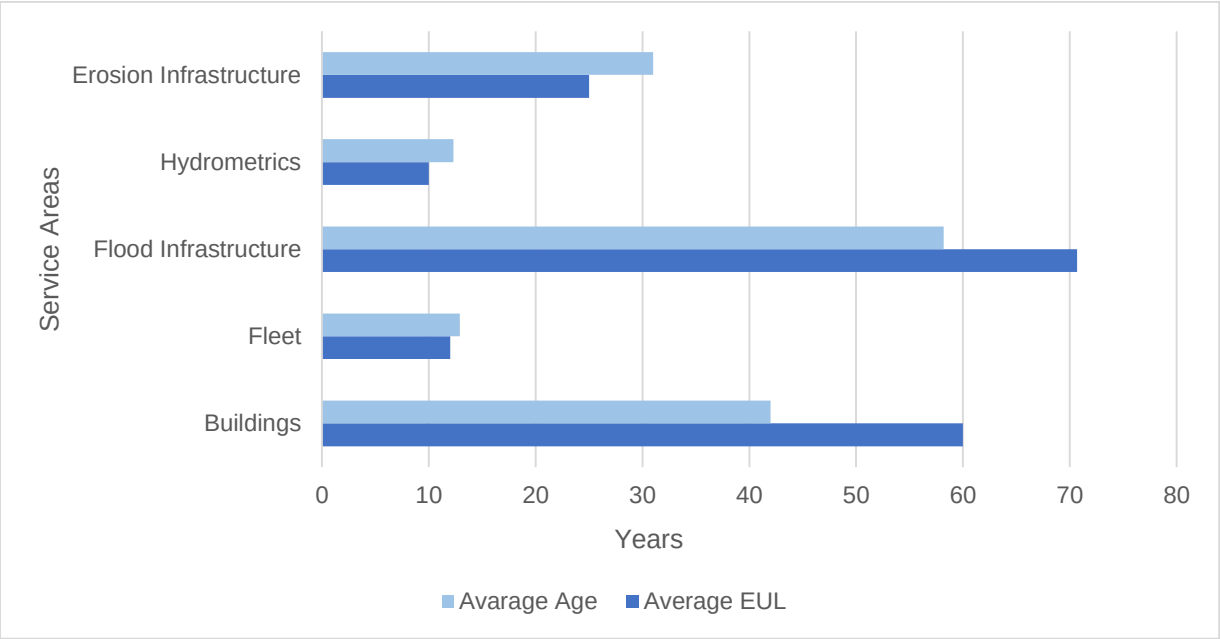


Figure 3.3 – Average Age and EUL in years

3.3 Asset Condition

Asset condition is simply a measure of the health of a particular asset accounting for its engineered service life and current level of use. An asset condition assessment provides an estimate of the remaining useful life of an asset. TRCA inspects assets on schedules that are appropriate to the asset group, with more critical assets such as bridges and structural culverts being inspected more frequently than others. In addition to routine inspections, TRCA also commissions periodic condition assessments reports for its long-lived assets. Depending on the asset class, TRCA utilizes various tools and methodologies to validate the condition of its assets. Some of these are listed below:

Table 3.8 - Facilities General Condition Grading System

Grade	Description	Condition (Criteria)
VG	Very Good	Very Good Condition - Only normal maintenance required
G	Good	Minor Defects only - Minor maintenance required (5%)
F	Fair	Maintenance Required to Return to Accepted Level of Service - Significant maintenance required (10% - 20%)
P	Poor	Requires Renewal - Significant renewal/upgrade required (20-40%)
VP	Very Poor	Asset unserviceable - Over 50% of asset requires replacement

- **Building Condition Index (BCI)** - The BCI is a standard facility management benchmark that is used to objectively assess the current and projected condition of a building asset.
- **Pavement Quality Index (PQI/ RQI)** - This is an industry standard benchmark used to indicate the general condition of linear assets such as pavements and roads based on a technical inspection of the number and types of distresses in a pavement. Pavement distress includes low ride quality, cracking, bleeding, bumps and sags, depressions, potholes, etc.
- **Bridge Condition Index (BCI**) - The BCI is a commonly used benchmark that rates the condition of a bridge by evaluating and rating its sub- components, such as foundations, piers, deck structure, sidewalks/curbs/median, abutments or side walls, railings, etc. All bridges with a span greater than 3 meters are inspected every two years as per the Provincial mandate.
- **Age and Expected Useful Life** - When no formal condition assessment was available, the Age of the asset and its Expected Useful Life (EUL) were used to estimate its current condition. The EUL is the average amount of time in years that an asset is estimated to function when installed new and assuming routine maintenance is practiced. The age-based condition was evaluated by comparing the age of the asset to its expected useful life, as per Table 3.9

Table 3.9 – Age and Expected Useful Life Condition Grading Standard

Condition	% of UL
Very Good	80-100
Good	60-80
Fair	40-60
Poor	20-40
Very Poor	0-20

TRCA uses an industry standard general condition grading system for the purpose of translating technical condition assessment data into easily understandable asset information. The grading scale is summarized in Table 3.10.

Table 3.10 – Five Point Infrastructure Rating Scale

1	Very Good	The infrastructure in the system is in generally good condition, typically new or recently rehabilitated. A few elements show signs of deterioration that require attention.
2	Good	The infrastructure in the system is in good condition; some elements show signs of deterioration that require attention. A few elements show signs of significant deficiencies
3	Fair	The infrastructure in the system or network is in fair condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies.
4	Poor	The infrastructure in the system or network is in poor condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration.
5	Very Poor	The infrastructure in the system or network is in unacceptable condition with widespread signs of advanced deterioration. Many components in the system exhibit signs of imminent failure, which is affecting service.

10% of the assets in scope in this Asset Management Plan are rated **Poor to Very Poor** and carry an estimated replacement value of **$80,369,208.** These assets are good candidates for further investigation given the risk of impacting TRCA's ability to provide efficient and effective service to the community.

Section 4:

EXPECTED LEVELS OF SERVICE

SECTION 4: EXPECTED LEVELS OF SERVICE

Levels of service (LOS) are key business drivers that influence decisions about managing assets. By defining quantifiable LOS, decisions are made based on their impact on customers, the community, and the environment. This enables a clear line of sight to be established, from TRCA's strategic goals through to day-to-day asset management decision making. This section summarizes the Levels of Service and performance measures relevant to TRCA.

This Plan provides TRCA with a set of LOS measures which were developed through a series of consultation sessions with relevant TRCA staff.

4.1 Level of Service Framework

Level of Service (LOS) is a key business driver and influences all asset management decisions. LOS statements describe the outputs intended to deliver the service attributes such as quality, capacity, reliability, sustainability, availability, safety, timeliness, accessibility, and cost.

When setting the LOS measures, it is essential to define reasonable and realistic expectations, considering current and future needs over the lifecycle of the assets, as well as affordability, risk, timing, and external constraints.

TRCA employs a service delivery approach to define the various LOS. This involves identifying the levels of service to customers and other stakeholders, and quantifying the funds required to maintain this level of service.

LOS are linked at three levels within TRCA as shown in Figure 4.1:

1. **Corporate LOS:** considered to be the overarching principle to ensure that levels of service are in alignment with the organization's strategic goals and objectives.
2. **Customer LOS:** measures how the community receives the service and whether the organization provides community value.
3. **Asset (or Technical) LOS**: Defines the technical requirements needed to achieve service objectives. using metrics that describe what the organization provides.

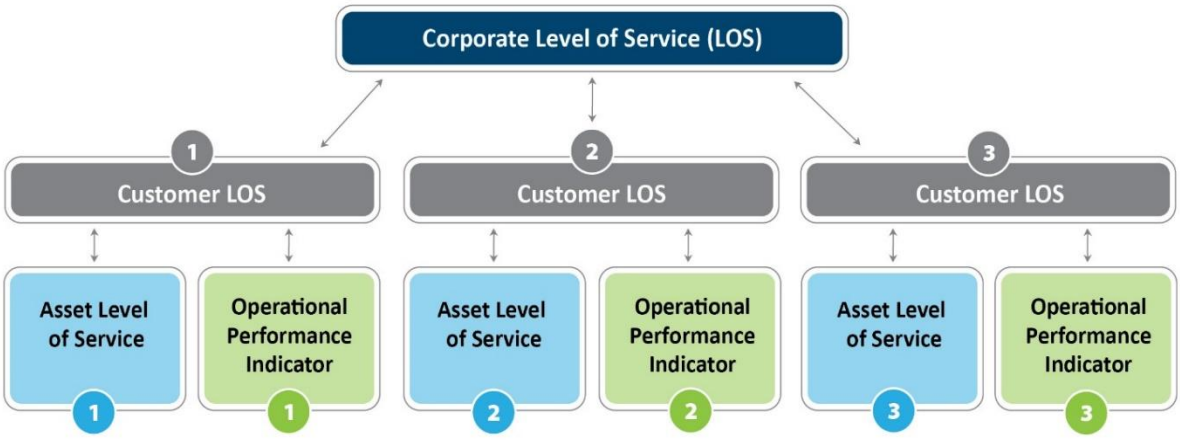


Figure 4.1 – Levels of Service Framework

It is important to define and quantify the Levels of Service within each service area, as these become the driver for the identification of asset needs and the basis for investment decisions.

Levels of Service are linked at three levels within TRCA—corporate, customer and asset levels to provide a clear line-of-sight between corporate objectives and asset-focused objectives, as shown in Figure 4.2.

Figure 4.2 – Alignment of Levels of Service to Corporate Strategy

4.2 Corporate Levels of Service

In alignment with the vision of achieving safe and resilient communities, TRCA's Corporate LOS are centered around the four (4) strategic pillars:

1. Environmental Protection and Hazard Management - Mitigating hazard risks to communities and protecting the natural environment.
2. Knowledge Economy - Contributing to environmental targets through knowledge advancement.
3. Community Prosperity - Building communities to drive local action and improve wellbeing.
4. Service Excellence - Customer service excellence for efficient service delivery to adapt to a changing environment.

Within each of the four strategic pillars, TRCA has identified specific actionable objectives. Examples of these are:

- Deliver provincially mandated services pertaining to natural hazards including flood and erosion.
- Maintain healthy and resilient watershed ecosystems.
- Optimize the total life cycle and the associated cost of assets.
- Maintain high quality levels of client and customer service.
- Seek opportunities to incorporate green technology.

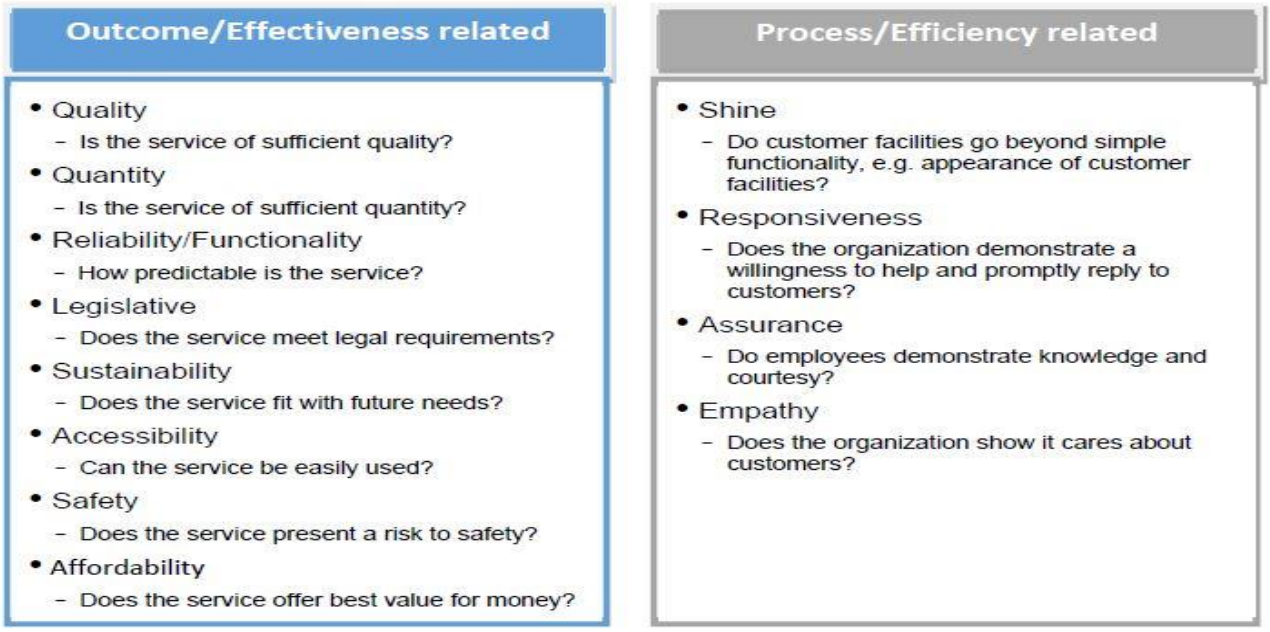
The objectives within the Corporate LOS factor into the organization's asset management policy cascading down to the asset management strategy and finally to individual asset management plans for each of the Major Service Areas.

4.3 Customer Levels of Service

Customer Levels of Service describe how a service is expected to be received by the customer and sets non-technical service targets. Customer LOS should be defined as statements of desired performance outcomes that are:

- High priority to customers, or
- Of importance to the integrity of the environment, or
- Required by regulators/legislation.

The LOS should be within the control of TRCA and its organizational processes and be clearly linked to activities undertaken by the organization. Key questions asked while developing the Customer LOS are outlined in the list below.



4.4 Asset (Technical) Levels of Service

Asset/Technical Levels of Service are specific and measurable. The Technical LOS defines what TRCA must accomplish to deliver services that meet customer and legislated LOS.

Given the unique nature of TRCA's assets, legislated requirements are the key drivers within certain asset classes e.g., flood and erosion control infrastructure as well as fleet services. On the other hand, Technical LOS for building and other public facing assets have customer and stakeholder requirements that are more dynamic i.e., seasonality.

The physical health and suitability of the assets is measured via the Asset Condition and Performance Levels. These levels are also factored in when establishing Technical Levels of Service for a given group of assets within a service category.

Capital projects to improve the condition of the assets generally involve major rehabilitation or replacement of the assets. Capital projects to improve the performance of an asset or system can include replacing and upgrading an old asset with more modern technology, reconfiguring assets, or adding additional assets.

Typically, Technical LOS for an asset type are categorized as:

Condition - the physical "health" of the assets.

- Measures on the condition of the asset e.g., pipe breaks, pavement wear, roof leaks, foundation cracks, equipment malfunctions and failures.
- Can be forecasted using lifecycle models.
- Capital projects to improve the condition of the assets generally involve major rehabilitation or replacement of the assets.

Performance - the "suitability" of the assets.

- Assess the assets' or asset systems' ability to provide sufficient quality and quantity of service and/or have adequate capacity to reasonably protect against external risks to services.
- Examples of performance levels of service would be the ability of HVAC systems to operate within a target range, fleet assets meeting/exceeding legislated performance targets.
- Capital projects to improve the performance of an asset or system can include replacing and upgrading an old asset with more modern technology, reconfiguring assets, or adding additional assets to the system.

4.5 Performance Measures

Performance management is an integral part of the overall Asset Management Program; more specifically under TRCA's defined levels of service for various asset categories and systems. This process involves identifying goals, measuring progress, reporting the results in a meaningful way, and using results to drive improvement.

Performance measures are segmented into two broad categories:

Current Performance – These are the actual performance metrics as derived from previous years' performance measured by staff or determined using data held in corporate information systems. E.g., number of maintenance service requests, downtime for fleet assets, effectiveness of flood or erosion mitigation measures etc.

Desired Performance - These measures are the targets that should be set as part of the 3-10-year business and asset management planning processes and should be based upon a realistic estimate of how performance can be maintained or improved over the current baseline, considering the availability of funding and the associated capital and operational investment strategies that can be implemented over this period.

4.6 Service Areas Levels of Service

Levels of service (LOS) tables for each of the service areas (Flood Control, Erosion Control, Buildings, Fleet) are developed and maintained through discussions with staff that support the provision of the respective service area.

Major components of the tables are identifying customer values, corporate LOS objectives, customer focused performance measures, and technical focused performance measures.

The LOS measures include mandatory metrics that are prescribed by O. Reg. 588/17. The customer and technical performance measures include both the current performance, as well as a proposed future performance target. Each service area section also discusses any external trends or issues that may affect expected levels of service or our ability to meet them (e.g., new accessibility standards, climate change impacts).

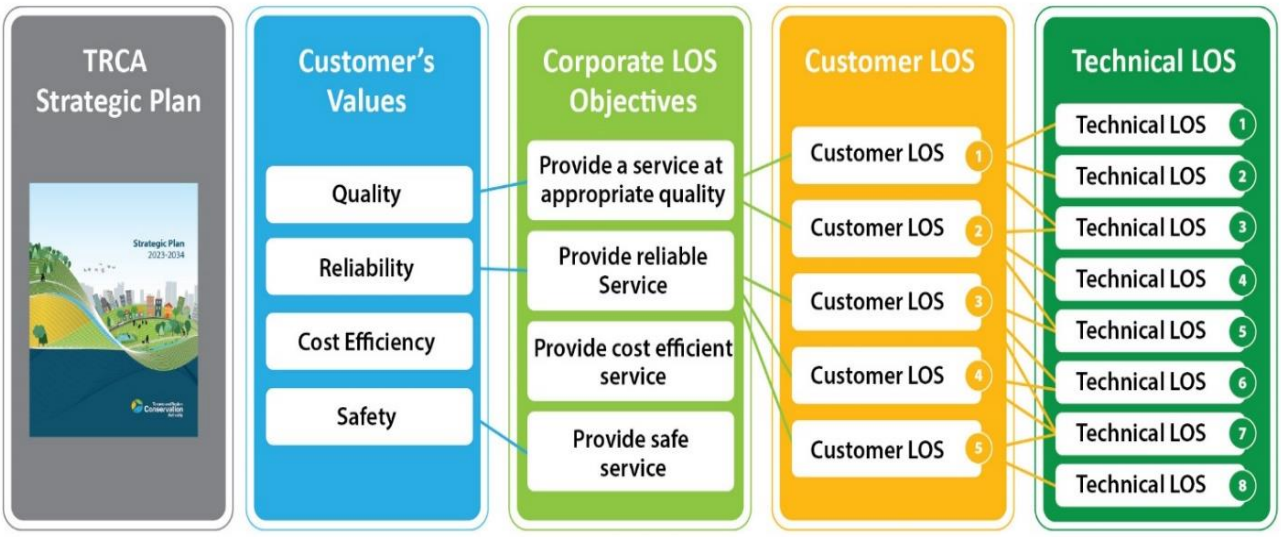


Figure 4.3 - Level of Service Hierarchy by service area

4.7 Internal and External Trends

Many internal and external factors and trends have the potential to impact on TRCA's ability to continue to deliver its programs and services. Table 4.1 below outlines factors that may influence TRCA's Asset Management Program.

Internal benchmarking allows TRCA to evaluate performance over time in response to internal pressures. External benchmarking allows TRCA to benchmark its performance against similar organizations to help identify best practices and position itself amongst its peers.

It is crucial that TRCA's performance measures and performance planning within the asset management program be dynamic in order to align to internal and external trends.

Table 4.1- External and Internal Trends

Key Trends	Potential Impact
New Regulations / Upcoming Regulations	New legislation (e.g., emissions standards or further accessibility requirements) could result in the existing assets not being able to meet the new LOS. To address this, TRCA has established processes to monitor when and how future legislation can impact the asset base and, where possible, new assets are 'future proofed' where their design and construction considers to the extent possible the potential impact of any new legislation.
Complexity in growth forecasts	The timing and scale of development across TRCA, which can sometimes be difficult to predict or plan, varies in accordance with market demands and TRCA's own approval processes. This has the potential to impact on both financial and operational performance indicators.
Expectations	Societal and political influences will continue to shape TRCA's strategy and priorities. Social trends have the potential to impact LOS delivered by the assets, as people increasingly want more information and more dialogue, and this could be regarding the type and quality of service delivery by TRCA. Also, residents will likely expect to use a broader range of communication approaches, including social media, to connect TRCA and its residents regarding service levels.
Aging infrastructure	The flood control system and infrastructure is relatively old. This is a known trend that will continue to burden TRCA and impact on its ability to provide high levels of service. While TRCA does have relatively young buildings, TRCA does still have several older assets in its portfolio. As these assets deteriorate, there is a risk LOS will decline. However, the adoption of asset management practices by TRCA will enable cost-effective and timely maintenance and rehabilitation activities to mitigate this risk.

Key Trends	Potential Impact
Rapidly changing technology	Rapidly changing technology in a changing and uncertain macro environment challenges how quickly we adapt in the way we connect with residents and deliver services.
Funding and sustainability	Refer to the Finance Strategy section, for potential impacts related to these trends.
Future Pandemics or Diseases impact and response	Future pandemics or diseases can have multi-year implications on how TRCA operates and maintains assets. These events may also cause permanent impacts on asset design and delivery of capital programs.
Environmental changes / Climate change	Full impacts of climate change that have already affected the asset base (i.e., frequency of storm-related events etc.) are not fully known at this time. Increased occurrences of flooding can occur as the assets increasingly struggle to cope with higher intensity storm events, and this will impact key stormwater ponds, the stormwater network, flood monitoring network gauges and potentially other related assets. TRCA must fully assess a range of climate change scenarios and embark on a comprehensive development of a Risk Management Strategy and have the capabilities to make the management of TRCA assets more sustainable.

Section 5:

ASSET MANAGEMENT STRATEGY

SECTION 5: ASSET MANAGEMENT STRATEGY

5.1 Purpose of the Asset Management Strategy (AMS)

The Asset Management Strategy (AMS) is the basis for delivery of TRCA's Asset Management Policy, the efficient compliance with business needs, achievement of corporate goals and objectives. Also, the Asset Management Strategy sets a framework to guide the development, implementation, and maintenance of individual Asset Management Plans. Each service area covered in the AMP undertakes an individual approach to asset condition assessment and the identification and prioritization of asset renewal needs.

Figure 5.1 below shows how the strategy and planning are a component of the whole AMP.

Figure 5.1 - Strategy and Planning in Asset Management Plans

The focus of this document is on the specific actions to be undertaken by TRCA to develop a structured set of actions aimed at best Asset Management practices.

The purpose of this Strategy is to:

- Develop and sustain asset management practices and ensure that these practices are applied consistently across the organization.
- Ensure a comprehensive approach to asset management that recognizes the functionality and performance of assets through time and plans for the eventual replacement of existing assets.
- Outline long-term goals, processes, and steps TRCA will take to deliver optimized lifecycle costing and priority setting.
- Establish a work plan and schedule for the preparation of and updates to Asset Management Plans.
- Assess and prioritize maintenance and operation's needs, and investment therein, based on criticality and reliability.
- Define routine preventative maintenance activities to ensure the preservation of existing assets.
- Ensure operational and maintenance requirements are considered when planning new infrastructure.
- Establish a process for reporting on the State of Good Repair.

This Asset Management Strategy considers asset and non-infrastructure solutions. These solutions can be used to identify renewal, growth and improvement, maintenance projects, and optimizing the maintenance of TRCA's infrastructure while continuing to meet target LOS.

Components of Asset Management Strategies

An effective asset management strategy requires knowledge of the condition of the assets, the performance of the assets as compared to desired levels of service (LOS) and the associated costs to maintain, rehabilitate, replace, dispose, and expand the asset systems and components. Required work can then be prioritized based on the relative risks of the assets.

5.2 Data and Information Management

Organizations rely on data and information as key enablers in undertaking activities for Strategy and Planning. Access to accurate asset data is the first step in successful strategic asset management practice, and capturing this information in an objective, repeatable manner is essential.

TRCA is currently in the process of implementing an Enterprise Asset Management system (EAM) that supports TRCA asset management plans, enhances the monitoring, reporting and capital planning functions, and ensures all asset data is captured accurately and stored in a central location.

The EAM database will provide the following:

- Decision makers will be able to rely on verified information as a base for their decisions.
- Provide readily available, reliable information for effective management of the assets.
- Users will have readily available, user-friendly access to information including the ability to identify trends.
- Proper maintenance of an organization's asset infrastructure to assist in ensuring safety, complying with regulations, and achieving the financial and operational targets that are established.

The Enterprise asset management software includes the Maintenance Management System application that connects with the inventory management system. Maintenance manager and Asset Manager Modules are used to maintain facilities and infrastructure. These modules integrate with a GIS ESRI Arc system. Proper maintenance of an organization's asset infrastructure is a key to ensuring safety, complying with regulations, and achieving the financial and operational targets that are established. This software enables the organization to create work orders, schedule resources and track costs associated with asset maintenance and repair. In addition, employees can create an online self-service request to report or request maintenance, repairs, renovations, and other service activities.

Also, mobile-friendly applications will improve our service delivery for daily maintenance work involving our vendors, clients, and staff, while improving connectivity, communication, and collaboration, and reducing data duplication and error.

5.3 Risk Management

Inherent in delivering a wide range of services to the community, TRCA is exposed to a variety of internal and external factors that add uncertainty to the successful delivery of services. Uncertainties that influence the organization’s ability to achieve its objectives are termed “risks” and have the potential to significantly affect TRCA’s ability to deliver services in an effective and efficient manner.

5.3.1 Risk Management Process

Risk management assists in managing risks effectively through the application of the risk management process at varying levels and within specific contexts of the organization. Furthermore, it also ensures that information about risk derived from the risk management process is adequately reported and used as a basis for decision making and accountability at all relevant organizational levels.

Figure 5.2 outlines the components of the Risk Management Process and strategy.

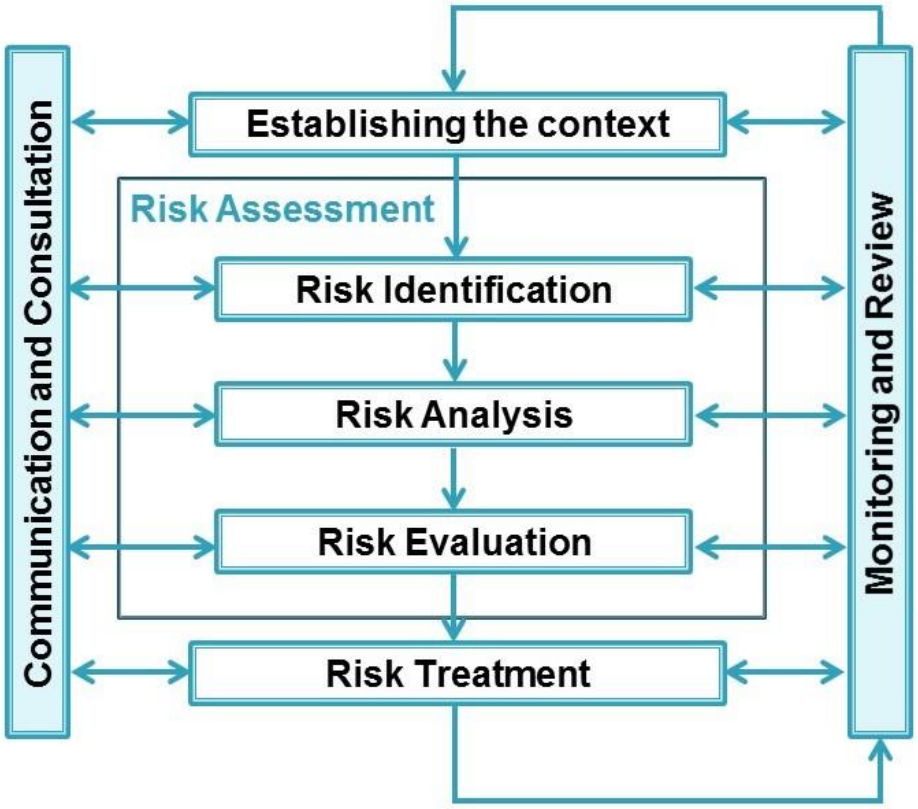


Figure 5.2 - Risk Management Process

5.3.2 Risk Assessment

A risk assessment evaluates how likely an asset is to fail, and what the impact of that failure would be for the community. Risk assessment includes risk identification, risk analysis and risk evaluation.

Risk Identification

Risk identification is the process of identifying as many sources of risk, areas of impact, events their causes and their potential impacts as possible. The aim is to identify risks that are under and outside of the organization's control as well as internal and external to the organization across several categories including **legal/regulatory, operational, financial, and strategic risks.**

Risk Analysis

Risk analysis involves consideration of the causes and sources of risk, their positive and negative consequences, and the likelihood that those consequences can occur. Combined they can provide a quantifiable measure of each risk faced by TRCA.

The framework states that all risks are a result of the likelihood and consequence of risk related events.

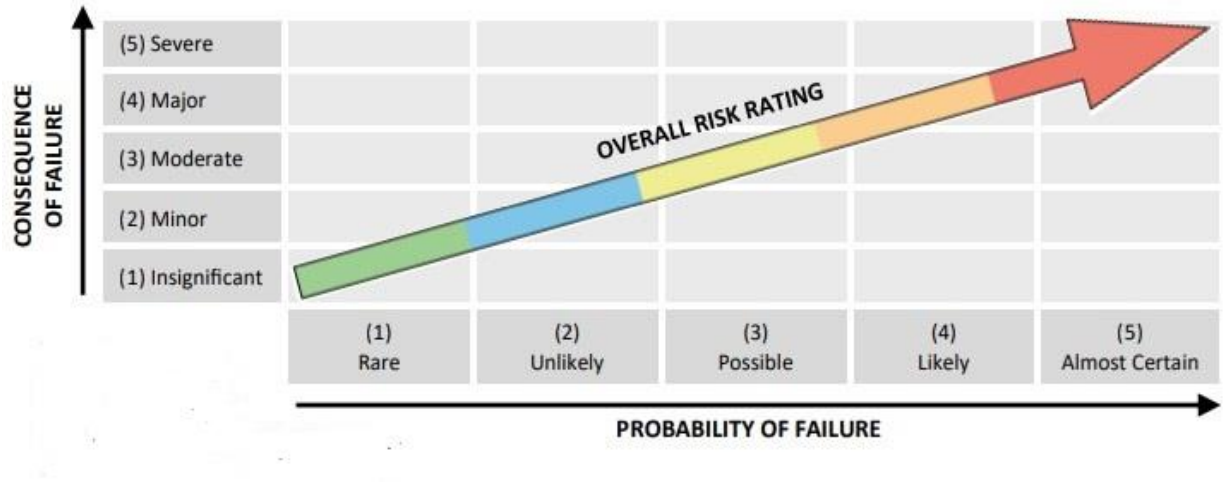


Figure 5.3 - Risk Analysis

The probability of failure (POF) - Likelihood

This represents the likelihood that an asset will not achieve the desired level of service or will not be able to fulfill a certain need. If the condition of an asset deteriorates, the probability of failure will increase. However, even assets with a high condition score can be at risk of failing to meet community needs if they no longer meet regulatory requirements or are inadequate to meet changing demand. The factors used to estimate the probability of failure vary by asset class, and may include things like construction material, condition assessments and age. The likelihood of failure will be determined on an asset-by-asset basis based on a qualitative score from 1 to 5 where 5 represents the highest likelihood of failure.

The consequence of failure (COF) – Consequence

This represents the outcome of an event affecting the levels of service. The consequence can be expressed from both a qualitative and or quantitative perspective. Similar to the likelihood of failure, the consequence will be determined on an asset-by-asset basis. An asset is assigned a consequence based on a 1 to 5 scale where 5 represents the highest consequence if an asset is considered to fail. The consequence of failure is determined based on the degree to which a risk event would impact levels of service based on the following criteria:

- **Health and Safety**: associated with the magnitude or seriousness of injuries that can occur under a certain risk event. This would correspond to the legal and regulatory category of the risk.
- **Reputation/Social**: refers to the perception of the public of the service being provided by the asset. This would correspond to the strategic category of the risk where factors such as shifts in demographic or social awareness would affect the consequence.
- **Service**: considers the level of disruption if an asset does not provide the target level of service. This would correspond to the operational category of the risk where factors such as changes to the level of service would affect the consequences.

- **Economic**: refers to the financial/economic impact if an asset does not provide the target level of service. This would correspond to the financial category of the risk where factors such as current economic or market conditions are the drivers of the consequence.
- **Environmental**: considers the impact on the natural environment, and the timeframe in which the impact can be reversed. This is related to both legal and regulatory compliance and the strategic categories of the risk with a key driver of risk increase by climate change.

Risk Evaluation

Risk evaluation involves comparing the level of risk found during the analysis process with risk criteria established when the context was considered. Based on this comparison, the need for treatment can be considered. After establishing the parameters associated with likelihood and consequence, the information can be used to generate a quantitative assessment based on the following formula:

Likelihood x Consequence = Risk Rating

The risk categories, and associated color coding, are defined as follows:

- **Insignificant - Very low (Green)** – No actions required. A very low risk has a low probability of risk occurring, and a low impact to service delivery. This risk can be responded to by maintaining routine procedures, and planning renewals in the longer term.
- **Low (Blue)** – May be acceptable but monitoring of assets may be required. A low risk has a low-moderate probability of occurring, and low-moderate impact to service delivery. This risk can be responded to by establishing a monitoring program and planning renewals in the intermediate to long term.
- **Moderate (Yellow)** – Requires some consideration by management with necessary risk management, and monitoring adopted as needed. A moderate risk has a moderate probability of occurring, and a moderate impact to service delivery. This risk can be responded to by establishing a monitoring program, and planning renewals in the intermediate term.
- **High (Orange)** – Requires consideration by management, risk management and monitoring are required. A high risk has a moderate-high probability of occurring, and moderate high impact to service delivery. This risk can be responded to by establishing a monitoring program with frequent risk assessments, and planning renewals in the intermediate to near term. Consideration should also be made for additional preventative or correction actions.
- **Extreme - Very high (Red)** – Requires extensive management input, risk mitigation to reduce to an acceptable level is essential. A very high risk has a high probability of occurring, and high impact to service delivery. This risk can be responded to by establishing a monitoring program with frequent risk assessments, and planning renewals in the near term. Consideration should also be made for additional preventative or correction action.

The application of the risk model allows TRCA to prioritize resources, ensure vital services are available, streamline inspection programs, optimize operations and maintenance programs; and prioritize and optimize capital budget program delivery and above all minimize risk.

Table 5.1 – Example of Risk Assessment Matrix for TRCA assets

Risk Treatment

Identifying what risk treatments are required to manage/reduce the risk of assets failing to provide desired levels of service. Different risk treatments will have varying effects on levels of service, and it is important to ensure that the optimal risk treatments are utilized.

It also becomes necessary to identify the costs of the lifecycle activities. Factors such as funding availability and affordability for undertaking mitigation actions will need to optimize which lifecycle activities will have the greatest net positive impact to the organization. Therefore, a cost-benefit analysis will need to consider these factors to help prioritize lifecycle activities that are feasible to undertake.

Monitoring and Review Processes

Encompasses all aspects of the risk management process and involves regular checking, supervising, critically observing or determining the status to identify the change from the performance level required or expected.

The objective of risk management is to assess which risks pose unacceptable conditions to the organization and advance plans to address them. TRCA primarily manages the risks around infrastructure – which include poor performance, high costs and premature failure – through maintenance and rehabilitation activities based on assessment of assets' age and/or condition and performance testing.

Figure 5.5 – Risk Treatment Framework

5.4 Asset Life Cycle Management

Most of TRCA's physical assets are long-lived assets having service lives lasting several decades. As a result, infrastructure-related decisions have a lasting impact. These decisions need to be made looking at the lifecycle or whole life of the assets in conjunction with risk and Level of Service. The whole life costs are to account for the complete lifecycle of the assets, including planning, designing, construction, acquisition, operation, maintenance, renewal, replacement, and disposal costs.

5.4.1 Asset Lifecycle Management Strategy (LMS)

The asset Lifecycle Management Strategy is the set of planned actions that will enable the assets to provide the desired levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost. The AMP includes a framework to formalize the (LMS), develop a plan to identify the lifecycle actions necessary to continue to provide services in a financially sustainable manner. LMS at TRCA is generally categorized using the below lifecycle activity categories using the six **lifecycle action categories**: non-infrastructure solutions, operations and maintenance, renewal/rehabilitation, replacement, disposal, and expansion.

Table 5.2 - Typical Asset Lifecycle Activities

Lifecycle Activity	Description	Examples
Non-Infrastructure	Actions or policies that can lower costs or extend asset life	Better integrated infrastructure planning and land use planning, demand management, process optimization, managed failures
Maintenance	Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events	Sewer spot repairs, fixing potholes
Rehabilitation	Significant treatments to extend the life of the asset.	Road resurfacing, Major Roof repairs
Replacement	Activities that are expected to occur once an asset has reached the end of its useful life and renewal/ rehabilitation is no longer an option	Vehicle's replacement, road reconstruction
Disposal	Activities associated with disposing of an asset once it has reached the end of its useful life, or is otherwise no longer needed by the municipality	Salvage or sale of fleet vehicles & equipment, demolition of residential assets
Growth/Service Improvement	Planned activities required to extend services to previously unserved areas - or expand services to meet growth demands	New conservation park; AODA compliance; green focused infrastructure improvements to service existing and new communities

5.4.2 Asset Lifecycle Categories

Non-Infrastructure Solutions

Non-infrastructure solutions refer to actions or policies that can lower costs or extend asset life but are not directly related to work on the asset itself. The types of non-infrastructure solutions include integrated infrastructure planning and co-ordination with other levels of government, demand management through the growth-planning process or continual improvements processes to achieve cost efficiencies. Including master plans, asset management plans, development related studies.

Non-infrastructure solutions are largely captured through the capital budget on an annual basis.

Operations and Maintenance (O and M) Activities

The goal for maintenance is to prevent or mitigate the deterioration of performance of assets in service and manage risk of failures. It is good asset management practice to have a maintenance strategy to

ensure an acceptable level of performance through the useful life of the asset. This includes inspections, testing, monitoring, and preventive maintenance regimes (time based, condition based, usage based). The maintenance activities are funded from the operation budget.

Operation and maintenance (O and M) will not extend the life of an asset or add to its value; however, not performing regular maintenance may reduce an asset's useful life and/ or levels of service. Regular O and M therefore ensures the asset continues to deliver defined levels of services.

Asset O and M requirements and required resources are assessed and prioritized based on:

- Carrying out legislated O and M activities at or above minimum standards to ensure safety and environmental sustainability in accordance with appropriate regulations.
- Conducting routine and preventative maintenance activities to ensure preservation of existing assets; and
- Analysis of current O and M costs of delivering defined levels of services to forecast future O and M costs.

Best asset management practices include an appropriate mix of maintenance management techniques, so the assets do not fail prematurely and continue to perform well throughout their estimated useful life. These maintenance management techniques include:

Preventative Maintenance, which is regularly scheduled maintenance activities, completed while the asset is still in an "operational" condition. The purpose of preventative maintenance is to ensure the asset remains in service throughout its design life.

Demand Maintenance ("**Reactive"**) are physical repairs to an asset that has broken down or has not functioned as intended. The repair generally reinstates the asset to a normal operating condition but does not extend the life of the asset. These types of repairs are expected as assets age and are part of the overall lifecycle management to keep the asset operational for as long as physically and economically viable. It is important to consider that when the repair costs begin to escalate as the asset ages, and it becomes not feasible to operate, the asset may be best renewed or replaced.

Renewal/Rehabilitation Activities

Renewal/rehabilitation activities are mostly associated with significant repairs designed to extend the life of an asset. These types of activities are undertaken at key points in the lifecycle of an asset to ensure the asset reaches or exceeds its designed useful life. The decisions on the scope and timing of renewal are largely based on assessing the conditions of assets. Costs associated with renewal activities are captured through the capital budget and are largely embedded in individual project costs.

Replacement Activities

Replacement activities are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation, or maintenance is no longer an option. Replacement activities are usually considered to be capital in nature as they are usually accounted as fixed costs. TRCA undertakes replacement activities on a regular basis particularly for assets with smaller design lives or rolling stock such as vehicles, furniture, or equipment. The replacement activity costs are captured through the annual capital budget.

Disposal Activities

Disposal activities are actions associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed. Most assets will have one-time associated disposal costs particularly for those that need to be disposed of in an environmentally safe manner. Other assets such as vehicles may be disposed through sales on the used vehicle market or recycled. The disposal costs are captured through the capital budget and are included as part of individual project costs, typically when replacement or major renewal takes place. Additionally, TRCA is working on identifying potential Asset Retirement Obligations (AROs) for its asset categories as mandated by PSAB 3280.

Expansion Activities

These are related to planned activities required to extend or expand the services to accommodate the demands of growth. As development occurs, additional infrastructure is required to service new residents and businesses. For a municipality this would include additional roads, facility space or extended fire services and for TRCA this could include additional erosion control or trail infrastructure. Expansion activities would be new additions to the asset portfolio. Costs associated with expansion activities are capital in nature and are related to acquisition of assets or construction costs of infrastructure. The expansion activity costs are captured through the capital budget.

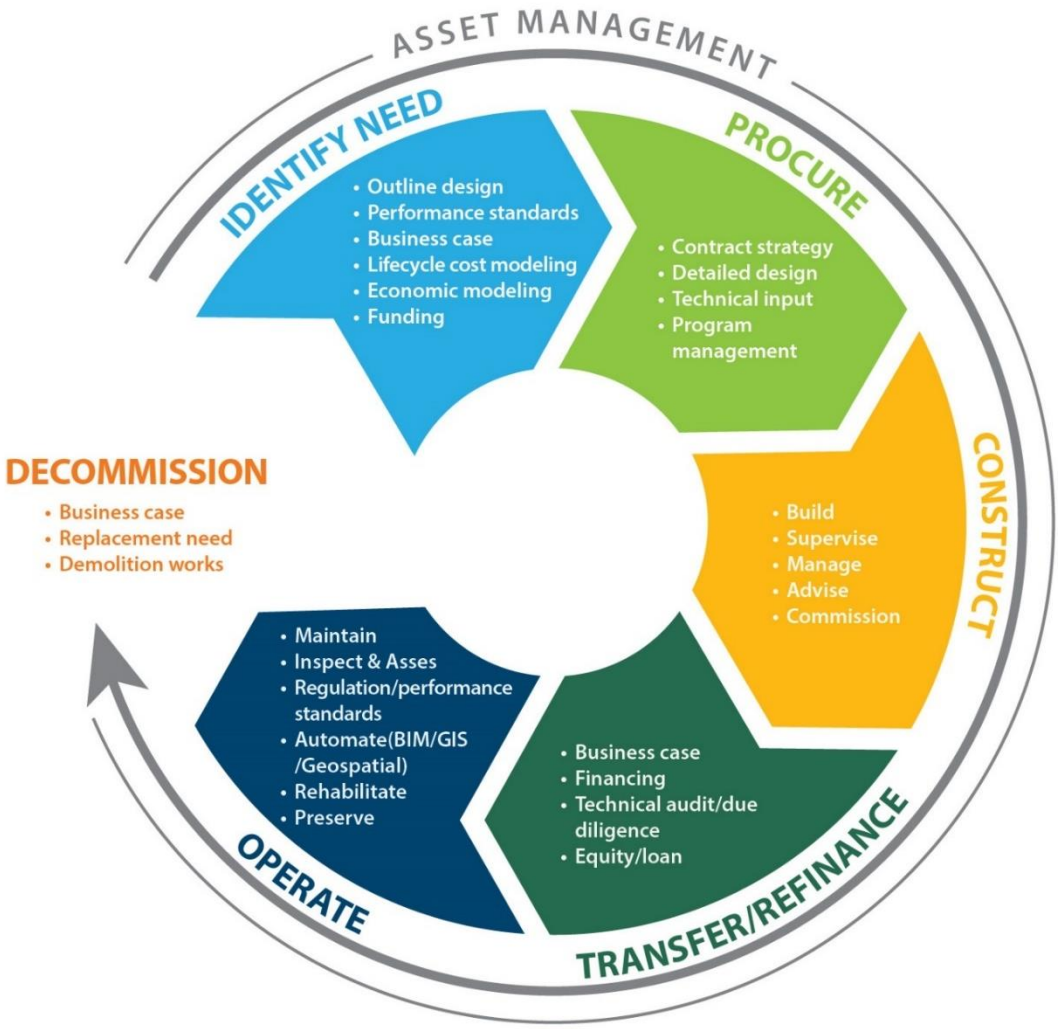
5.4.3 Asset Operation Strategy

Asset Operation concerns the day-to-day operational activities necessary to support asset users, including maintenance, and the delivery of the activities identified through the asset management strategy. The operations component within an asset management lifecycle is shown graphically in Figure 5.6.

Asset Operations are very important in contributing to meeting the required service level and to achieving the organization's objectives. Accordingly, it is important that operators have precise guidelines on how to operate the assets within the appropriate design, the maintenance, and operational parameters.

As an example, Linear Infrastructure comprises a network of generally horizontal assets that may include road pavements, bridges and tunnels, each component having its own requirements for ongoing asset condition assessment, risk assessment, routine maintenance, preservation works, incident management and planned component replacement.

Figure 5.6 - Operations within the lifecycle management of an asset



5.4.4 Asset Renewal Strategy

All assets physically deteriorate at different rates to eventual failure and loss of ability to deliver the required LOS. Asset condition is a measured assessment of an asset's current position or place on the asset "decay" or deterioration curve. Many assets deteriorate slowly at first to a fair condition and, after that, there is more rapid degradation. This typical lifecycle pattern is illustrated in Figure 5.7, which shows the relationship between condition and effective life (i.e., age).

The majority of TRCA's assets in scope of this AMP are rated in **Good** to **Fair** condition; they are good candidates for rehabilitation activities. As evident from the decay curve, it is far more cost effective to maintain and rehabilitate assets before they reach a condition where the only option is costly reconstruction. Understanding the asset's current condition and place on the asset decay curve enables forecasts of future condition and determination of optimal treatment type and timing – key aspects of lowest lifecycle cost renewal decision-making.

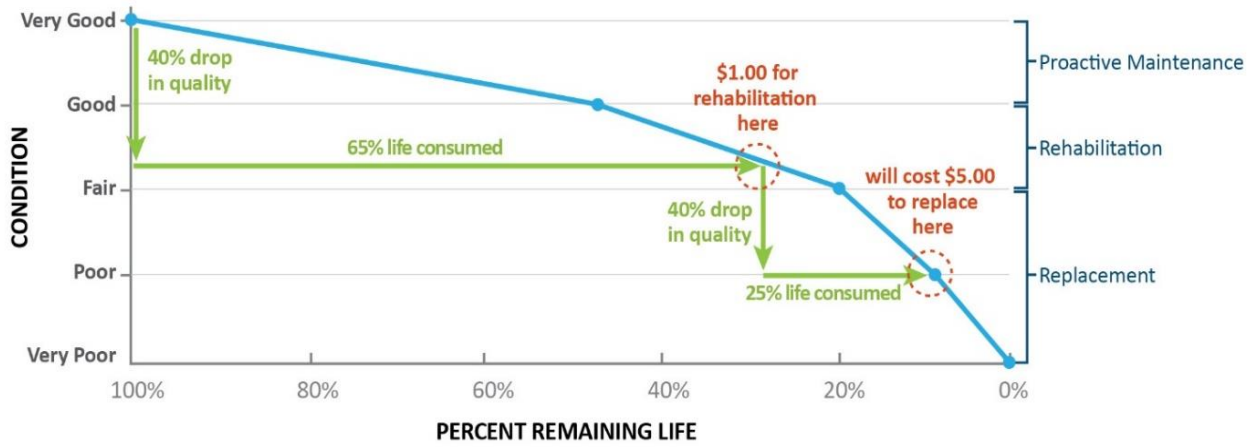


Figure 5.7- Asset Decay Curve

With the utilization of condition assessment reports, TRCA will have a better ability to track asset condition, compare this condition to targets, and use the information to make more effective decisions about renewing or replacing assets.

Table 5.3 – TRCA asset condition within each service area

Service Areas	Very Good	Good	Fair	Poor	Very Poor
Flood Control Infrastructure	13%	42%	34%	10%	1%
Erosion Control Systems	16%	39%	35%	9%	1%
Administration Buildings	83%	10%	7%	-	-
Residential Buildings	-	25%	29%	43%	3%
Parks Facilities	8%	76%	12%	3%	1%
Fleet	23%	24%	16%	18%	19%

5.4.5 Lifecycle Cost Model

The sum of all asset lifecycle management strategies informs the minimum cost to sustain each asset type. These principles are summarized utilizing the lifecycle cost model, which describes both the activities and associated costs to allow assets to provide the desired levels of service. There are several costs undertaken which include initial costs to acquire the asset, Operation and Maintenance (O and M) costs throughout the lifecycle, periodic rehabilitation costs and end of life disposal and replacement costs. The sum of these costs is considered the full lifecycle cost.

- Minimize the total cost of ownership. Failing to take care of assets can impact the total cost of ownership for that asset and can also have other impacts such as negative effects on the levels of service. Renewal and O and M activities should therefore be timed to reduce the risk of failing to provide the levels of service due to deterioration in asset condition, and to minimize the total cost of ownership.
- The deterioration curve maps out the condition of an asset over its life. As the asset ages, deterioration of the asset tends to occur at a faster rate. All assets physically deteriorate at different rates to eventual failure and loss of ability to deliver the desired level of service. Many assets deteriorate slowly at first to a fair condition and, after that, there is more rapid deterioration.
- To understand the condition of assets, condition assessments or inspections need to be undertaken on a regular basis. Asset condition is a measured assessment of an asset's current position or place on the asset deterioration curve.
- A key observation is that it is more cost effective to maintain and rehabilitate assets before they reach a condition where the only option is a considered replacement.

An example depicted in Figure 5.8 illustrates the relationship between lifecycle cost, activity, and timing through the asset life.

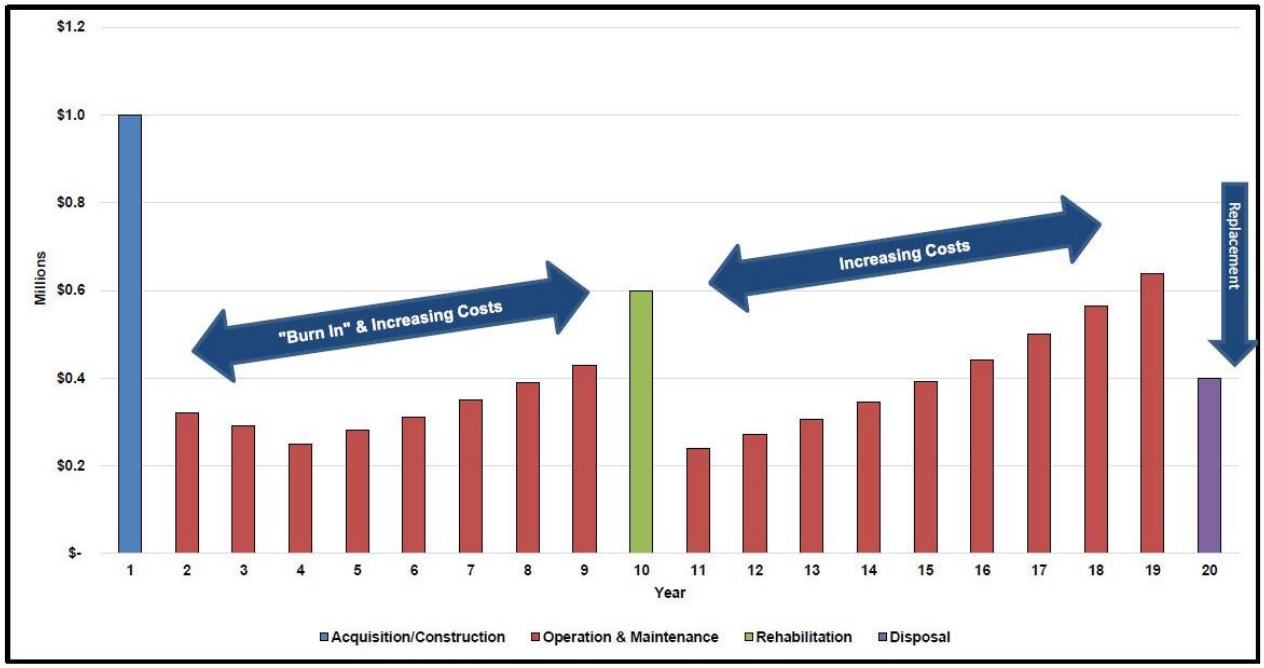


Figure 5.8 - Lifecycle Cost Model

5.5 Capital Prioritization Process

TRCA develops its asset renewal strategies through an annual prioritization process of service area asset renewal submissions. The prioritization of TRCA's capital needs is delivered annually to the Board of Directors the budget and business planning process. Capital needs are not only prioritized at the departmental level but are also prioritized at the corporate level. Corporate prioritization of capital

needs is undertaken by TRCA to assist in the decision-making process for the identification of the most critical projects across the corporation, and for the allocation of limited financial resources to fund asset renewal for the various service areas most in need. The capital prioritization results are reviewed by Senior Management through a variety of filters, and adjustments are made to ensure the most critical needs are approved for the delivery of TRCA's Asset Management Strategy. The five categories used by the corporate capital prioritization process are defined below:

- **Priority - Mandatory:** These projects have locked in commitments or vital components associated with cash flow projects approved by the Board of Directors in prior years. These projects have legal, life safety hazards, regulatory or other mandated requirements, where not achieving these requirements will lead to legal action, fines, penalties, or the high risk of liability against TRCA. These projects cannot be deferred or stopped.
- **Priority - Critical:** These projects maintain critical components in a state of good repair and at current service levels. If not undertaken, there would be a high risk of breakdown or service disruption.
- **Priority - Efficiency or Cost Savings:** Projects that have a break-even or positive return business case over the life of the capital due to operational cost savings or cost avoidance.
- **Priority - Proactive Replacement:** Projects in this category relate to proactive replacement of building systems and components at the end of their useful life. The funding for these projects is needed to maintain targeted service levels and reflects life cycle costing; and
- **Priority - Improve:** These projects provide service enhancements.

5.6 Demand Management

Demand analysis typically includes the analysis of future demand for the product or services being offered, and the requirements this demand will place on the asset portfolio. Currently, demand management is decentralized, however with the implementation of the Enterprise Asset Management Software (EAM), TRCA will aim to standardize the development of a long-term demand management forecast for all major service areas. There are several elements of Demand analysis that need to be considered:

- Historic Demand
- Drivers for demand
- Future demand and change in demand over time
- Changes in required levels of service
- Current and future utilization and capability of assets
- Impact on future performance, condition, and capability

At this stage of the AMP, most of the costs associated with the demand activities identified are related to changing demographic trends and technological advancements. However, it is recognized that continued efforts through the individual departmental plans and future AMP updates will continue to evolve this framework and the correlation between demand and costs. Undertaking an in-depth analysis on a service area basis will allow for a more refined look at the different demand drivers affecting each and allow for better monitoring of their effects going forward.

Section 6:

FINANCING STRATEGY

SECTION 6: FINANCING STRATEGY

The financing strategy is predicated on the financial state of the TRCA including revenues, operational and capital expenditures, reserves/reserve fund, and forecasted future commitments. The importance of the assets along with their significant capital and operating budget implications are intended to inform TRCA's long-term financial and service delivery planning.

6.1 Assumptions

The following types of assets are not included in this financial strategy:

- Land and land improvements which are anticipated to be added in the following year as part of Green Infrastructure update to the Asset Management Plan;
- Historical treasures, including artifacts and buildings;
- TRCA's Fleet assets – capital acquisition costs and operational expenses are offset via interdepartmental recoveries. Supluses are deposited into fleet reserve fund to replenish any deficits due to unanticipated/ unplanned capital acquisitons.

6.2 Sources of Funds and Financial Planning at TRCA

TRCA's annual budget process is closely tied to the budget process of its partner municipalities. As half of the revenues for TRCA are municipal contributions, the annual budget is approved only after each partner municipality council approves their contribution. Major contributors to TRCA's budgets are 1) The City of Toronto, 2) Region of York, 3) Region of Peel and 4) Region of Durham. Other contributors to a much lesser degree include senior levels of government depending on grants available through government programs.

The eligibility of municipal funding is based on three categories:

1) Mandatory Programs and Services – TRCA is required to provide in its jurisdiction, and eligible to be funded by participating municipal levy.
2) Municipal Programs and Services – TRCA agrees to provide on behalf of a municipal partner and is eligible for funding based on a MOU or an agreement.
3) Other Programs and Services – Supplemental to the above two categories, eligible for municipal funding (wholly or partially) through a cost apportioning agreement.

Of the Major Service Areas within this Asset Management Plan, Flood Control Infrastructure and Erosion Control Infrastructure fall within Mandatory and Municipal Programs and Services. The Public Building Facilities (Administrative, Residential and Parks) as well as Fleet infrastructure would be categorized as Other Programs and Services.

Capital expenditures have been primarily financed through municipal capital levies, which accounted for 85% of building maintenance, 76% of flood infrastructure maintenance and 93% of erosion control infrastructure maintenance since 2012.

The remaining 19% of flood infrastructure maintenance has been facilitated by MNRF Section 39 funding and other provincial grants. 7% of erosion control infrastructure maintenance has been financed by federal and provincial grants. TRCA's corporate buildings, education centers and conservation area maintenance has been supported by government and non-government grants (8%) in addition to the Toronto and Region Conservation Foundation (6%).

In addition to governmental funding and grants, TRCA supplements its revenues through Authority Generated Revenue such as user fees, rental income, and land sales. Donation of cash or in-kind also factor into the overall revenue structure for the TRCA.

6.3 Forecasted Needs and Funding

An assessment of the current state of infrastructure and desired level of service are outlined in sections 7 through 12 for each of TRCA's major asset classes. A summary of TRCA assets, excluding Fleet, is provided in Table 6.1 below:

Table 6.1 – Funding Summary by Service Area (2023 numbers)

Service Area	Replacement Cost (million)	Annual Capital Need - 10 years (million)	Annual Capital Funding Available (million)
Administration Buildings (excluding Head Office)	$ 15.31	$0.4	$0.5
Residential Buildings	$33.4	$0.9	$0.2
Parks Public Buildings	$76.1	$4.4	$2.0
Erosion Control Infrastructure	$376.5	$14.3	$11.4
Flood Control Infrastructure	$197.7	$3.4	$0.5

Table 6.2 - Summary of TRCA assets by Service Area

Service Area	Target Reinvestment Rate	Actual Reinvestment Rate
Administration Buildings	2.61%	3.29%
Residential Buildings	2.69%	0.59%
Parks Public Buildings	5.78%	2.63%
Erosion Control Infrastructure	3.79%	3.02%
Flood Control Infrastructure	1.72%	0.25%

Individual asset management plans for each of TRCA's asset types indicate that current levels of financial contributions for capital repair and replacement are not sufficient to fully fund the forecasted financial need for TRCA's major infrastructure assets until 2034.

Flood

Funding for the operation, maintenance, inspection, and repair of TRCA flood infrastructure is from several sources including MNRF Section 39, and grant funding such as Water and Erosion Control Infrastructure funding, National Disaster Mitigation Program, Disaster Mitigation and Adaptation Fund and Investing in Canada Infrastructure Plan funding. Currently, Flood Infrastructure allocates approximately $0.5 million in funding to capital projects. However, TRCA's aging flood infrastructure requires significant investment to meet state of good repair and public safety requirements.

Current capital funding from municipalities and the Province is inadequate to be able to perform the large capital repairs required to ensure dams, channels, and dikes are performing safely. Currently, the deficit in capital repairs to all TRCA owned flood infrastructure is approximately $34 million. This number will grow as infrastructure continues to age. TRCA is currently focusing on the highest priority capital projects to reduce immediate risk to the public.

In addition to capital repairs, TRCA is focusing on decommissioning structures that are no longer required and cannot be reasonably upgraded to meet current guidelines and standards. This eliminates long-term operational and capital investment while allowing for naturalization of the land no longer needed for the asset. Operating accounts, responsible for the day-to-day operation, preventative maintenance, and inspections on flood infrastructure have not kept up with rising costs. Decommissioning costs are included in the $34 million cost estimate for capital work.

Erosion

Based on the current state of the erosion control systems, the current forecasted funding should support 79.9% of the renewal needs to maintain these assets in an acceptable condition. The renewal needs are significantly funded by the City of Toronto, since 69% of TRCA's assets are located within the City. The biggest funding gaps are currently for assets located in York Region, the Region of Durham, and the Region of Peel, where the ERMP receives limited funding to maintain 31% of TRCA's assets, which represents 89 different erosion control systems. TRCA's ERMP will continue to work with its municipal partners and senior governments to support the maintenance of erosion control systems that protect publicly owned and privately-owned infrastructure from the natural hazard of erosion. Where TRCA has no funding for the maintenance of its erosion control assets, the ERMP will work with its municipal partners on a recoverable basis to be able to maintain TRCA's erosion control assets.

The ERMP is expecting a capital budget for the City of Toronto and York Region of approximately $105.98 million (excluding 2023) towards the renewal of TRCA's erosion control assets. At present, the waterfront assets are undergoing major maintenance over the next 10 years. Although some factors are unpredictable, such as storm events and high lake levels, it is estimated that the waterfront assets backlog balance will decrease to 38% by the end of 2033. In the next decade, the total funding for the valley and river assets will increase by a total of approximately $10 million compared to the last decade of funding. This total forecasted funding of $26.01 million over the next 10 years will not be enough to address the maintenance of the forecasted backlog of 49% of the valley and river assets by the end of 2033.

Currently, an additional annual investment of $2.86 million would allow the Erosion Risk Management Program to maintain all the assets in 'acceptable' condition. This level of investment would minimize the overall asset management risk, prevent premature deterioration of TRCA's erosion control systems, and eliminate the unfunded renewal need. Future projections will improve with continued refinement of the erosion control asset data.

Buildings – Administration, Residential and Parks

Each category of building portfolio varies in age, condition and remaining service life and thus faces unique financial challenges and requires tailored strategies to ensure long-term sustainability and maintenance.

The completion of the Building Condition Assessments of TRCA's building assets has provided the financial information required to approach municipal partners regarding additional levy to support current assets within their respective jurisdictions. This work will also be used to inform grants to senior levels of government and for fundraising purposes.

Administrative Buildings

For administrative buildings, excluding the new Head Office, the total maintenance expenditure required from 2024 to 2034 is estimated at $4.37 million, with an Average Annual Required Investment (AARI) of $436,795 against an average annual budget of $500,000. However, the actual annual expenditures would vary by year depending on the planned projects. To address potential funding shortfalls, particularly anticipated in 2029, TRCA should prioritize critical capital projects during surplus years and build capital reserves. A combination of early project completion and reserve accumulation can help smooth out annual funding fluctuations and ensure continuous maintenance of the administrative buildings within the target condition range.

Residential Buildings

Given the age of residential buildings, approximately 43% of the portfolio is in poor condition. There is a significant deferred maintenance backlog of $3.096 million as of 2023, with total required spending from 2024 to 2034 projected at $9.15 million. Given the current spending on maintenance and repairs, which stands at 38% of approximately $900,000 in gross revenues, TRCA should increase this percentage and strategically time essential projects to align with revenue peaks, specifically before 2026 and 2031. Additionally, accumulating reserves during surplus years and conducting a thorough portfolio analysis to divest surplus assets or enter into updated agreements with tenants when possible on underperforming assets we must maintain, will help provide necessary funds and reduce long-term deferred maintenance, ensuring the residential buildings remain in fair condition.

Parks Facilities

Parks facilities currently have a $11.7 million deferred maintenance backlog. With an annual investment requirement of $4.4 million against an average annual revenue of $2.0 million, this discrepancy will likely result in a growing backlog, projected to reach $35.7 million by 2034. To mitigate this, TRCA should bundle or advance critical projects during surplus periods and utilize corporate capital reserves, at the Board's discretion, in a phased approach to reduce the State of Good Repairs (SOGR) backlog. Drawing

from reserves during years of funding pressures will help maintain the parks facilities in good to fair condition, preventing service level declines and infrastructure deterioration.

6.4 Capital Reserve for Infrastructure Assets

At this time, TRCA does not maintain a reserve for infrastructure assets. Amounts not earmarked for any particular business unit will annually be directed to the corporate reserve and used for corporate endeavors, as outlined in annual budget submissions.

Reserve allocations are approved by TRCA's Board of Directors typically following a report with recommendations of staff. TRCA staff may recommend its accumulated surplus to capital reserve to finance the cost of tangible capital assets purchases, maintenance, and related capital expenditures.

TRCA staff will be examining with its municipal partners, options for how the reserve can be supplemented to address projected infrastructure investment needs through modest increases on service rates or other means through ongoing budget discussions with our municipal partners.

Erosion Control Systems

SECTION 7: EROSION CONTROL SYSTEMS

Introduction:

TRCA owns 282 erosion control systems across its jurisdiction, each built to protect privately and publicly owned assets. TRCA's Erosion Risk Management Program (ERMP) that is part of the Restoration and Infrastructure division (R and I) is responsible for the monitoring and maintenance of these assets. This number constantly fluctuates as TRCA completes multiple projects per year to address new erosion hazards or changes at existing sites; and we often find legacy or other unknown structures on TRCA property that become adopted as assets. The 282 erosion control systems are made up of a total of 824 erosion control structure parts, and the total replacement value of all these systems is estimated to be $376 million by the end of 2023. TRCA's erosion control systems are not traditional assets in the sense that their degradation and/or failure is not necessarily a negative outcome if the infrastructure that they are protecting is not at immediate risk. Through a more traditional Asset Management Plan (AMP) approach, the erosion control infrastructure owned by TRCA are reported through four components:

- Asset inventory
- Levels of service
- Asset management strategy
- Financial strategy

Mandated Services

Pillar 1 of TRCA's 2023-2034 corporate Strategic Plan states that TRCA will "deliver provincially mandated services pertaining to natural hazards including flood and erosion", more specifically, through conducting inventories of erosion infrastructure and monitoring conditions when funding is available. Over the last half century, TRCA has made significant investments to construct and maintain its inventory of erosion control systems to meet the objective of protecting the public from erosion and slope instability. As part of the revised *Conservation Authorities Act* (the Act), TRCA's ERMP provides mainly 2 types of programs and services to its municipal partners under Section 21 of the Act. Specifically, Section 21 states that conservation authorities are empowered to:

a. Provide mandatory programs and services related to the risk of natural hazards or related to the conservation and management of land owned or controlled by TRCA (category 1)

b. Any programs and services that may be provided on behalf of a municipality situated within TRCA's jurisdiction under a memorandum of understanding (category 2).

As part of its Strategic Plan, TRCA choose to further develop and maintain category 1 and category 2 programs and services to prevent loss of life and property damage from flooding and erosion hazards. To meet this objective, TRCA constructs and maintains erosion control and slope stabilization structures fitting the category 1 services and programs under the Act. TRCA also commissions geotechnical studies and watercourse assessments to provide detailed analyses and outline potential root causes of the deficiencies discovered during the investigation. These studies and assessments are critical in identifying strategies to address risks to our communities and to planning future capital projects.

State of TRCA's Erosion Control Infrastructure

7.1 Asset Data Inventory

As of July 2023, TRCA owns and maintains 282 erosion control systems across its jurisdiction, with 253 systems located along the slopes and riverbanks of TRCA's watersheds, and 29 systems located along the Lake Ontario shoreline between Ajax (to the east) and the border of Toronto and Mississauga (to the west).

TRCA maintains comprehensive inventory, condition, and maintenance priority data for all these erosion control assets in TRCA-developed *Stream, Erosion, and Infrastructure Database* (SEID). TRCA also assesses and maintains an inventory of known erosion hazards rated in order of risk, which may become future erosion control assets if stabilization works are completed. These assets are mainly designed to protect essential municipal, regional, and private assets, such as sanitary sewers, roads, and dwellings. The erosion control systems range in age from a few months old to 60 years old and approximately 11% of them are rated as being in 'Poor' or 'Very Poor' condition and therefore require capital improvements to restore them to an 'Acceptable' condition.

To obtain an overview of TRCA's erosion control assets network for the valley and river segments and waterfront segments, the following asset conditions were documented: current state; inventory; valuation; age; and condition. The ERMP assesses each part of these erosion control systems to efficiently monitor the condition of these assets and assess erosion hazards to public safety and essential structures. This also helps improve planning and maintenance of these systems. The valley and river segment are categorized as either valley or watercourse erosion control systems, and this is based on the location of these structures within the geological valley. The waterfront systems are simply categorized as waterfront segment type.

7.2 Asset Valuation

In order to proactively manage assets through their full life cycle, estimated replacement costs are calculated to ensure appropriate funds are being set aside for the future rehabilitation and replacement of assets as required. Replacement values do not account for major expansions, and do not include costs associated with potential environmental assessments, land acquisitions or significant provincial or federal permits that may be required as a result of a major expansion in the footprint or function of the asset.

Replacement values are used as the basis for estimating the cost of replacing an asset when it reaches the end of its engineered design life. The total replacement value of the erosion control assets in this AMP is $185.03 million for the river and valley assets compared to $191.44 for the waterfront assets, which sum up to $376.47 million. The replacement value was determined using standard accounting methodology based on historic costs, an estimated service life, and inflationary effects.

As shown in Figure 7.1, replacement value of TRCA's assets is much greater in the City of Toronto (roughly $340 million at the end of 2023), than in Peel, York, and Durham Regions combined (roughly $37 million). This is partly due to all of TRCA's waterfront erosion control structures being within the City of Toronto limits, along with the denser and earlier historical development of the City of Toronto

compared to other regions in TRCA's jurisdiction. It was estimated that a total of $41 million of TRCA's assets are currently in need of major maintenance, excluding the assets that need minor repairs. The backlog is categorized by systems that are past their useful life of 25 years. These systems are more prone to failure due to their age. A total replacement value of $200 million is in the backlog.

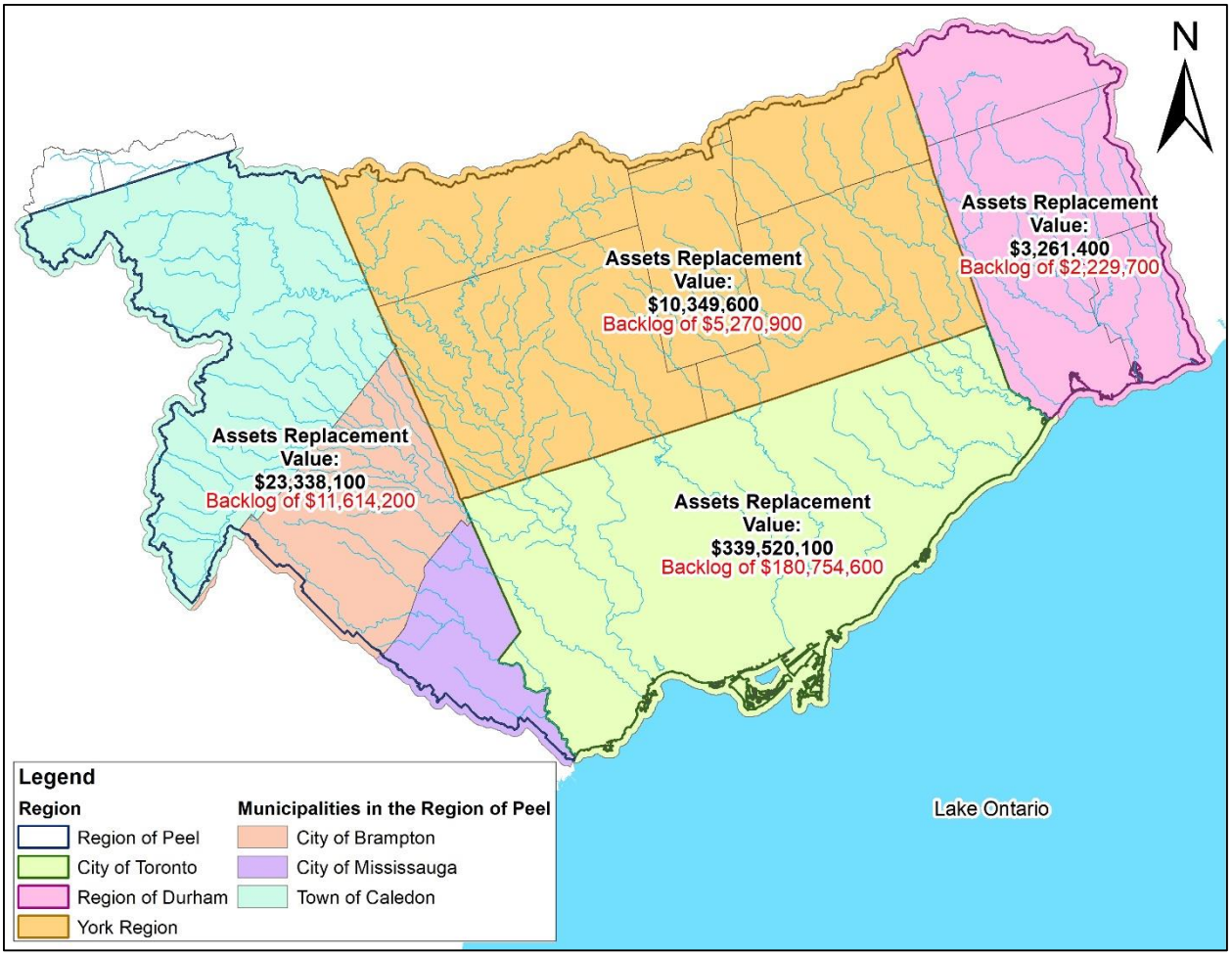


Figure 7.1 - Total replacement value of TRCA's erosion control assets (end of 2023) based on their regional location in TRCA's jurisdiction.

TRCA currently owns 43 erosion control systems protecting 57 clusters of underground infrastructure and other assets owned by the Region of Peel. These assets' replacement value in the City of Mississauga totals $12.9 million compared to $7.7 million and $2.7 million in the City of Brampton and in the Town of Caledon, respectively.

TRCA's ERMP is constantly innovating as we are developing more efficient processes to assess risk and make decisions related to erosion and slope instability hazards in our jurisdiction. It should be noted that the replacement value of most of these assets is based on the original construction cost with an annual inflation rate. Therefore, the asset replacement value does not fully consider the ERMP's expertise in monitoring, managing, and building such structures in present conditions as some costs are omitted in this approach due to the different design and permitting requirements for legacy structures.

7.3 Asset Useful Life

The useful life of erosion control assets is highly variable depending on the return period storm that the asset was designed to withstand and the actual number of storm events that occur over time, which meet or exceed the design storm.

The typical return period design storm for most erosion control assets ranges from the 10-year storm to the 100-year storm. The 100-year storm is not an event that occurs every 100 years, but rather an event that has a 1 in 100 (or 1%) chance of occurring in any given year. The service life of erosion assets, based on annual and post-storm monitoring, ranges between 10 and 50 years before major maintenance or complete replacement is required. It is important to note that the replacement schedule for erosion control assets will vary significantly. It is mainly based on frequency of maintenance, through minor works, used to keep the assets in an 'Acceptable' condition. In its financial strategy, however, the actual replacement schedule must remain flexible and give staff the ability to update it as needed in response to significant changes in a structure's condition following major storm events.

Each year, TRCA completes a State of Good Repair (SOGR) Backlog Analysis to identify which assets are required to be replaced in its 5 and 10-year capital plans by regional municipality, and to support requests for additional funding where it can be demonstrated that there is a backlog of maintenance required beyond the funding envelope provided. As shown in Figure 7.2, the depreciation of an asset leads to degradation, and ultimately, failure. Although time is an important factor, the ERMP is slowly shifting its focus to undertake more frequent maintenance of its assets to extend the useful life of its erosion control structures. This effort to conduct more frequent maintenance work is anticipated to lead to major cost savings in the long term as higher costs for major maintenance works should be reduced.

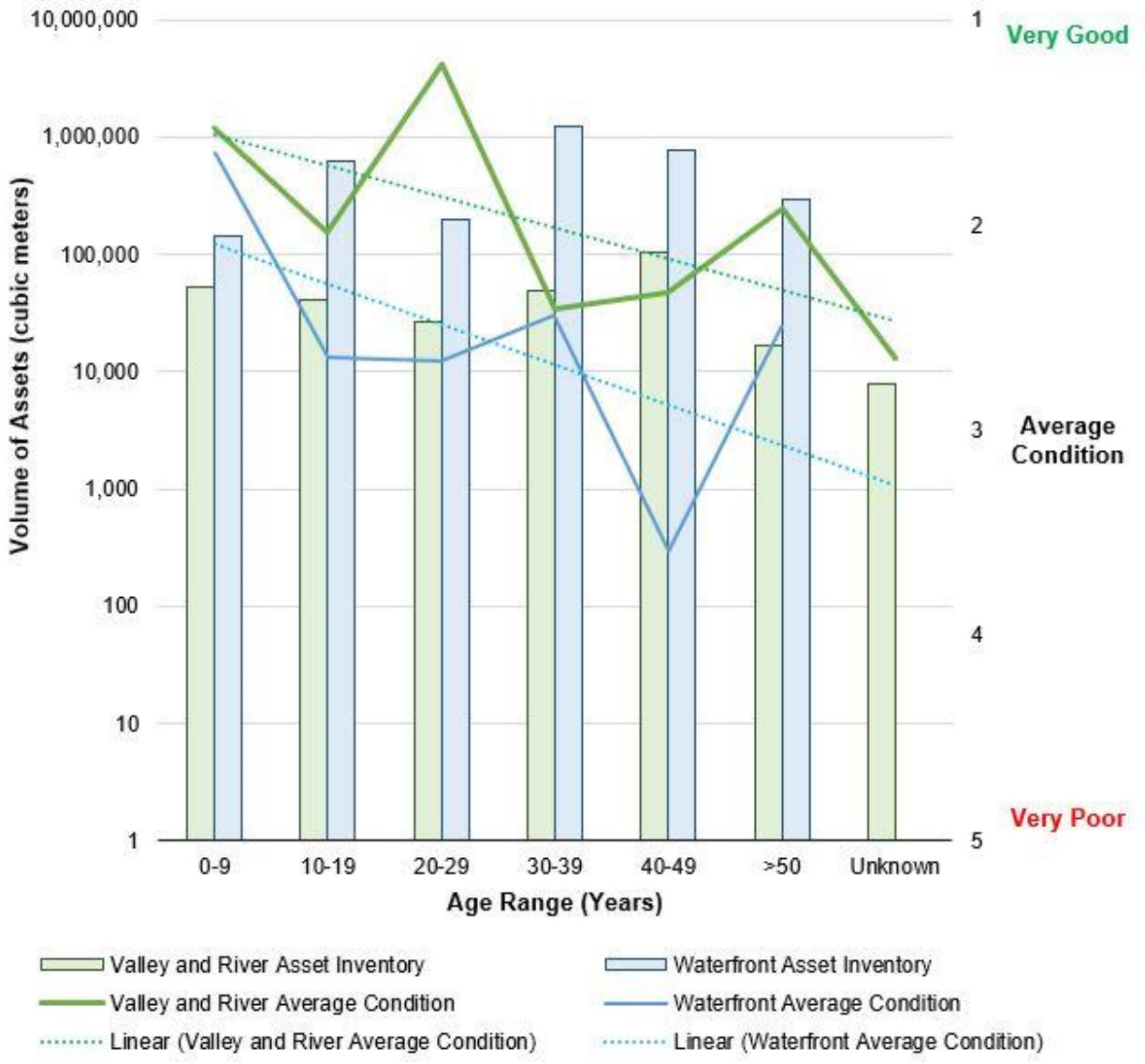


Figure 7.2 - Erosion control assets' condition based on age adjusted by their size.

7.4 Asset Condition

The condition of erosion control assets is reviewed and analyzed on a regular basis by both internal staff at TRCA and external engineering consultants. Details related to the condition of these assets can be found within inspection records in TRCA's SEID.

Based on overall score ranges, each erosion control asset was assigned the corresponding condition and numerical rate, as outlined in **Error! Reference source not found.**. The current scoring system is slightly subjective and can vary depending on the inspector's perspective. While the inspector's assessment skills and knowledge are valued, the current rating system will be replaced with an updated numerical scoring system in the next few years.

Table 7.1 - Condition rating of TRCA's erosion control assets

Asset Condition	Definition	Percentage of Assets
Very Good 	No deficiencies or very minor deficiencies were observed. No observed risk to infrastructure that erosion control structure is protecting, or public safety.	16.0%
Good 	The erosion control system is overall in good condition. Minor to moderate deficiencies or deterioration observed may require further attention. Minor risk to infrastructure that erosion control structure is protecting, or public safety.	38.7%
Fair 	The erosion control system is in a failing condition. Moderate deficiencies or deterioration were observed, and displacement of material may start to affect the parts' constructed purpose; therefore, it is putting the infrastructure it is protecting at a greater risk, or public safety. Some areas of the system may require preventative actions.	34.8%
Poor 	The erosion control system is in a failing condition. Moderate to major deficiencies or deterioration were observed. Public safety and the infrastructure that is being protected by the erosion control system may be at risk.	9.6%
Very Poor 	The erosion control system has failed or may imminently fail; the system is no longer performing its constructed purpose. Major to significant deficiencies and/or complete displacement of the system's material may have occurred. The infrastructure protected by the erosion control system and/or public safety is at high risk.	1.1%

TRCA has made significant progress in upgrading the condition of its erosion control assets over the last twenty years. Numerous projects have been undertaken to replace failed structures and to construct new assets where public safety and/or essential structures have been deemed at risk through engineering studies.

Various parts of the erosion control systems may be in better or worse shape, an analysis by the ERMP staff has determined that 89% of these assets are in an 'acceptable' condition (better than or equal to 'Fair'). Although the waterfront assets represent a small quantity of assets in number, their size (in volume) is significant compared to the valley and river assets (Figure 7.3**).** Therefore, only 3 'Poor' condition waterfront assets represent more than 95% of the total volume of all 'Poor' condition assets.

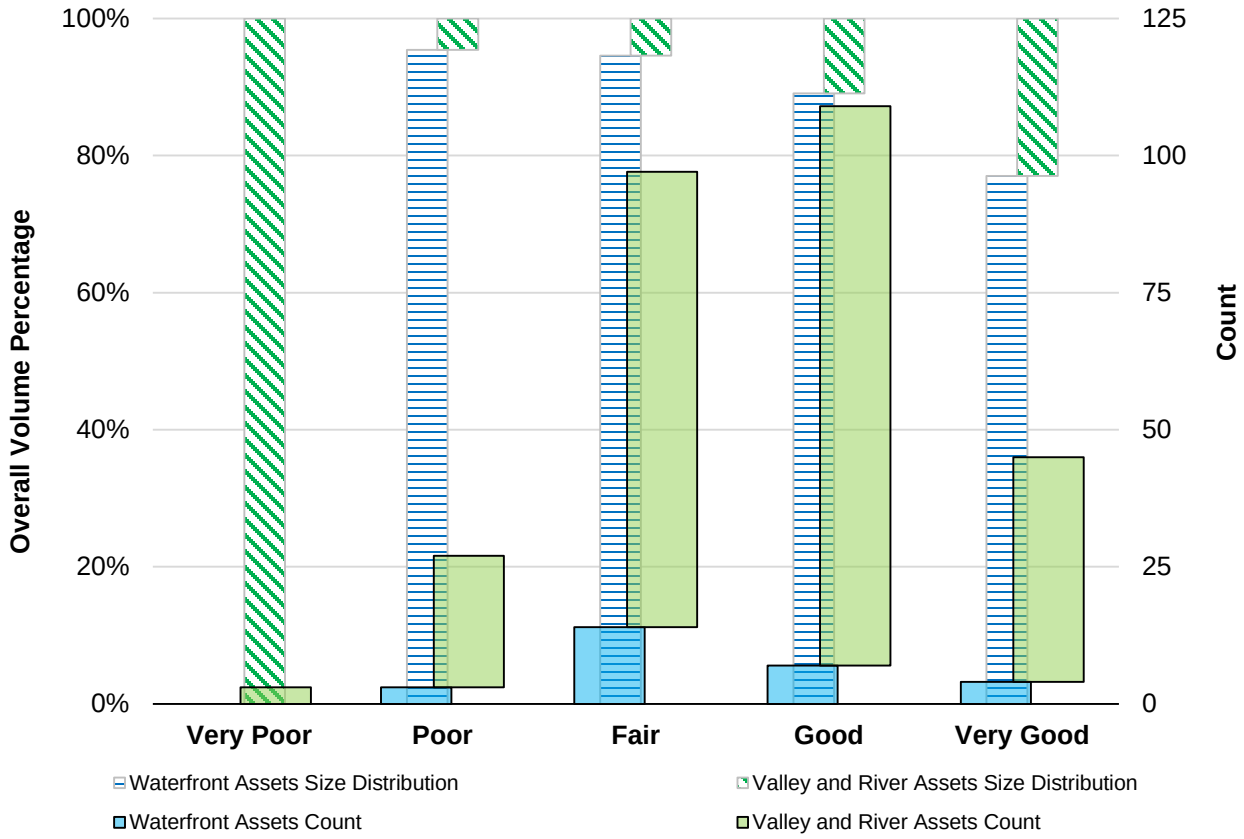


Figure 7.3 - Condition of all erosion control systems compared to their volume percentage and count.

TRCA's erosion control assets are unconventional. Since these systems are preventing the removal/displacement of material (i.e., erosion), the size of these assets is determined by volume (**Error! Reference source not found.**). The factsheet regarding the valley and river assets and waterfront assets can be found on pages 74 and 75, respectively.

Table 7.1 - TRCA's erosion control systems summarized by segment type

Segment Type	Category	Count	Total Size (m^3) *	Replacement Value (end of 2023)
Valley and River	Valley	51	121,030	$ 55,695,100
	Watercourse	202	176,200	$ 129,338,400
Waterfront	Waterfront	29	3,361,670	$ 191,436,100
Total		**282**	**3,658,900**	**$ 376,469,600**

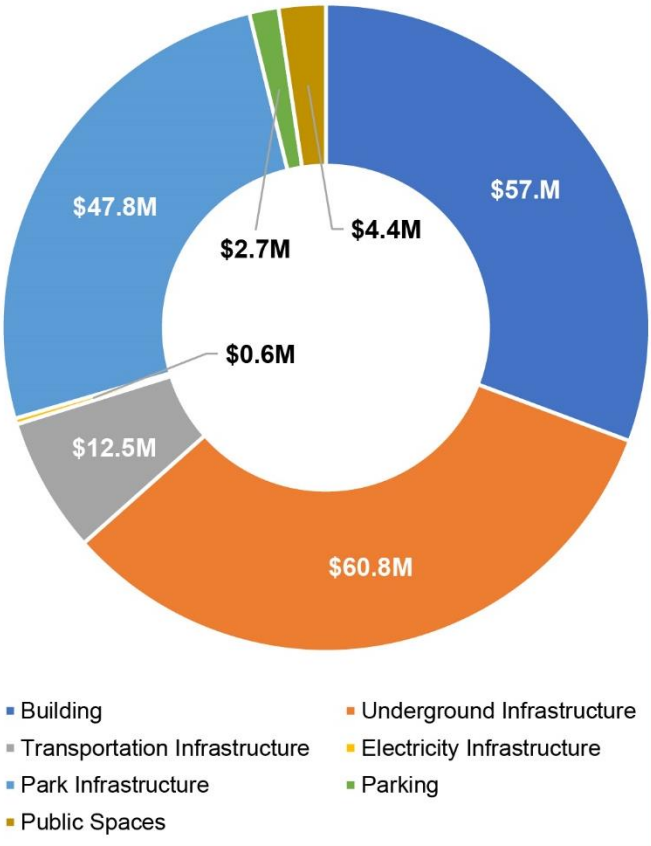
* Based on the original footprint of the assets when it was first constructed (if applicable)

VALLEY AND RIVER ASSETS FACTSHEET

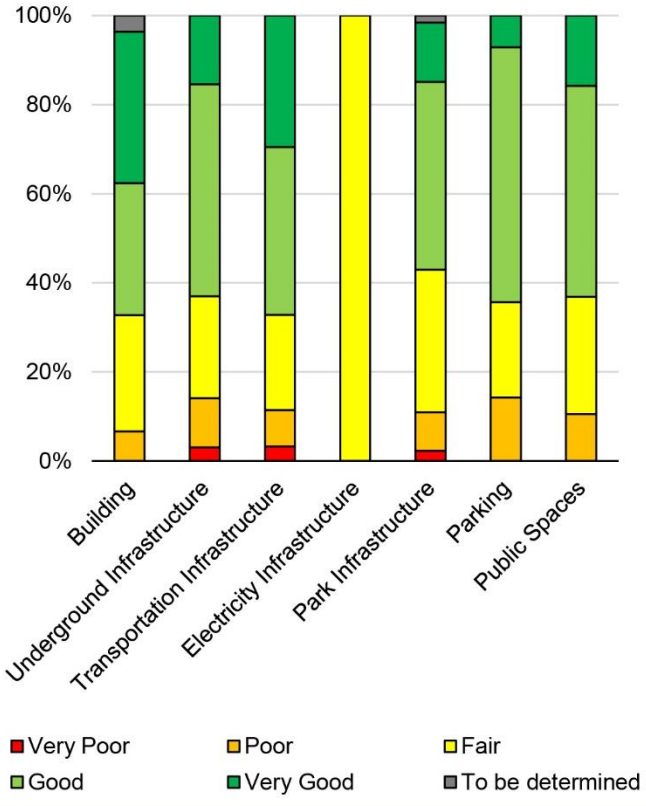
Total Asset Replacement Value:	**$ 185,033,477**
Current Condition:	**● Good**
Future Condition Trend (next 10 years):	**↓Degradation**
TRCA Strategic Plan:	Pillar 1 – Environmental Protection and Hazard Management
Assets Included in this Factsheet:	Valley erosion control systems, and Watercourse erosion control systems
Data Confidence and Reliability:	Moderate, because of high subjectivity and low consistency

The total replacement value of TRCA's valley and river erosion control systems is $185.0 million, where 57% of the assets are in 'Good' to 'Very Good' condition, and 33% are in 'Fair' condition. Approximately 48% of these assets are past the end of their service life and are more prone to degrade. TRCA's valley and river erosion control systems are overall in 'Good' condition, these assets are meeting the current needs, but they are aging and will require attention.

TOTAL REPLACEMENT VALUE BY PRIMARY CUSTOMER LEVEL OF SERVICE



AVERAGE CONDITION DISTRIBUTION OF THE SYSTEMS' PARTS BASED ON PRIMARY CUSTOMER LEVELS OF SERVICE

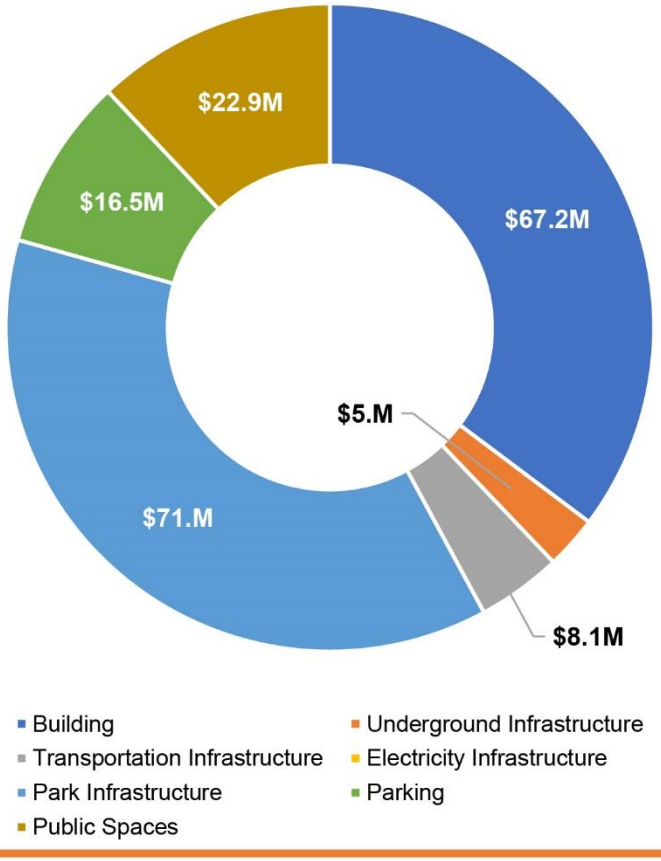


WATERFRONT ASSETS FACTSHEET

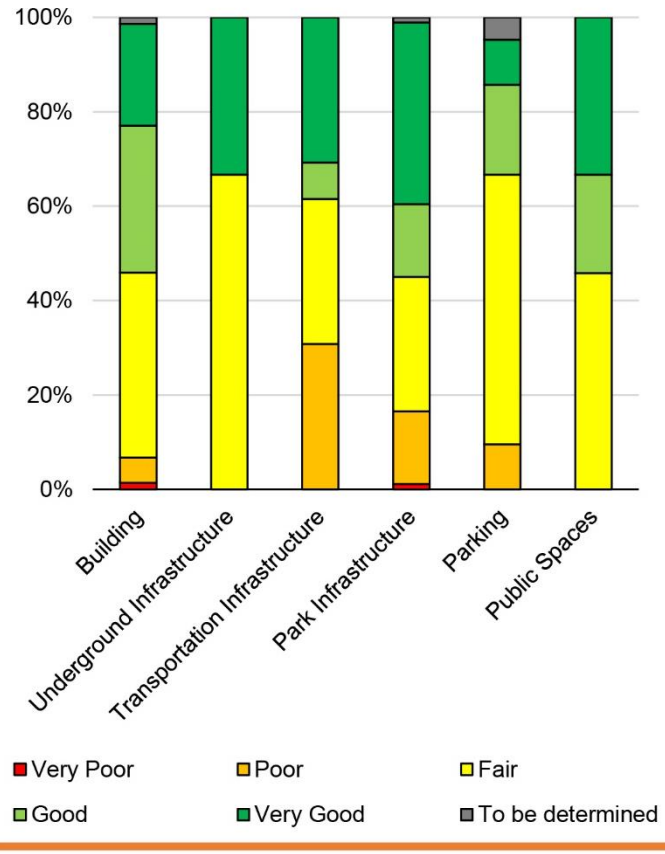
Total Asset Replacement Value:	**$ 191,436,082**
Current Condition:	**Fair**
Future Condition Trend (next 10 years):	**Good** (maintenance scheduled)
TRCA Strategic Plan:	Pillar 1 – Environmental Protection and Hazard Management
Asset Included in this Factsheet:	Waterfront erosion control systems
Data Confidence and Reliability:	Moderate, because of high subjectivity and low consistency

The total replacement value of TRCA's waterfront erosion control structures is $191.4 million where 42% of the assets are in 'Good' to 'Very Good' condition, and 32% are in 'Fair' condition. Approximately 57% of these assets are past the end of their service life and are more prone to degrade. TRCA's waterfront erosion control systems are in an 'acceptable' condition. They are scheduled for maintenance within the next decade.

TOTAL REPLACEMENT VALUE BY PRIMARY CUSTOMER LEVEL OF SERVICE



CONDITION DISTRIBUTION OF THE SYSTEMS' PARTS BASED ON PRIMARY CUSTOMER LEVEL OF SERVICE



7.5 Levels of Service

The level of services (LOS) of the tangible capital assets referred to in this plan, the erosion control assets, are key business drivers and influence the asset management decisions by the ERMP. In accordance with the Act and TRCA's Pillar 1 (Environmental Protection and Hazard Management) of the 2023-2034 Strategic Plan, **Error! Reference source not found.** provides an overview of the core objectives of the ERMP when it comes to TRCA's erosion control systems based on the three key LOS. Ultimately, these assets support TRCA's mission to **be a provincial leader in conserving, restoring, and managing natural resources to advance safe and sustainable development**.

Table 7.2 - Overview of Level of Service (LOS) of the erosion control assets

LOS	TRCA Strategic Plan	Approach
Corporate	Mitigating hazard risks to communities and protecting the natural environment.	Functional erosion control systems to mitigate hazard risks to safeguard public safety and protect essential infrastructure.
Customer	Deliver provincially mandated services pertaining to natural hazards including flood and erosion.	Maintain erosion control systems through partnership with communities, municipalities, and government to deliver erosion hazard and slope instability monitoring services and remediation works (category 1).
Technical	Monitor health of erosion control systems and maintain these assets functional.	Monitor and maintain erosion control assets to ensure they are providing adequate customer level of service.

7.5.1 Corporate Level of Service

Based on Pillar 1 of the 2023-2034 Strategic Plan, TRCA aims to mitigate hazard risks to communities and to protect the natural environment. Erosion control systems mitigate hazard risks to safeguard public safety and protect essential infrastructure. From an asset management perspective, the ERMP is responsible for supporting this corporate LOS through the monitoring and maintenance of the erosion control assets.

7.5.2 Customer Level of Service

These assets provide erosion control and slope stability services to different types of customers. Due to limited levy funding (category 1 programs and services of the Act), the ERMP can only maintain these systems through partnership with communities, municipalities, and government (category 2 programs and services of the Act). The different type of infrastructure directly and indirectly protected by the erosion control systems are identified in Table 7.3. These types of infrastructure can be publicly or privately-owned assets. This table summarizes all the infrastructure cluster types each part of the erosion control systems is protecting. For example, an erosion control system can be designed and built to protect a sanitary sewer running parallel to the riverbank (direct protection), the trail adjacent to the sewer is also benefiting from this erosion protection (indirect protection).

Table 7.3 - Customer LOS of the erosion control systems

Safety Consideration	Asset Clusters Protected	Count
Essential Structures	Building	322
	Underground Infrastructure	331
	Transportation Infrastructure	152
	Electricity Infrastructure	3
Public Safety Concerns	Park Infrastructure	323
	Parking	50
	Marina	24
	Public Spaces	52

In the above table, the building assets protected refer to essential structures, such as commercial buildings, residential detached or multi-residential buildings, etc. The underground infrastructure encompasses sanitary sewer, watermain, and stormwater infrastructure. The transportation infrastructure can refer to regional or municipal roads, railway, emergency, or maintenance access, etc. The electricity infrastructure refers mainly to transmission towers and utility posts. The park infrastructure refers to paved/formal trails and pedestrian bridges (including trail-connected maintenance access bridges).

The ERMP will improve this dataset over the next years by incorporating the scale and the specific type of assets receiving services from the erosion control systems (i.e., how many and what type of buildings are protected by the erosion control systems, what length of trail/road/railway is protected by the erosion control systems, etc.).

7.5.3 Key Stakeholders

Based on the type of assets protected, the location, and the current and historical ERMP partnerships, an overview of the main stakeholders for each type of protected asset is summarized in this section. Confirming the landownership of the protected structures will is a significant undertaking, which will be part of the data evolution and refinement over time as described in the previous section.

When it comes to erosion control systems protecting buildings and underground infrastructure, the current and historical partnerships and funding bring insights to the stakeholders receiving the erosion control and slope stability benefits. Approximately 80% of the building clusters protected are privately-owned by Torontonians. This increased significantly following the July 2013 storm event.

Financial strategy For underground infrastructure, 80% of the assets receiving erosion protection are owned by Toronto Water compared to 17% owned by the Region of Peel and 2% owned by York Region. This is the product of the evolution of the ERMP within each of these municipalities.

For the other protected assets, history and funding do not reveal many details on the exact ownership of these public and private assets. Rather than making assumptions on the beneficiary of the services provided by the erosion control assets, Figure 7.2 summarizes the location of the different protected assets within each municipality.

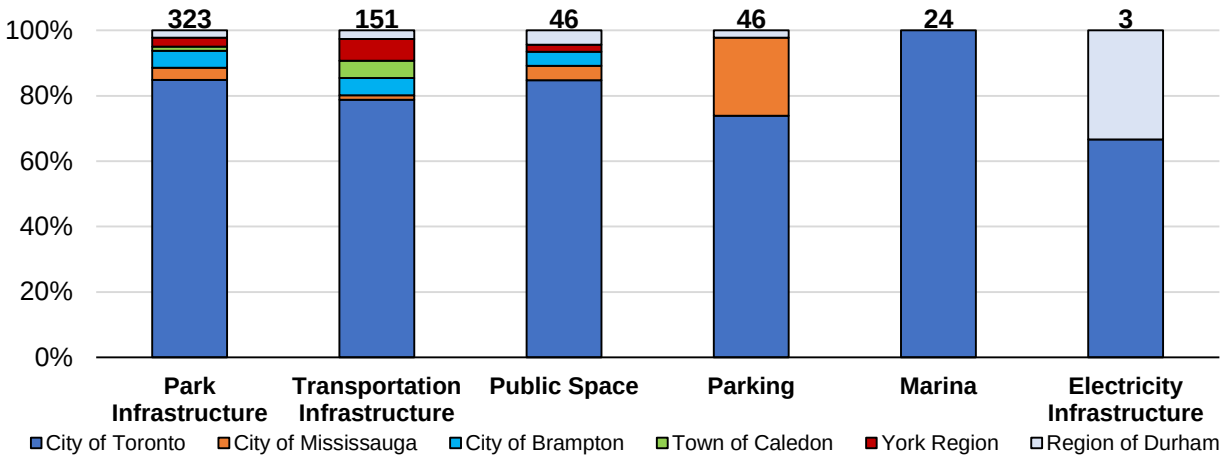


Figure 7.2 - Geographic distribution of the types of asset clusters protected by the erosion control systems.

7.5.4 Technical Level of Service

The ERMP is responsible for monitoring and maintaining the erosion control assets to ensure they provide an adequate customer level of service with limited funding. To ensure efficient monitoring and maintenance planning, ERMP staff inspect the parts of these erosion control systems. Inspections are based on a defined schedule determined by the parts' condition and any associated risk to public safety and essential infrastructure.

The goal of the ERMP is to keep 65% of TRCA's erosion control assets in 'Acceptable' condition to support the corporate LOS. Currently, approximately 89% of the erosion control systems are in 'acceptable' condition. This is the result of significant investment by the City of Toronto in the ERMP to support erosion hazard and slope instability remediation to protect their assets. Although only 10% of the erosion control systems need major maintenance and repair, this represents millions of dollars of publicly and privately owned assets at risk of erosion and slope instability. The protected asset clusters at risk due to the full or partial failure of the erosion control systems are summarized in

Table 7.4. This represents the percentage of all parts of the erosion control systems in need of minor repairs or major maintenance. This considers the fact that multiple parts of an erosion control system can inherently protect multiple types of publicly and privately-owned assets.

Table 7.4 - Percentage of all parts of erosion control systems requiring maintenance

Safety Consideration	Protected Asset Clusters	Assets Requiring Maintenance*
Essential Structures	Building	5%
	Underground Infrastructure	14%
	Transportation Infrastructure	13%
	Electricity Infrastructure	0%
Public Safety Concerns	Park Infrastructure	18%
	Parking	12%
	Marina	4%
	Public Spaces	2%

* Requiring major maintenance (excludes minor repairs)

As mentioned previously, the ERMP staff will work towards quantifying the exact extent of the risk for the protected asset clusters. This will help assess the intrinsic value that each erosion control system provides to other infrastructure and public safety. The current LOS of the erosion control systems is summarized in Table 7.5.

Table 7.5 - Summary of the technical LOS of the erosion control assets

Objective	Measure	Target Baseline	Performance	Trend
Mitigating hazard risks to communities and protecting the natural environment through functional erosion control systems	% of the erosion control systems in 'Acceptable' condition	65%	89%	

The selection of the target baseline acknowledges the inherent uncertainties of the future when it comes to climate change. It considers practical constraints, such as the expected decrease in funding for the maintenance of these assets and serves as a flexible starting point for ongoing adaptation in response to evolving circumstances.

7.6 Asset Management Strategy

The effective management of these unconventional assets can have tremendous consequences on safeguarding public safety, or property, along with savings for municipal and regional partners. While the ERMP is still focusing on the repairs of the backlogged assets damaged by the 2013 severe storm event and the recent 2017 and 2019 high lake levels on the shoreline, it is also focusing on innovating and implementing new methodologies and approaches to increase its efficiency to address depreciation and degradation of the erosion control assets.

With a significant backlog of systems past their useful life, the ERMP is focusing its strategy on more frequent maintenance of the erosion control systems through minor repair works. To support this strategy, the ERMP is currently in the process of developing the procedures and protocols for site assessment and prioritization, and the scheduling of minor works. This will allow TRCA to keep the erosion control assets in an 'acceptable' condition, hence extending the useful life of the assets and reducing the long-term expenses of major works and maintenance.

7.6.1 Operation

The ERMP is slowly shifting its strategy towards a more effective AMP through continuous maintenance, more efficient monitoring of its assets, and a more defensible, repeatable, and transparent maintenance priority assessment along with periodic life cycle costing analysis.

7.6.2 Asset Monitoring

TRCA's ERMP monitoring staff are equipped with a micro Remotely Piloted Aircraft System (mRPAS), the DJI Mini 2 (Figure 7.3), allowing for more efficient and safer inspections. It also provides the opportunity to safely capture a different vantage point of a site, providing insight when communicating erosion risk to various stakeholders, or when assessing the erosion risk (example: Erosion hazard at Boyd Conservation Area remediated in 2021 with a 75m long revetment HR123 (see Figure 7.6).

Figure 7.3 - Micro Remotely Piloted Aircraft System (mRPAS) (DJI Mini 2). Source: DJI, 2021.

Figure 7.4 - Former erosion hazard at Boyd Conservation Area captured by mRPAS before construction of a new erosion control system (before on the left photo, and after on the right photo). Source: TRCA, 2021.

7.6.3 Remote Sensing

Being more accessible and affordable than ever before, remote sensing provides the opportunity to get accurate models of erosion control systems and the surroundings. These models can then be used to inspect change over time and measure dimensions, and ultimately, assess risk. This is especially useful when dealing with ever-changing environments at the locations of the erosion control assets (i.e., valleys, watercourses, and shorelines).

Along with its improved monitoring techniques, the ERMP staff conduct scheduled and post-storm monitoring inspections on each of its assets depending on the level of risk and the corresponding inspection frequency. The post-storm monitoring leverages another type of remote sensor – the stream and rain gauges. The results of these inspections are used to determine if the systems are safe and to prioritize capital works to maintain these assets in an 'acceptable' condition.

TRCA's Remotely Piloted Aircraft System (RPAS) Program can collect video-based asset inspections. For more detailed assessment, the RPAS team can also quickly create photogrammetric models (Figure 5), providing the opportunity to measure dimensions and compare changes over time at a low cost. This approach is cheaper than RPAS light detection and ranging (LiDAR) data but does not penetrate vegetation.

Figure 5.7 - Photogrammetric model a waterfront system at the toe of Lakehurst Crescent (WF20). Source: TRCA, 2021.

The alternative to photogrammetry is to collect RPAS LiDAR data. It can penetrate vegetation to collect elevation data. This data can then be used to create a Digital Surface Model for observing changes on a site scale over time and assessing risk (

Figure 7.6).

Figure 7.6 - Two merged Digital Surface Models (collected by RPAS for land, and by multibeam echo sounding for underwater) of the erosion control system at Colonel Sam Smith (WF04). Source: TRCA, 2022.

7.7 Continual Improvement and Innovation

The operation and management of the erosion control systems are continuously evaluated and improved through clearly defined actions such as:

- Review of asset performance;
- Up to date inventories;
- Updates to asset information;
- The inclusion of unplanned corrective maintenance expenditures;
- Updates to preventative maintenance plans;
- Performance metric reviews;
- Return on Investment reviews (note again that ROI is a data gap in the program);
- Life Cycle Costing Index reviews; and
- Review of new trends and technologies.

The ERMP is currently improving their data collection, evaluation, and risk assessment for a more defensible, repeatable, and transparent methodology. In comparison to the current site assessment and evaluation methodology, this approach aims at connecting a site geospatially to each of the component parts of risk – hazard, exposure, and consequence of failure. This will result in a quantifiable score that can be derived from data linked to various internal and external databases in a GIS-based platform.

7.8 Financial Strategy

The ERMP has developed a plan to effectively manage and sustain its erosion control assets. The plan in conjunction with long-term financial planning will ensure that TRCA is managing erosion control systems in a manner that is fiscally responsible and sustainable over the long term. The key objective is to ensure that the ERMP has predictable investment in these structures to mitigate time-varying pressures such as aging, deterioration, and climate that affect the current state and the overall long-term performance of these assets.

This section provides a summary of the financial information presented as part of the individual asset category to have an overall understanding of the financial need of TRCA's erosion control assets. The financial data and future projections are based on the current asset inventory and condition information to date, focused on optimal asset lifecycle and value-based level of service, and summarized in the following sections:

- Historic Overview
- Predictable Investment
- Replacement Values and Unfunded Need
- Future Need
- Risks and Assumptions
- Importance of Full Life Cycle Costing.

TRCA's municipal partners have been proactive in providing a base level of dedicated funding to the

ERMP over a number of years while TRCA moves forward to asset management based on full lifecycle costing**Error! Reference source not found.**. This dedicated funding has provided the flexibility and liquidity required to finance current erosion control asset needs, as well as assist in addressing unfunded needs to mitigate new erosion hazards that arise from severe weather events.

Historic Overview

In order to understand the factors influencing TRCA's erosion control assets, an overview of the historical ERMP partnerships, and grants, is necessary. This helps explain how TRCA have been able to maintain their existing erosion control assets and build new ones, based on available funding. It also highlights major changes impacting on the condition of the erosion control systems (i.e., storms), and subsequently, an increase in funding from different municipal partners. The following presents a summary of TRCA's investment in erosion control infrastructure over the last 20 years:

2000 - Funding is relatively static up to 2006 at a total of approximately $2.0 million per year:

- $1.7 million for the City of Toronto, and
- $0.3 million for the Regions of York, Peel and Durham combined.

2006 - Region of Peel increases its funding for the ERMP by $600,000 per year for climate change mitigation and adaptation.

2011 - The ERMP gets funded $6.3 million by the City of Toronto, allowing the construction of 18 new assets in 2011 and 2012 through the *Shoreline and Valley Regeneration* portfolio.

2012 - Transition of the *Shoreline and Valley Regeneration* portfolio to:

- *Waterfront Major Maintenance and Remedial Works* portfolio (account 241-01) to address erosion hazard on Lake Ontario waterfront, and
- *Watershed and Valley Erosion Control* portfolio (account 134-01 and 139-01) which focuses on repairing deficient erosion control systems.

2013 - York Region increases its erosion funding to protect municipal water and wastewater infrastructure by $530,000 and then by $240,000 the following year for a total funding of $1.0 million in 2014.

2014 - City of Toronto increases its erosion funding by $50.0 million over 10 years in response to the severe weather event of July 8, 2013. A new program was created to address erosion and slope instability issues across the City of Toronto:

- *2014 Enhanced Erosion Major Maintenance* portfolio (account 133-01 and 133-03).

2019 - TRCA successfully obtains project approval under the Disaster Mitigation and Adaptation Fund (DMAF) that will contribute approximately $8.6 million per year over 10 years:

- $1.2 million for the 2014 Enhance Erosion Major Maintenance (133-01),
- $3.8 million for the Watershed and Valley Erosion Control (134-01 and 139-01)
- $1.9 million for the Erosion Maintenance Program with York Region (189-01), and
- $1.6 million for the Erosion Maintenance Projects with the Region of Peel (189-05).

Durham Region funding has been eliminated resulting in a monitoring and maintenance gap for 13 erosion control systems in Durham Region.

The available funding provided by each municipal partner to the ERMP for each specific program is illustrated in **Error! Reference source not found.**. It should be noted that not all these municipal programs directly fund erosion control assets maintenance. The funding provided by the City of Toronto through the *Watershed and Valley Erosion Control* portfolio and the *Waterfront Major Maintenance and Remedial Works* portfolio are directly focused on the maintenance of TRCA-owned erosion control assets. The other portfolios are more focused on the municipal partners' infrastructure at risk and *could* coincide with TRCA's failing/failed erosion control systems that put their infrastructure at risk, but not automatically.

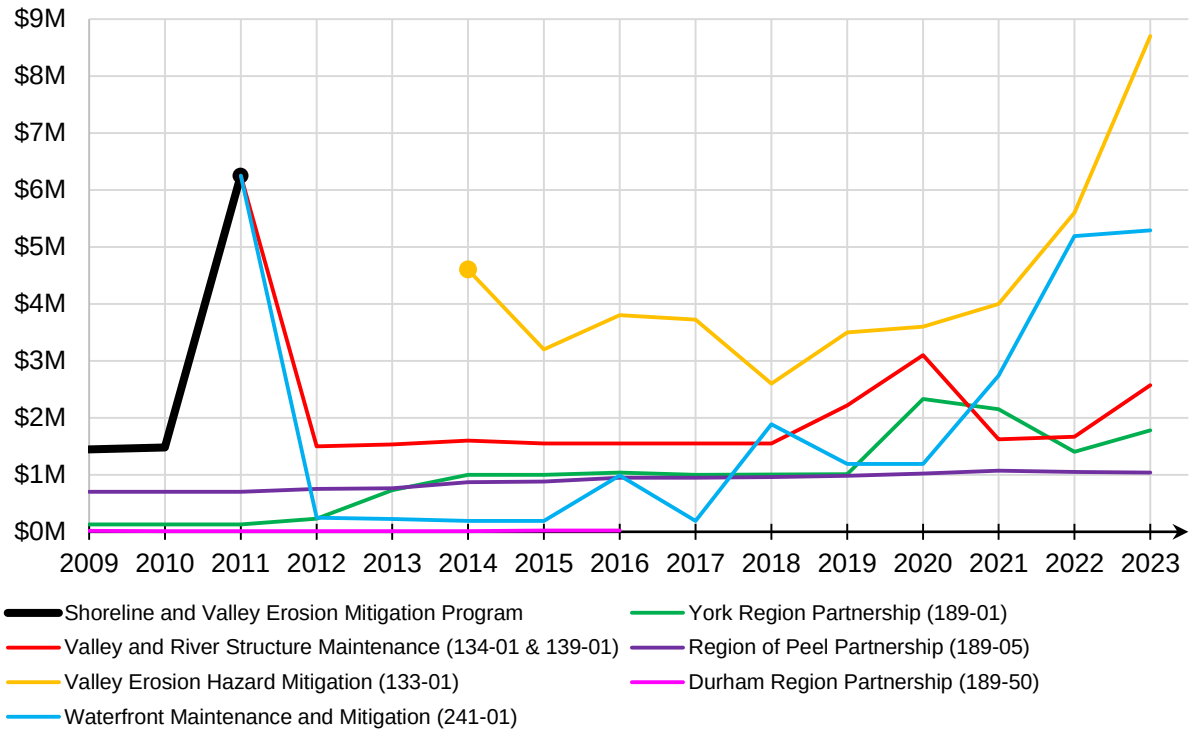


Figure 7.7 - Past funding for erosion hazard mitigation in TRCA's jurisdiction.

As highlighted previously, TRCA owns most of its erosion control assets within the City of Toronto. After the transition to the three core portfolios in the City of Toronto (2012) and the 2013 severe storm event, a total of 28 erosion control systems were built to address erosion and slope instability (see Figure 7.8 and Figure 7.9). For the same period, a total of 17 valley and river assets, and 8 waterfront assets, have been repaired and maintained to be brought into an 'acceptable' condition.

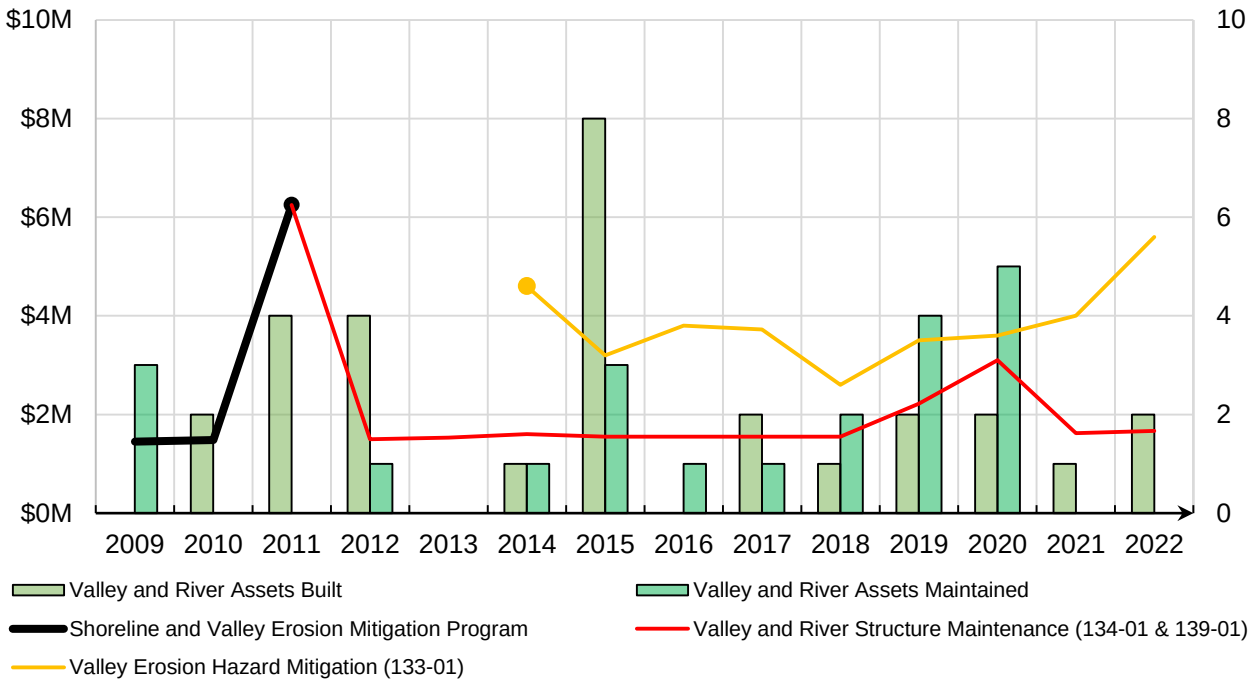


Figure 7.8 - Recently constructed and maintained valley and river assets in the City of Toronto.

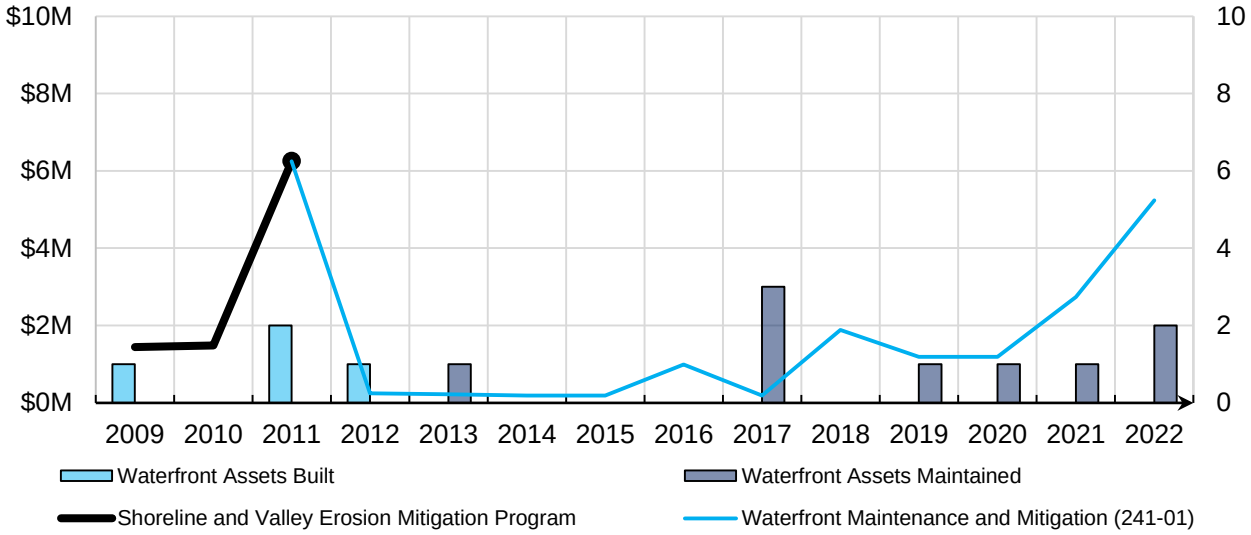


Figure 7.9 - Recently constructed and maintained waterfront assets in the City of Toronto.

Although a smaller portion of TRCA's erosion control system is located outside of the City of Toronto, a total of 22 assets were built recently (since 2009) (Figure 7.10). Compared to the City of Toronto's strategy that funded the repair and maintenance of 25 assets, the ERMP were only able to maintain 3 assets outside of Toronto for the same period.

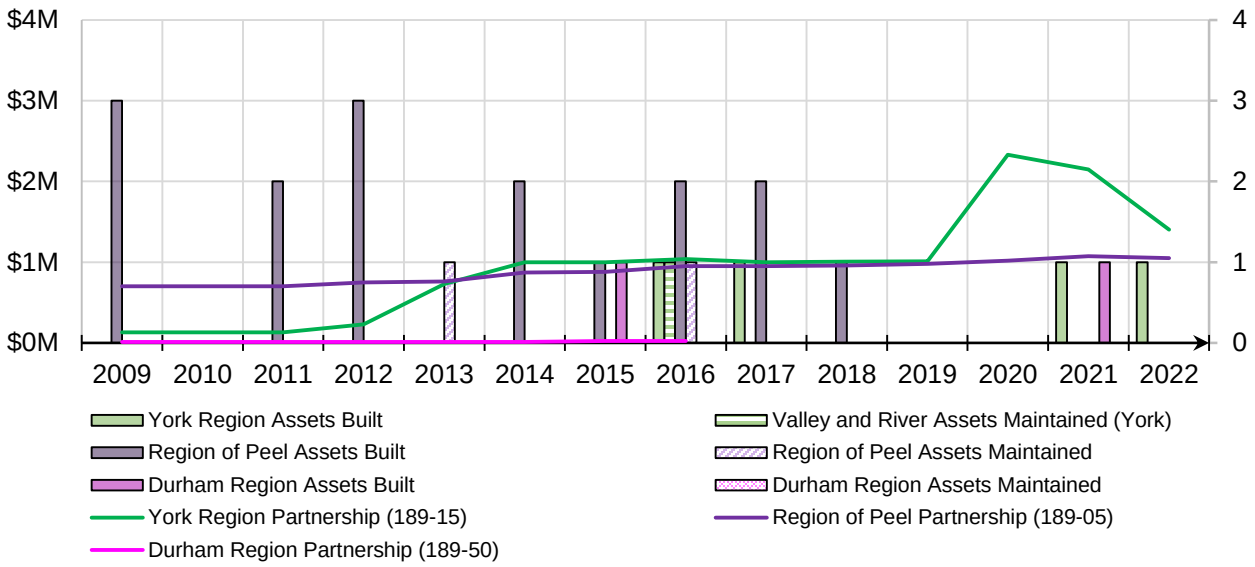


Figure 7.10 - Recently constructed and maintained assets outside of the City of Toronto.

Disaster Mitigation and Adaptation Fund (DMAF)

As part of the Disaster Mitigation and Adaptation Funds (DMAF), approved in March 2019 for the ERMP, Infrastructure Canada (INFC) agreed to contribute to TRCA not more than 40% of the total eligible expenditures up to a maximum of $22.3 million by the agreement end date of March 2028. This funding opportunity provides financial support to TRCA and its municipal partners to remediate erosion and slope instability across the valleys, rivers, and the waterfront throughout its jurisdiction.

Along with reporting and auditing, communicating with INFC, and indigenous consultations, TRCA must ensure the ongoing operation, maintenance and repair of any assets that were identified through this DMAF application during the Asset Disposal Period. The Asset Disposal Period represents 20 years after the effective substantial completion date. Therefore, TRCA needs to maintain ownership of the asset through land conveyance, including easements as required to access the structures for monitoring and maintenance. If land conveyance is not viable, access needs to be secured to maintain an asset for the duration of the Asset Disposal Period.

Fundamentally, this funding opportunity increases TRCA's ability to meet its core mandate to protect the public from the natural hazard of erosion and flooding. Despite having funding to remediate erosion and slope instability, TRCA's ERMP receives a larger percentage of funding to study and address erosion hazards rather than maintain existing erosion control infrastructure. The costs associated with maintenance and easement is negligeable on a site-by-site basis but will compound quickly. TRCA has a risk tolerance approach when it comes to its erosion control infrastructure ownership. When possible, this ownership is transferred through land conveyance to TRCA's municipal partners or private customers. This land conveyance of erosion control infrastructure removes TRCA's liability and places the maintenance and associated costs on the protected infrastructures' beneficiary. With this DMAF funding and the inclusion of the Asset Disposal Period, TRCA will increase its liability, without the financial means to monitor and maintain its erosion control infrastructures as needed; a fact that will eventually need to be addressed and managed accordingly.

The Long Branch Park waterfront erosion control infrastructure was the first assets TRCA's ERMP was able to substantially repair as part of the DMAF program in 2021 (Figure 7.11). This erosion control

system was repaired with a total eligible cost expenses of $1,560,100 to date, where TRCA will receive a total funding of $624,000 from INFC.

Figure 7.11 - post-construction maintenance of the waterfront erosion control system at Long Branch Park (WF03). Source: TRCA, 2021.

As TRCA continues to organize its data and more INFC funded maintenance projects are completed, the Asset Management Plan will be refined to identify the benefits of the DMAF and the potential challenges and funding needs over the Asset Disposal Period.

Forecasted Investment

The ERMP staff maintain a 10-year forecast for maintenance of TRCA's existing erosion control systems based on anticipated funding (**Error! Reference source not found.**) and site prioritization. In-year adjustments are expected and required given the dynamic and unpredictable nature of events that may trigger damage to these assets. These adjustments are required to adapt and respond to risk appropriately and maintain the expected service level to the highest degree possible. The ERMP assumes the status quo for the forecasted funding.

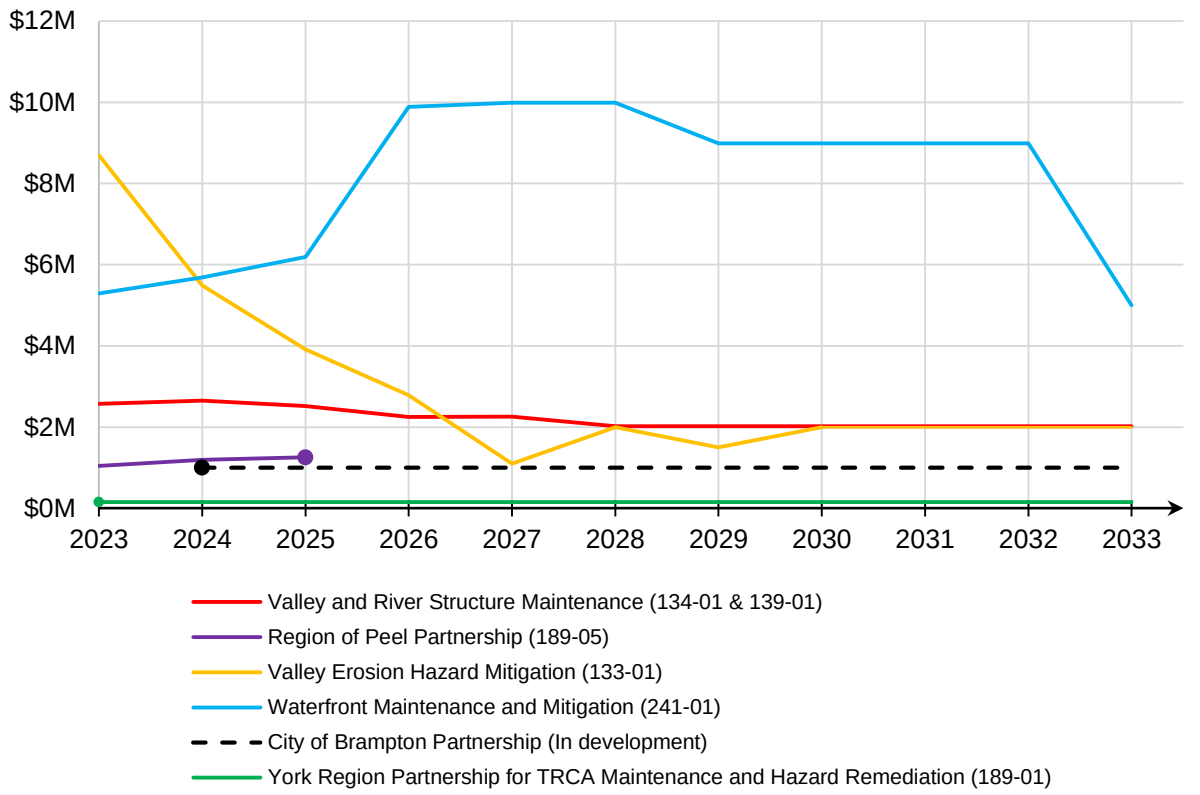


Figure 7.12 - Forecasted budget for the valley and river, and the waterfront, for erosion hazards remediation and erosion control systems maintenance across TRCA's jurisdiction.

While funding budgets for the remediation of valley and river erosion and slope instability hazards are peaking in 2023 through the *Valley Erosion Hazard Mitigation* portfolio (133-01) due to DMAF funding, the regional partnership for *TRCA Maintenance and Hazard Remediation* portfolio (189-01) will also provide minor support for the maintenance of valley and river erosion control systems in York Region. Alternatively, the *Waterfront Maintenance and Mitigation* portfolio (241-01) will focus on the repair of existing waterfront assets.

The regional partnerships with York Region and the Region of Peel are not expected to increase TRCA's erosion control asset inventory. This is because the regional partners assume ownership, and maintenance, of newly built structures since they ultimately protect their own linear buried assets: sanitary sewers, watermains, and stormwater infrastructure.

Additionally, the ERMP started to work with the City of Brampton in 2016 to inventory erosion hazards to public safety and essential infrastructure throughout the City within TRCA's jurisdiction. The ERMP is working towards a Service Letter Agreement for 2 years with the City of Brampton for monitoring services and remediation works to address erosion risks and keep the City's stormwater infrastructure functional. This will be the pilot for a longer-term agreement. Although this is not focused on TRCA's erosion control assets, TRCA owns 19 erosion control systems with a current replacement value of $7.7 million in the City of Brampton. Based on the proximity between TRCA's and the City's assets, this partnership could support the maintenance of TRCA's erosion control systems.

In the next 10 years, the ERMP will implement repairs and maintenance to 7 valley assets, 21 watercourse assets, and 12 waterfront assets as summarized in Figure 7.13. Given that some of these

maintenance projects take years to complete, the figure below only identifies the number of assets repaired at the expected year of substantial completion of the maintenance. With the current funding and grants, TRCA will be able to invest roughly $26 million in the maintenance of valley and river assets compared to $88 million for the waterfront assets, mainly in the City of Toronto.

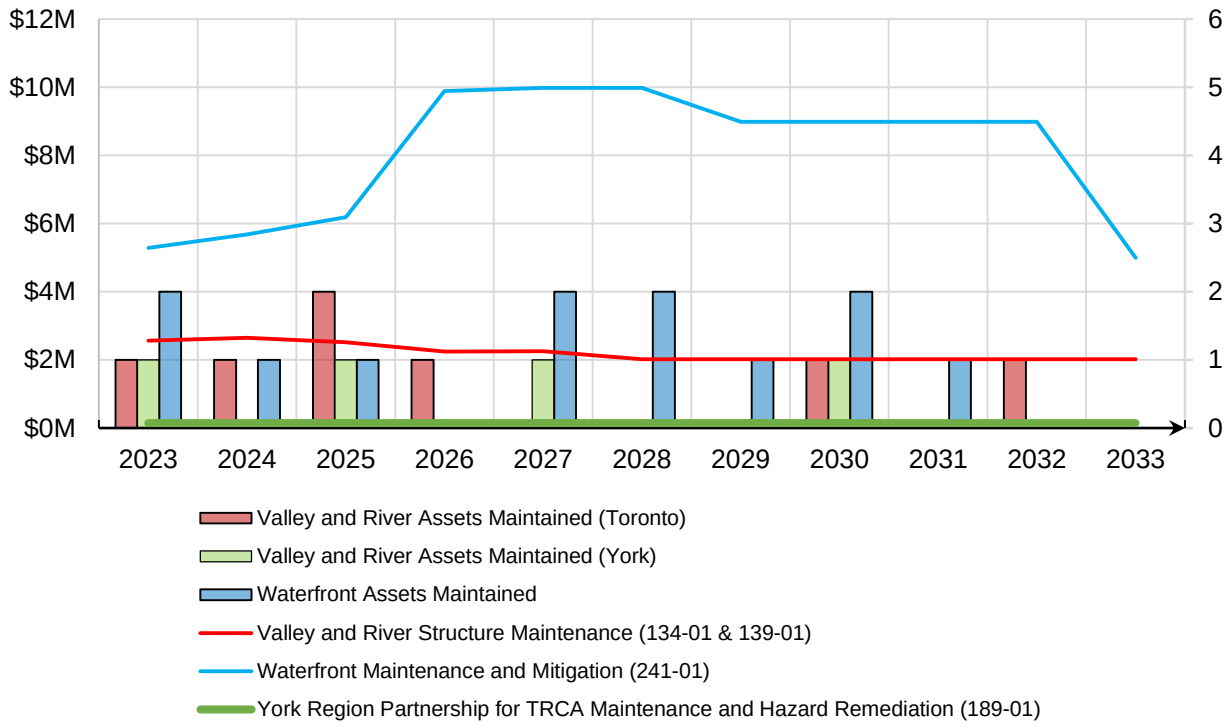


Figure 7.13 - Forecast maintenance of the erosion control systems over the next 10 years.

Unfunded Renewal Need

Maintaining TRCA's erosion control assets in an 'Acceptable' condition is identified in the ERMP's long-term financial plan, which seeks to optimize TRCA's investment in asset rehabilitation and replacement by strategically undertaking work on the right assets, at the right time. The assumed useful life of erosion control assets is set at 25 years to assign the scheduled replacement year, but it is the field assessed condition that provides the recommended replacement year. This step is critical to ensure that the primary goal of protecting life and property from the natural hazard of erosion and slope instability is always kept at the forefront of decision-making.

It is the objective of the asset management strategy to maintain or improve the LOS for erosion control assets. The current average condition of TRCA's erosion control assets is 'Good' with an overall average condition rating on the 5-point rating scale of 1.9 for the valley assets compared to 2.5 for the watercourse assets, and 2.6 for the waterfront assets. To keep improving and maintaining this level of performance, continued investment in the erosion control systems is required. The maintenance focus for these assets is to repair or replace all assets prior to failure, or by the end of its useful life whichever comes first; the former may occur sooner due to sustained damage from multiple storm events over time.

To track whether the LOS is being achieved, an annual SOGR Backlog Analysis of the erosion control assets is completed based on regional municipality, which aligns with how the ERMP is funded for the maintenance of existing erosion control assets and the construction of new erosion control assets. The annual SOGR Backlog Analysis tracks the scheduled repair/replacement year, as well as the recommended replacement year; the latter being updated annually and following weather events that have significantly changed the condition of the asset and overrides the scheduled replacement year.

As shown in Table 6, the average condition of erosion control assets across TRCA's jurisdiction is currently in 'Good' condition with an overall average ranking of 2.3. Approximately 89% of these assets are in 'acceptable' condition, which is above TRCA's goal of 65%. Most of the erosion control systems needing major maintenance are located in the City of Toronto's waterfront. Although parts of erosion control systems can be in 'Fair' condition, this type of asset can still be functioning as intended overall but might need repairs to prevent further erosion and displacement of other parts of the system.

Table 6.7 - Distribution of the current state of erosion control systems by municipality and estimated Rough Order of Magnitude (ROM) repair investment needed.

	Waterfront		**Valley and River**				
	City of Toronto		**York Region**	**Region of Peel**			**Region of Durham**
				Mississauga	**Brampton**	**Caledon**	
'Very Poor'	2%	1%	0%	0%	0%	0%	0%
'Poor'	22%	5%	3%	0%	0%	1%	3%
'Fair'	32%	25%	38%	9%	26%	3%	59%
Average Condition	2.3	2.3	2.5	2.2	2.6	2.1	2.2
Needed ROM Repair Cost* (in Millions)	$69.73	$23.10	$3.30	$1.79	$1.17	$0.13	$1.00
	$95.83		**$3.30**		**$3.09**		**$1.00**

* This includes the replacement value for 'Very Poor,' 'Poor,' and 'Fair' condition assets.

Based on current trends of the aging assets and considering the scheduled maintenance of TRCA's erosion control systems, Figure 7.14**Error! Reference source not found.** compiles the projected assets age distributed by volume in 2033 by municipality. Overall, 33% of all assets based on their size will be past their useful life. As previously demonstrated, there is a strong correlation between the age of the erosion control systems and their functional customer LOS.

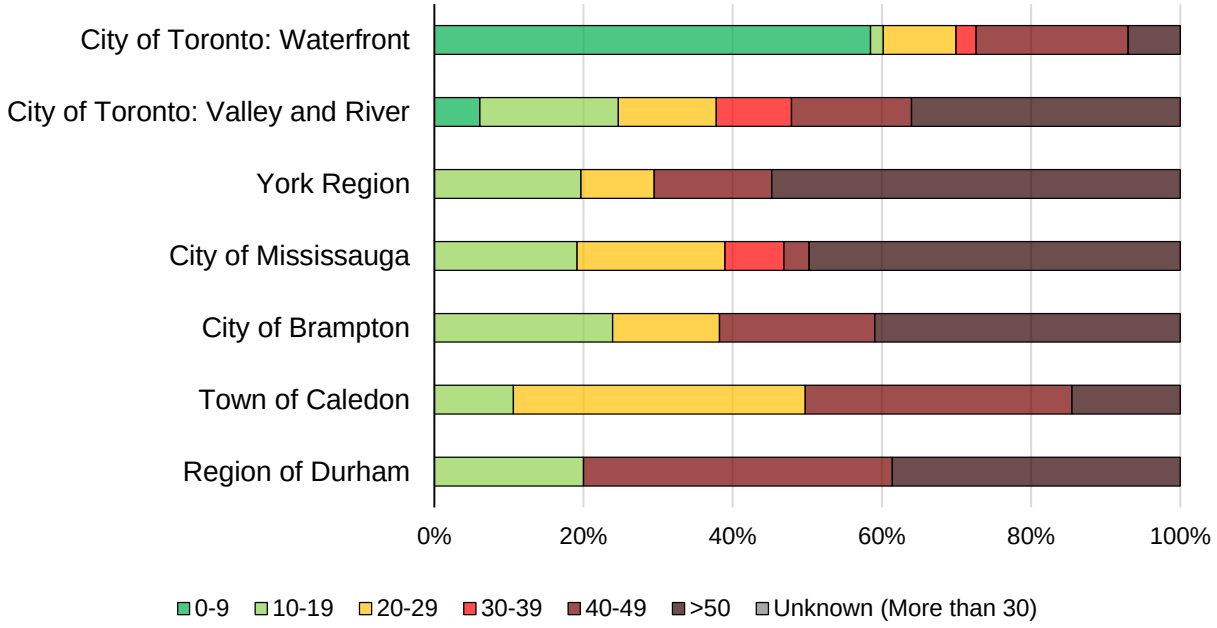


Figure 7.14 - Forecasted age (by 2033) of assets distributed by volume in the different municipalities.

With the current partnerships, the ERMP is expecting to increase the number of new erosion control systems by 31 in the next decade. This is supported by the partnership with City of Toronto for *Valley Erosion Hazard Mitigation* (133-01) portfolio in accordance with the updated *Private Landowner Contribution for Erosion Control Works* (Effective in 2022 – DSP-7.01-P). While details and agreements remain to be determined, most of these erosion and slope instability mitigation works will be implemented by land conveyance. To date, the rough order of magnitude of these projects is estimated to be $28.8 million.

As shown in Table 7.7, while funding for the maintenance of the valley and river systems might be enough to maintain the majority of TRCA's inventory in 'Acceptable' condition, a lack of funding will not allow an increase in the average condition rating of the structures. This means that although most of the structures will be in 'Acceptable' condition, most of the systems are still projected to be in 'Good' to 'Fair' condition.

Table 7.7 - Past and forecasted state of TRCA's erosion control systems*

Maintenance of Existing Assets		**2014 to 2022**	**2023 to 2033 (Forecast)**	**Change**
Valley and River	Maintained/Repaired (count)	19	24	**+ 5**
	Avg. Condition Rating	2.3	2.2	**- 0.1**
	Past 'Acceptable' Condition	11%	7%	**- 4%**
	Backlog Distribution	45%	49%	**+ 4%**
	Avg. Annual Budget (in millions)	$ 2.05	$ 2.60	**+ $ 0.55**

Maintenance of Existing Assets		2014 to 2022	2023 to 2033 (Forecast)	Change
	Total funding available (in millions)	$ 16.41	$ 26.01	**+ $ 9.60**
	Avg. Budget per Asset Volume	$ 55.20/m3	$ 77.95/m3	**+ $ 22.75/m3**
Waterfront	Maintained/Repaired (count)	6	12	**+6**
	Average Condition Rating	2.3	2.0	**- 0.3**
	Past 'Acceptable' Condition	12%	3%	**- 9%**
	Backlog Distribution	56%	38%	**- 18%**
	Avg. Annual Budget (in millions)	$ 1.72	$ 8.80	**+ $ 7.08**
	Total funding available (in millions)	$ 13.79	$ 87.98	**+ $ 81.23**
	Avg. Budget per Asset Volume	$ 4.09/m3	$ 26.17/m3	**+ $ 22.08/m3**

*Assuming no severe weather events or high lake level.

This forecast does not consider storm events, likely to increase in frequency due to climate change. The condition of TRCA's valley and river erosion control assets can easily decrease after a single event. For the waterfront systems, the majority of the funding increase will have positive impacts on the overall condition of these assets.

For the valley and river erosion control assets, the average annual funding per asset volume will increase by $22.75/$m^3$ in the next decade. Although this seems positive, this is mainly driven by the estimated 31 new assets that will be built as part of the *Valley Erosion Hazard Mitigation* portfolio (133-01). When newly built, these new structures are expected to be in 'Very Good' or 'Good' condition. With an average annual funding increase of $7.08 million, it is projected that the waterfront average overall condition rating will decrease significantly in the next 10 years.

With less than 10% of these assets past the 'acceptable' condition, the backlog distribution of should be noted with 49% of the Valley and River assets, and 38% of the Waterfront assets. These assets will be past their useful life of 25 years. These assets might not directly need major maintenance, but unpredictable factors, such as severe weather events and high lake levels, could make them more prone to failure.

Future Renewal Need

In Table 7.8, the forecasted maintenance is overall positive, but not optimal. An additional annual investment of approximately $1.44 million over the next 10 years for the valley and river erosion control assets would allow TRCA to slow down the overall degradation of its assets. Similarly, the waterfront assets would require an additional annual investment of $1.42 million. This would be the optimal

investment required to keep all these assets in 'acceptable' condition.

Table 7.8 - Forecasted and optimal state of the erosion control systems by 2033*

Maintenance of Existing Assets		Forecast	Optimal	Difference
Valley and River	Avg. Condition Rating	2.2	2.0	**-0.2**
	Past 'Acceptable' Condition	7%	0%	**-7%**
	Backlog Distribution	49%	43%	**-6%**
	Avg. Annual Budget (in millions)	$ 2.60	$ 4.04	**+ $ 1.44**
	Total funding available (in millions)	$ 26.01	$ 40.42	**+ $ 14.41**
	Avg. Budget per Asset Volume	$ 77.95/m^3	$ 119.61/m^3	**+ $ 41.65/m^3**
Waterfront	Avg. Condition Rating	2.0	2.0	**0.0**
	Past 'Acceptable' Condition	3%	0%	**- 3%**
	Backlog Distribution	38%	35%	**- 3%**
	Avg. Annual Budget (in millions)	$ 8.80	$ 10.22	**+ $ 1.42**
	Total funding available (in millions)	$ 87.98	$ 102.22	**+ $ 14.21**
	Avg. Budget per Asset Volume	$ 26.17/m^3	$ 30.41/m^3	**+ $ 4.24/m^3**

*Assuming no severe weather events or high lake level.

Even with this additional investment, 43% of the valley and river assets, and 35% of the waterfront assets, will be past their useful life. This creates a total of $218 million of assets more at risk of severe weather events and high lake levels, while also assuming that recently maintained assets have higher standards and can more robustly face the impact of climate change over the next decade.

7.9 Risks and Assumptions

This section of the asset management plan highlights all the current and foreseeable risks along with the assumptions made to forecast the future needs.

Risks

The AMP notes the following risks that can impact the timing and value of renewal needs:

- Weather
- Changes to LOS targets
- External Pressures
- Economic conditions
- Legislative requirements
- Modifications to assets from outside organizations or other R and I staff

Weather Impacts

Severe weather events can significantly impact the stability and lifespan of some erosion control structures. As an example, erosion control system MC02 was originally constructed as a gabion basket retaining wall in 1983 in Mimico Creek. The upstream portion of the retaining wall had failed and was replaced with armourstone in 2011. Toronto Water installed two vane/deflectors (not TRCA-owned assets) along the toe of the retaining wall as part of a larger channel restoration in 2012. The armourstone retaining wall constructed by TRCA was built to be more durable than the previous gabion basket retaining wall. During a severe weather event on July 8, 2013, large sections of the retaining wall were completely washed away leaving sections of the slope unprotected. TRCA performed maintenance work in 2020 to repair sections of the retaining wall.

Changes to LOS targets

The ERMP utilizes a technical LOS for prioritizing the construction, monitoring, and maintenance of erosion control assets. New sites in the form of major bank erosion along riverbanks or slope failures are continuously brought to TRCA's attention. As these sites are inspected and catalogued by the ERMP staff, this can impact on the timing of maintenance and renewal needs of existing assets. Some of the newly identified sites may be high profile or high risk, which may qualify them for emergency works and cause their remediation to take priority over older sites which require maintenance. The prioritization list is ever-changing as new sites are constantly added.

External Pressures

Some external pressures may change the timing of maintenance and renewal needs. This may come in the form of an erosion control system that is not currently rated on the ERMP's priority list, but external pressure has moved its maintenance to near the top of the priority list, or this pressure could add a

brand-new site to the ERMP's priority list. In both instances, this may alter timing and/or the value of the asset maintenance.

Legislative Requirements

Several legislative acts can potentially impact the timing of maintenance/renewal needs of erosion control systems. The construction timing for working in/near water, tied to the federal Fisheries Act and other provincial legislation such as the Environmental Assessment Act can impact the process, timing and extent of stakeholder and public consultation involved in securing approvals for construction. Another legislative act that can impact the timing is the Migratory Birds Convention Act, affecting when, and if, tree removals can occur.

Modifications to Assets from Outside Organizations

While it is an exception, outside organizations (e.g. municipal partners/contractors) have performed maintenance work on TRCA-owned assets without the knowledge of the ERMP. To ensure greater coordination going forward, TRCA staff are working with municipal partners (e.g. Toronto Water, Region of Peel, Region of York, City of Brampton) to share forecasted project work through geospatial information systems (GIS - i.e. maps). This shared knowledge provides an opportunity for TRCA and its municipal partners to efficiently remediate erosion vulnerable sites through collaborative erosion control asset implementation. For example, a collaborative reach-based approach where numerous vulnerable assets owned by various stakeholders could be protected with a larger erosion control project than any one municipal partner had planned on implementing.

Assumptions

The following are assumptions made throughout this report when compiling data for the AMP:

- The replacement value of the erosion control systems and their repairs was inflated over time. Stats Canada's Building Construction Price Index (BCPI) for Non-Residential Buildings in the City of Toronto was used between 1981 and 2023. Since the BCPI only starts in 1981, Stats Canada's annual average national Consumer Price Index (CPI) was used prior 1981.
- For any projection and forecasted replacement value, an average inflation rate of 3% was used between 2024 and 2033;
- Replacement values and plan assumes like-for-like with no expansion of the asset or major change in material type;
- Replacement cost includes planning, permits/approval, legal, construction, post-construction monitoring, and other miscellaneous costs;
- Asset replacement value does not consider the value of the asset it is protecting;
- Essential assets that TRCA's erosion control systems protect have not been thoroughly reviewed, therefore, it can be assumed that the customer LOS performance measures are potentially larger than reported;
- The projected number of new assets that will be constructed in the next 10 years is based on the average number of assets constructed per new projects as part of the Valley Erosion Hazard Mitigation portfolio (133-01). It is also based on currently known facts aligning with the Private Landowner Contribution for Erosion Control Works (Effective in 2022 – DSP-7.01-P);

- The asset condition rating uses the most recent erosion control system inspection data, maintenance data, or newly constructed data at the time the report was prepared (prior to July 2023); and

7.10 Importance of Full Life Cycle Costing

Life cycle costs should include all costs that are anticipated to occur during the ownership of an asset. This includes capital, operating and maintenance, and disposal expenditures. Unless these full life cycle costs are defined, it is difficult to effectively plan for complete infrastructure costs going forward. Once these expenditures are further understood, TRCA can utilize cost-effective management strategies by repairing or replacing the right assets at the optimal time. TRCA is working to better understand both the type and timing of treatments that lead to optimal infrastructure management. It is important that TRCA continues to analyze projects and manage existing assets based on full and optimal life cycle costing. This will ensure that current and future infrastructure will have sufficient funds available when needed. Plans for the ongoing improvement of information quality and the planning process will be an integral part of TRCA's Asset Management system going forward.

Flood Control Infrastructure

SECTION 8: FLOOD CONTROL INFRASTRUCTURE

Introduction

TRCA owns 29 flood control structures across its jurisdiction, comprised of dams, dikes, flood control channels, and two flood control walls. Given the highly urbanized area within TRCA's jurisdiction, it is critical to maintain this infrastructure to ensure public safety concerns are addressed. Through a more traditional Asset Management Plan (AMP) approach, the flood control infrastructure owned by TRCA is reported on through four components:

- Asset inventory
- Levels of service
- Asset management strategy
- Financial strategy

This AMP describes the four components for TRCA's flood control structures, and the strategies employed by TRCA to manage the inventory of aging, critical infrastructure. This AMP is a first attempt at quantifying the management needs to ensure TRCA's flood infrastructure inventory is operating at an acceptable and safe level. It is expected that this AMP will advance and expand as additional data is obtained.

State of TRCA'S Flood Infrastructure and Hydrometric Networks

The purpose of this report is to document the current state of repair of TRCA-owned flood infrastructure and hydrometric networks to outline the major capital improvement projects that have been implemented or that are required in the future. Information on the process of identifying projects, funding sources, and the regulatory framework for dam safety in Ontario is also included in this report.

Pillar 1, Environmental Protection and Hazard Management, of TRCA's 2023-2034 Strategic Plan outlines TRCA's objectives to mitigate known flood risks, which includes the operation, maintenance, and surveillance of flood infrastructure. Additionally, Conservation Authorities are mandated, under Section 21 of the *Conservation Authorities Act*, to ensure conservation, restoration, and responsible management of Ontario's water resources. Specifically, Section 21 empowers Conservation Authorities to:

- Erect works and structures and create reservoirs by the construction of dams or otherwise.
- Control the flow of surface waters in order to prevent floods or pollution or to reduce adverse effects thereof.

As part of this mandate, TRCA develops and maintains programs to prevent loss of life and property damage from flooding hazards. Where appropriate, this includes structural flood mitigation alternatives. TRCA has constructed various flood control structures to reduce flood risk in Flood Vulnerable Clusters (FVCs). The majority of TRCA's flood infrastructure was built between the late 1950's and the early 1980's as part of the flood mitigation response to the Hurricane Hazel flood of 1954. TRCA has also inherited infrastructure that controls or retains water through various land acquisition programs and transactions. For the purpose of this report, flood infrastructure refers to TRCA owned dams, channel, and dikes (TRCA's single flood wall is grouped under the dike category for simplicity). A general location

map of all TRCA flood infrastructure is presented in Figure 8.1.

TRCA's channels, berms and other structures are also experiencing some deterioration. For example, some TRCA channels have reduced flood capacity due to the accumulation of sediment, establishment of vegetation, failed concrete panels and erosion of channel banks. These structures were built between the 1950's and 1980's and the design life of these types of structures is typically around 50 years and some structures need some major repairs to extend their functional life.

In addition to the flood control structures that are documented in this report, TRCA's hydrometric network systems are also included. This is because TRCA's Hydrometric Program is managed under the Flood Infrastructure and Hydrometric business unit. TRCA's Hydrometric Program is comprised of large networks of stream gauges, precipitation gauges and climate stations that contribute data to the Flood Risk Management Program. The hydrometric network provides data to support flood forecasting and warning, dam operations, emergency management, infrastructure design and floodplain mapping. The hydrometric network is comprised of a large amount of specialized hardware and instrumentation and will benefit from the asset management process as this equipment has a finite life cycle and will require ongoing repairs, upgrades, and replacement to remain in a state of good repair.

To obtain an overview of TRCA's current state of Flood Control Infrastructure assets, the asset inventory, valuation, age, and condition were documented for the following asset categories:

- Dams
- Channels
- Dikes and Flood Walls
- Hydrometric Equipment

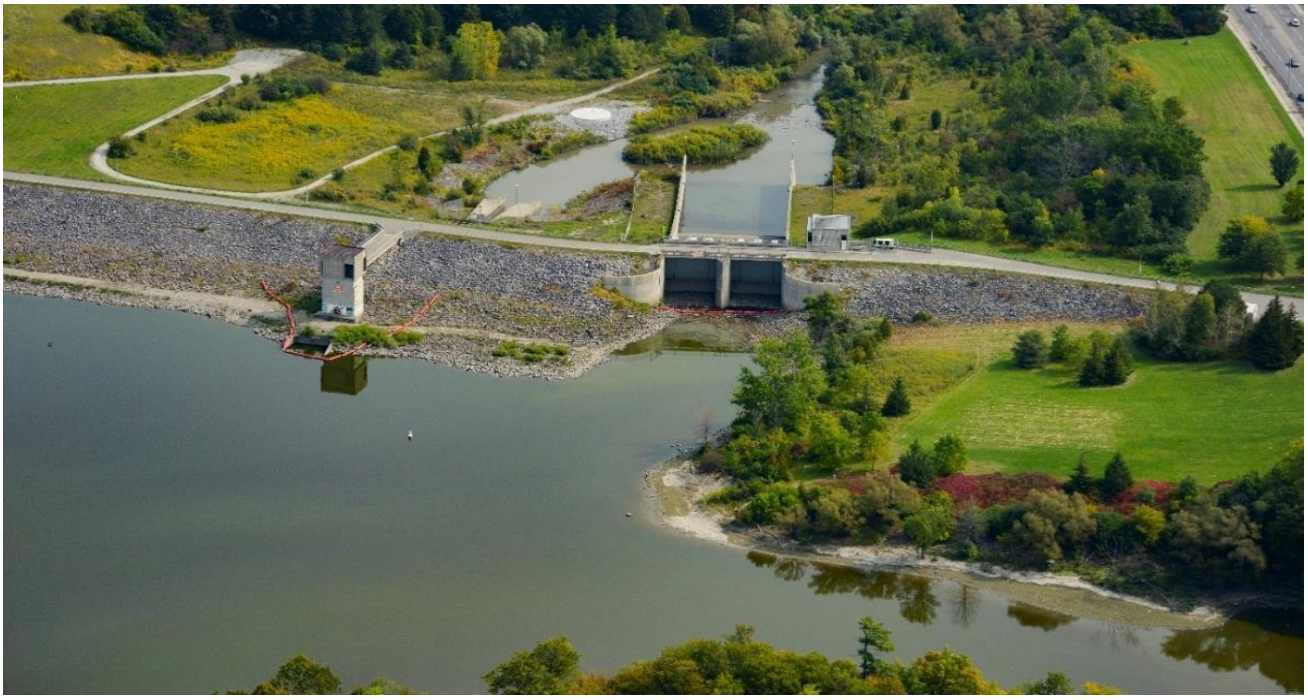
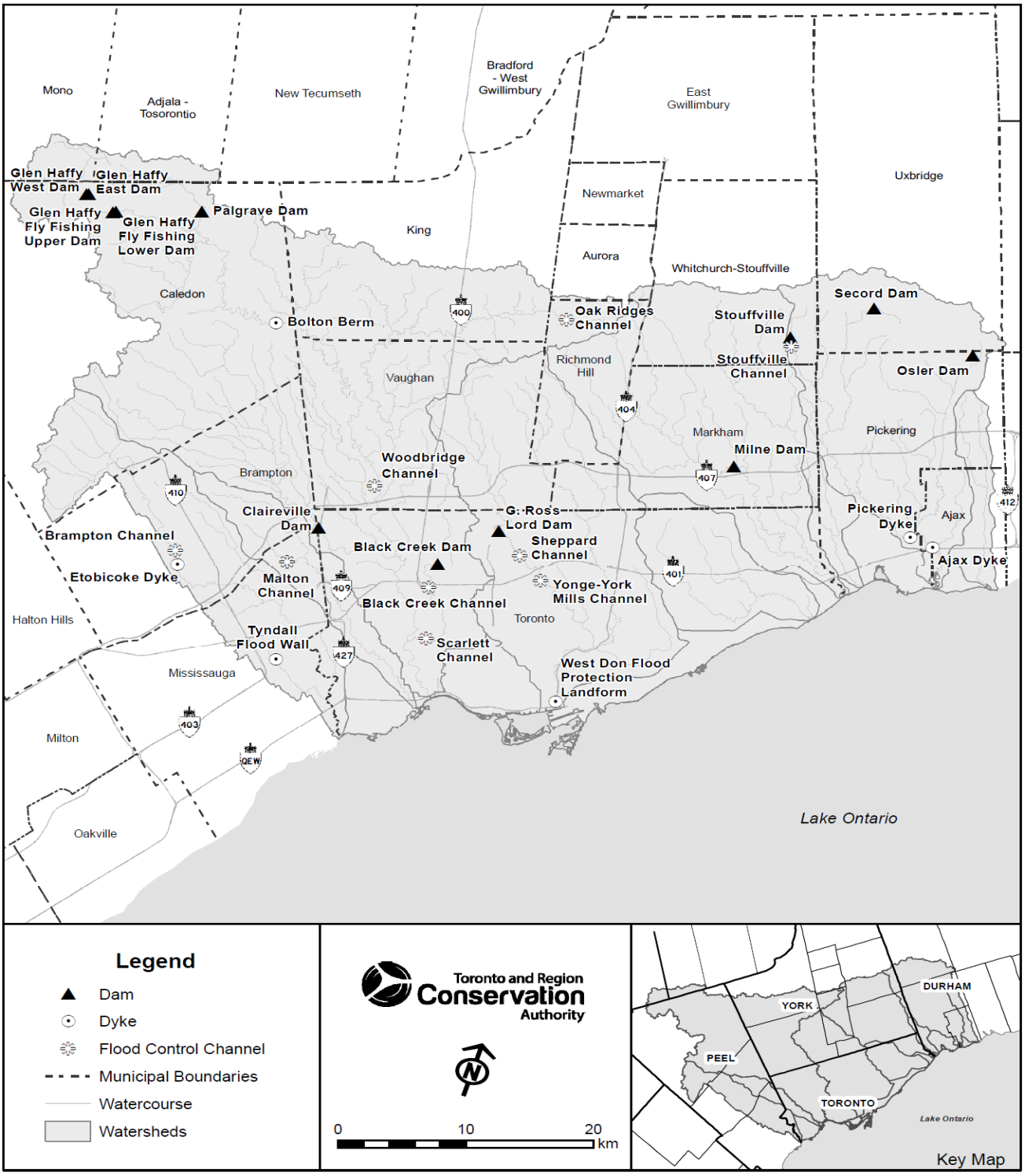


Figure 8.1 - Location of TRCA owned flood infrastructure including dams, dikes, and flood control channels



8.1 Asset Data Inventory

8.1.1 Structures and Equipment

The dams, dikes and channels assets included in the AMP make up the largest portion of TRCA's assets in terms of financial value and represent the greatest area of risk to public safety.

TRCA's dam inventory consists of 12 dams of which five provide flood protection. The other dams are historical mill and industrial dams acquired through land acquisitions. Also, TRCA has 17 flood control structures that include channels, dikes, and flood walls. The information below summarizes the dams, channels and other flood control assets inventory that are included in this AMP.

8.1.2 Dams

TRCA owns and operates several large and small dams and flood control structures. The two large dams are G. Ross Lord dam and Claireville Dam, located in the Don River watershed and in the Humber River watershed, respectively. These dams are actively operated structures, and their operational procedures are integrated with TRCA Flood Forecasting and Warning program. In addition to the 2 large dams, TRCA currently owns 10 small dams, and 15 flood control structures that include channels, dikes, and flood walls.

TRCA's dam inventory consists of 12 dams, of which 5 were specifically built to provide flood protection. The other dams are historical mill, recreational, and industrial dams acquired through various TRCA land acquisition programs. TRCA's dams' range in age between 45-85 years old and most require major capital improvements in order to meet current dam safety guidelines. A list of TRCA-owned dams is included in Table 8.1.

Over the past several years, there have been several high-profile dam safety incidents around the world that have resulted in loss of life, mass evacuation and population displacement, environmental damage, and extensive property damage. The consequences of dam failures illustrated by these incidents underscore the importance of having a robust dam maintenance program at TRCA.

TRCA Flood Control Dams

The G. Ross Lord Dam was constructed in 1973 and is an earthen embankment dam that was built based on a US Army Corps of Engineers Design. It consists of an upstream sloping impervious core, upstream riprap over filter layers, and a downstream grassed slope. There are two concrete spillways: low level outlets for controlling floods and the emergency spillway for preventing the dam from overtopping during flood events. The reservoir has a maximum storage volume of 5,500,000 m3. The two low level gates are used to operate the dam and maintain the upstream levels in the reservoir. For controlling higher flows, there are two radial gates, which discharge to a concrete spillway, however these have never been used to control flow through the dam. The G. Ross Lord Dam has been classified as a Large Dam and with a Very High Hazard Potential Classification (HPC). The G. Ross Lord Dam is located on the West Don River. The downstream watershed has several high-profile flood-prone areas; therefore, the proper operations and maintenance of the dam is of critical importance to TRCA. It is estimated that if G. Ross Lord Dam experiences a failure during flood conditions, that over 3200 persons would be at risk and over $1.3 billion in property damage would be expected.

Figure 8.2 - G. Ross Lord Dam Emergency Spillway

The Claireville Dam was constructed in 1963-1964. It consists of a concrete spillway, which is flanked on both sides by an earth embankment of homogeneous construction. The dam has a height of 15 m. The ogee type concrete spillway is controlled by five radial gates discharging into a concrete stilling basin. The spillway and stilling basin are 'anchored' to bedrock. The reservoir has a maximum storage volume of 4,700,000 m3. There are four low-level discharge pipes installed between the five gates within each of the four piers.

Due to its height and reservoir capacity, Claireville Dam is classified as a "Large Dam." It has an HPC of Very High due to potential downstream impacts in the event of dam failure.

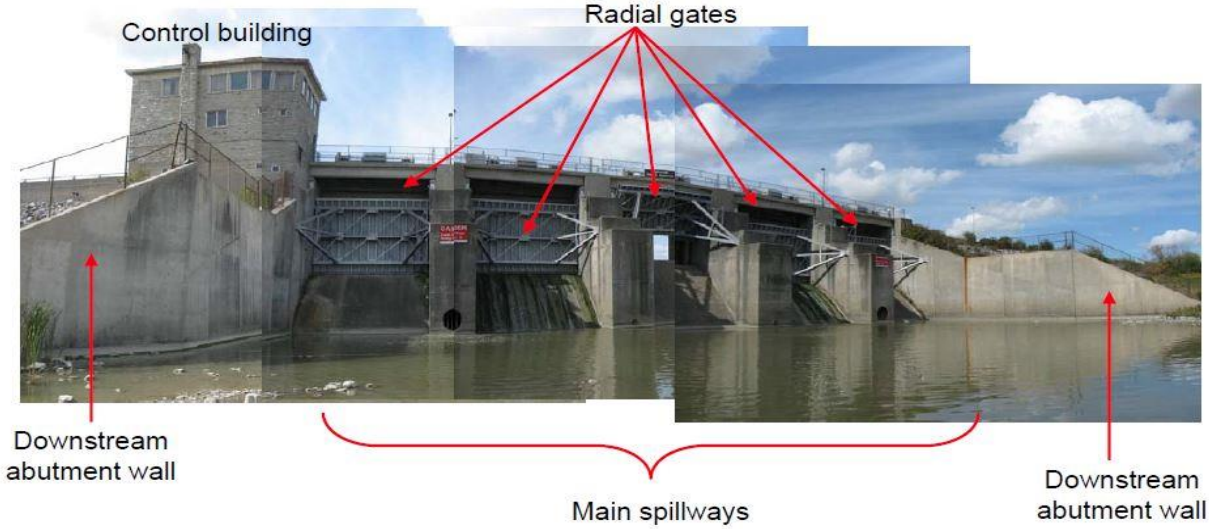


Figure 8.3 – Claireville Dam

The Stouffville Dam was constructed in 1969 to reduce the risk of flooding in the Town of Whitchurch-Stouffville. The dam is an earth embankment structure with a concrete drop spillway that discharges flow through the dam via a box culvert. Stouffville Dam has an HPC of Very High due to potential downstream impacts in the event of dam failure.

Milne Dam is located in the City of Markham. The dam is an earth embankment with a concrete ogee-type spillway. The dam has a small gate to lower the reservoir for maintenance. The dam replaced an older dam upstream that was severely damaged during Hurricane Hazel. Secondary uses include regulating summer flow and recreational purposes.

Black Creek Dam is located in Black Creek Humber upstream of the river crossing of Jane Street, south of Sheppard Ave. The Dam was constructed in 1960 for flood control in reducing downstream flows and velocities in the Black Creek and Scarlett Flood Control Channels. The dam is a rock check dam with corrugated steel pipe for controlling flows.

TRCA Small Dams

Palgrave Dam was originally constructed in the 1850s and was restored in 1983 after TRCA acquired it in 1979. The construction of the dam led to the creation of Palgrave Pond. This dam is no longer in operation as a mill dam.

Secord Dam was originally constructed to provide hydro power to a sawmill operated until the 1950s. The dam provides no flood protection. The reservoir is used for recreational purposes.

Glen Haffy Conservation Area contains four dams located on the Humber River and Centreville Creek headwaters. Glen Haffy West and East Dams were constructed to create two small trout ponds downstream of the Glen Haffy Conservation Park fish hatchery. The ponds are stocked with rainbow trout and are a popular fishing destination. The Glen Haffy Upper Dam and Lower Dam are located of Centreville Creek and also stocked with fish for recreational purposes.

Osler Dam was built in 1934. TRCA purchased the property in 1991. The dam was not designed for flood protection.

Table 8.1 – TRCA Dams

Dam Name	Watercourse	Region	Dam Purpose	Unit
G. Ross Lord Dam	West Don River	City of Toronto	Flood Control	Each
Claireville Dam	West Humber River	Peel Region	Flood Control	Each
Stouffville Dam	Stouffville Creek	York Region	Flood Control	Each
Milne Dam	Rouge River	York Region	Flood Control	Each
Black Creek Dam	Black Creek	City of Toronto	Flood Control	Each
Palgrave Dam	Humber River	Peel Region	Recreation	Each
Secord Dam	West Duffins Creek	Durham Region	Recreation	Each
Osler Dam	East Duffins Creek	Durham Region	Recreation	Each
Glen Haffy Dam West	Humber River	Peel Region	Recreation	Each

Dam Name	Watercourse	Region	Dam Purpose	Unit
Glen Haffy Dam East	Humber River	Peel Region	Recreation	Each
Glen Haffy Upper Dam	Centreville Creek	Peel Region	Recreation	Each
Glen Haffy Lower Dam	Centreville Creek	Peel Region	Recreation	Each

8.1.3 Flood Control Channels

Flood control channels are designed to increase the amount of flow that can be conveyed through a watercourse reach. Flood control channels are created by replacing the natural watercourse with an engineered channel. Flood conveyance is increased by lining the channel with concrete or stone to reduce resistance to the flow of water. Flood control channels often straighten the watercourse to increase flow conveyance. Flood control channels are extremely damaging to the natural processes of a river and are only used as a last option for reducing flood risk. Because they do not retain water, flood control channels are a less-risky flood control structure type, because a failure of a channel does not cause an uncontrolled release of water, unlike a dam or dike.

TRCA's flood control channels were built in communities with historic flood risk. These communities were built prior to the existence of TRCA's regulations on limiting development in the floodplain. TRCA owns 9 flood control channels totaling approximately 11.5km. Of this, 8.5km is of concrete trapezoidal design and the remaining channel types are a mixture of rip rap and gabion basket design. A list of TRCA's flood control channels is provided in Table 8.2.

TRCA Flood control channels

Are usually large dry concrete channels that run below the street levels in our city, so that if and when a flood occurs, the water will run into these channels, and eventually drain into a river.

Yonge York Mills Channel was constructed to provide flood protection for the community of Hoggs Hollow in conjunction with the G. Ross Lord Dam and reservoir.

Woodbridge Channel was designed to decrease erosion and provide storm water conveyance through the Woodbridge flood plain lands.

Stouffville Channel was constructed in conjunction with the Stouffville Dam to provide 100-year flood protection to the Town of Stouffville.

Black Creek Channel was designed to provide protection for public utilities against erosion and provide flood water conveyance of Black Creek.

Scarlett Channel was designed to provide protection for public utilities against erosion and provide flood water conveyance of Black Creek through Alliance Road and the Humberlea Corridor.

Brampton Channel was designed to provide protection from 100-year flood flows in downtown Brampton (1% chance of occurring in a given year).

Sheppard Channel was originally designed to facilitate the construction of the Sheppard Avenue bridge and provide some flood relief to the residents adjacent to Don River Boulevard.

Mimico Malton Channel was designed to prevent flooding of commercial and residential development within the flood plain in the Malton area.

Oak Ridges Channel was designed to prevent flooding of residential development within the flood plain in King City.

Bolton Channel was constructed as a diversion channel for high flows and helps the Bolton Dike achieve 350-year flood protection.

Table 8.2 – TRCA Flood Control Channels

8.1.4 Dikes

Channel Name	Watercourse	Channel Purpose	Channel Type	Channel Length
Yonge York Mills Channel	West Don River	Flood Control	Concrete Trapezoidal/ Gabion Trapezoidal	1670m
Woodbridge Channel	East Humber River	Flood Control	Rip Rap	1850m
Stouffville Channel	Stouffville Creek	Flood Control	Gabion Basket	370m
Black Creek Channel	Black Creek	Flood Control	Concrete Trapezoidal	2370m
Scarlett Channel	Black Creek	Flood Control	Concrete Trapezoidal	3600m
Brampton Channel	Humber River	Flood Control	Concrete Trapezoidal	570m
Sheppard Channel	West Don River	Flood Control/Erosion Control	Gabion Basket	350m
Mimico/Malton Channel	Mimico Creek	Flood Control	Gabion Trapezoidal	650m
Oak Ridges Channel	East Humber River	Flood Control	Gabion Basket	90m
Bolton Channel	Humber River	Flood Control	Rip Rap	80m

Dikes, sometimes also called berms or levees, are defined as an embankment built to control or hold back water. Dikes are typically built parallel to a river to prevent water from entering developed areas. Like dams, dikes hold back water during periods of high flows, however dikes are not considered dams under definitions provided by various dam safety and regulatory agencies. Included in this category is the Tyndall Flood Wall and the Bolton Flood Wall. The Tyndall Flood Wall is a masonry concrete wall and is not an earthen embankment structure like the other dikes. It is included in this category because it functions like a dike during periods of high water. The Bolton Flood Wall is a structural retaining wall

that allows increased flow though the oxbow restriction as part of the Bolton flood protection system.

Dikes are primarily earthen embankment structures, although one structure owned by TRCA was constructed as a masonry wall**.** Dikes, like dams, carry more risk than channels because a dike failure during a flood would create a situation where there would be an uncontrolled release of water into the area protected by the dike. TRCA owns 6 dikes totaling approximately 3.6km. A list of TRCA's Dikes is provided in Table 8.3.

Table 8.3 – TRCA Dikes

Dike Name	Watercourse	Dike Purpose	Dike Length
Pickering Dike	Duffins Creek	Flood Control	1250m
Ajax Dike	Duffins Creek	Flood Control	350m
Bolton Dike	Humber River	Flood Control	800m
Etobicoke Dike	Etobicoke Creek	Flood Control	460m
Flood Protection Landform	Don River	Flood Control	710m
Tyndall Flood Wall (masonry flood control wall)	Little Etobicoke Creek	Flood Control	80m
Bolton Flood Wall	Humber River	Flood Control/Erosion Control	50m

8.1.5 Hydrometric Network

TRCA owns and operates a network of stream gauges, precipitation gauges and climate stations to provide data to support flood forecasting and warning, dam operations, emergency management, infrastructure design and floodplain mapping. The hydrometric network is included in the flood infrastructure portfolio because often the hydrometric assets are located on or near existing dams, dikes, or channels. The hydrometric networks are located throughout TRCA's jurisdiction. They include telemetered stations that provide real-time hydrometric data to TRCA and remote stations that require monthly visits to download data. The hydrometric network is comprised of a large amount of specialized hardware and instrumentation that includes sensors, data loggers, telemetry equipment, power systems, and enclosures. TRCA's hydrometric network by station type is presented in Table 8.4.

Table 8.4 - TRCA Hydrometric Equipment

Hydrometric Equipment Type	Number
Real-time Stream Gauges	27
Real-time Precipitation Gauges	26
Stand-alone Stream Gauges	28

Hydrometric Equipment Type	Number
Stand-alone Precipitation Gauges	16
Climate Station	5

Figure 8.4 - Old Mill at Humber River Real-time Stream Gauge

8.2 Asset Valuation

To proactively manage assets through their full life cycle, estimated replacement costs are calculated to ensure appropriate funds are being set aside to fund the future rehabilitation and replacement of assets as needed. Replacement values are calculated using data from Stats Canada – Using the Non-Residential construction price index to approximate the replacement value for flood and erosion control infrastructure as of Q1 1981. Replacement values do not account for major expansions, and do not include costs associated with potential environmental assessments, land acquisitions or significant provincial or federal permits that may be required as a result of a major expansion in the footprint or function of the asset.

Replacement Values are used as the basis to estimate the cost of replacing an asset when it reaches the end of its engineered design life. The total replacement value of the dams and channels included in this Plan is **$167,531,298** and **$30,215,207** for other flood control assets for a total of **$197,746,505** (calculated to Q4, 2023). The total replacement value of all assets covered under this plan is illustrated in Table 8.5 below. Replacement costs are calculated by converting the original cost of the structure to

current prices using the Bank of Canada inflation index. For example, a dam costing $100,000 in 1960 would have a replacement cost of $875,159.24 in today's dollars. However, replacement cost should not be used as an indicator of the actual cost of rebuilding the structure. This is because engineering standards have evolved substantially since the majority of TRCA flood infrastructure was built. It would be expected that reconstructing a dam or similar structure would require significantly more design work and complex construction to meet current industry standards. The result would be much higher costs.

Further complicating the issue of replacement cost is that records available from the original construction are incomplete and/or unclear. It is difficult, and in many cases impossible, to break out exact construction costs. Non-construction costs such as engineering design and property acquisition are not itemized in the available documentation. Also, the regulatory framework that owners of flood infrastructure have today were not in place in the 1960's and 1970's and line items that would be required to construct a dam today such as habitat compensation and dewatering would not have been required in the past. This can skew replacement cost calculations.

Replacement Cost Valuation, there are three basic methods to estimate replacement costs needed for infrastructure renewal planning:

1. Local price indices: This is the most accurate method. TRCA has collected recent acquisition data demonstrating similar replacement activities. Since TRCA has not built new flood infrastructure since the 1980's, this method is not used in this report.
2. Published price indices: Where local indices are not available, TRCA uses published indices. This method is not used in this report.
3. Accounting estimates: When assets cannot be estimated against either index, TRCA uses accounting methodology based on historic cost, estimated useful life and inflationary effects to determine replacement value. The majority of structures valuations were calculated using original construction cost and, using the Bank of Canada Inflation Calculator, updated to reflect today's valuation.

Table 8.5 – Inventory & Replacement Values

Service	Asset		Inventory	Unit	Replacement Value (2023)
Flood Control	Dams	Flood Control Dams	5	Each	$99,328,934
		Recreation Dams	7	Each	$7,213,544
	Channels	Flood Control Channels	11,520	Meters	$60,988,820
	Dike	Flood Control	3,570	Meters	$28,548,641
	Flood Wall	Flood Control Wall	2	Each	$504,538
	Hydrometric Equipment		102	Each	$1,162,028
TOTAL					**$197,746,505**

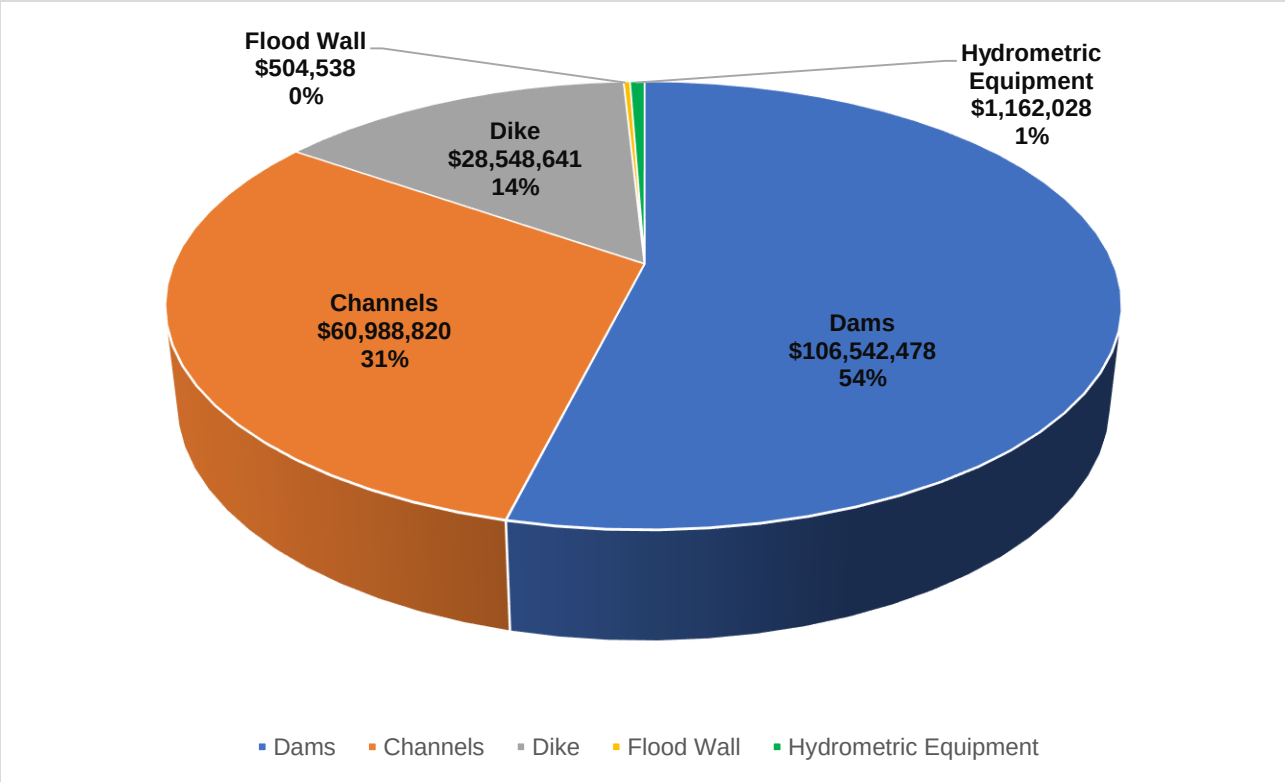


Figure 8.15 - Asset valuation by structure category

8.3 Asset Useful Life

Asset useful life for flood infrastructure components varies greatly depending on the type of asset. Earthen embankment components of a dam may have a design life of >100 years but the concrete structure of the dam may only have a 50-year expected useful life. Dikes would have a similar lifespan as an earth embankment dam, but a flood control channel may only have a 50-year expected useful life. Using the asset useful life and acquisition cost, depreciation can be calculated for a structure.

Table 8.6 – Asset Useful Life for Flood Infrastructure

System/Component	Service/Design Life
Dam – Reservoir[1]	Indefinite
Dam – Spillway Structures[1]	80 Years
Dam – Mechanical Systems[1]	50 Years
Dam – Embankment[1]	100 Years
Dam – Drainage/Pressure Relief[1]	50 Years
Dam – Power Supply (Grid System and Emergency Back-Up Power Systems)[1]	30 Years
Dam – Control and Monitoring Systems[1]	20 Years
Flood Control Channel – (Rip Rap and Concrete)[2]	50 Years
Dike – Embankment[1]	100 Years
Flood Control Wall – (Masonry)[2]	50 Years
Hydrometric Equipment (Hardware, Instrumentation)	10 Years
[1]Electric Power Research Institute, Hydropower Plant Modernization Guide, 1989 [2]Manitoba Infrastructure and Transportation, Water Control Structures Design Manual, 2011 (extrapolated from bridge design criteria)	

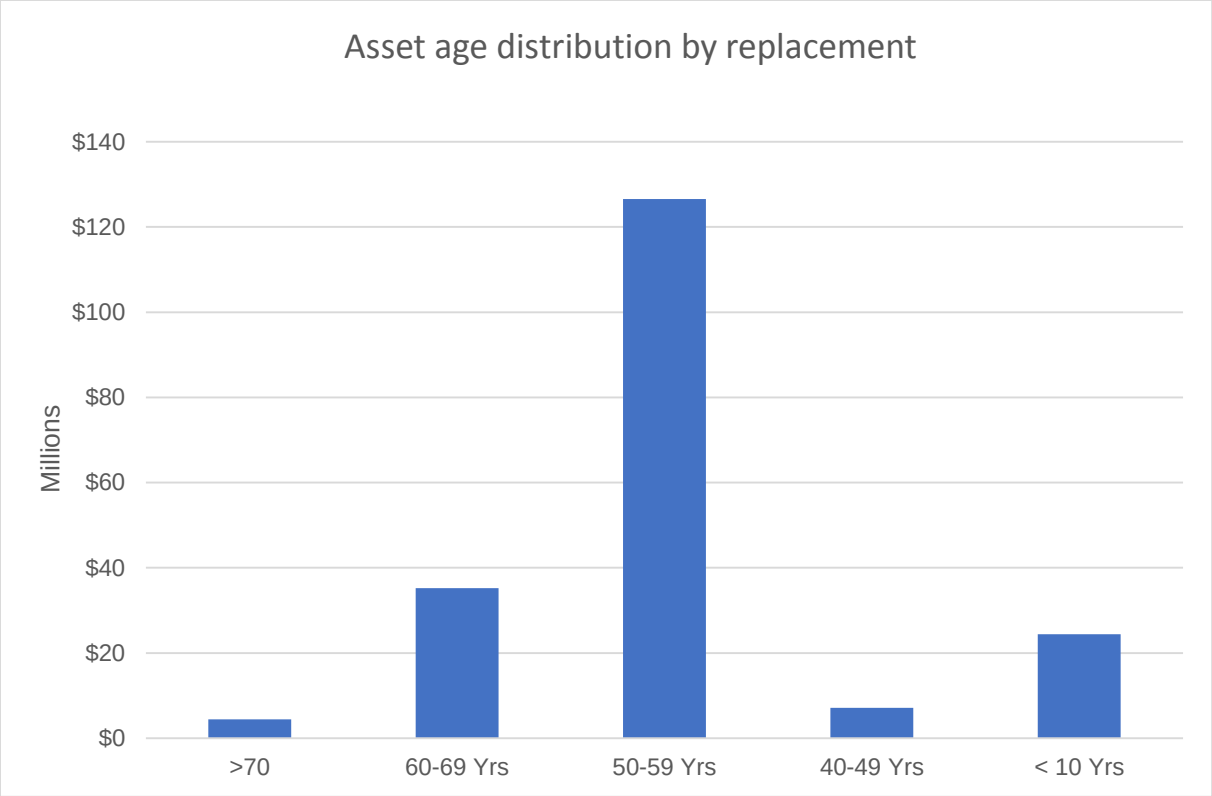


Figure 8.7 - Flood Control asset age distribution by replacement

8.4 Asset Condition

Dams

The Canadian Dam Association (CDA) defines risk as "the consequence of an adverse event and the probability of such an event occurring." Within a finite resource framework, it is not possible to completely eliminate the risks associated with dams. Using modern engineering analysis and techniques, however, it is possible to greatly reduce risk. When hazards are greater for a structure, the safety requirements are proportionately more rigorous to offset the increased risk. As the owners of flood protection infrastructure, TRCA has an obligation to identify and undertake works to maintain these structures in a state of good repair. With limited funding available for flood infrastructure repairs, TRCA must rank the priority of capital works. This requires that TRCA understand how each structure is performing using engineering judgement alongside criteria provided by the CDA and the Lakes and Rivers Improvement Act (LRIA). Using inspection and engineering reports, each structure is ranked using a probability/consequence matrix. In order to understand the overall safety of a structure, performance during several scenarios must be considered. For example, a dam may be considered safe for smaller, more frequent flood events but may not be able to withstand an extreme flood. Therefore, several scenarios are considered when evaluating the state of repair.

These include:

- **Normal Conditions**: This scenario would include typical flood events that are frequent. Normal conditions would also consider typical loading or stressing of the structure, particularly embankment stability.
- **Extreme Flood Conditions**: This scenario considers the ability of the dam to withstand extreme, less probable flood events. Dams that cannot safely pass extreme floods can overtop and fail.
- **Seismic Conditions**: Seismic activity in Ontario is rare and is usually limited to small magnitude earthquakes. However, dam safety guidelines require high hazard dams to be able to withstand extreme earthquakes.

Evaluating dams using the criteria listed above helps prioritize capital works. Structures that do not meet guidelines for normal conditions would rank higher for repairs than a structure that is only at risk during extreme, low probability flood and seismic events. TRCA's objective is to make dams, channels, and Dikes safe for all possible events, however this will require long-term and large capital investments to achieve.

Evaluating dams for normal, extreme flood, and extreme earthquake scenarios requires that a score be given to each condition. The score corresponds to the dam's ability to withstand normal and extreme events. For example, a dam may have a structure condition rated as very good for normal conditions. However, if the dam overtops during extreme floods, the structure condition for that scenario may rank as poor because the probability of failure is higher for this event. If the same dam meets the requirements for seismic events, the structure condition for that scenario would be rated as very good as the probability of failure would be low.

Normal Conditions Risk Ranking

Normal conditions risk ranking evaluates the risk of structures failing when conditions are within the expected range of events for a given year. Normal conditions would include periods with no precipitation and smaller, more probable flood scenarios.

For state of repair analysis for normal conditions, TRCA evaluates each structure and categorizes them in terms of "probability of failure" and "consequence rating." The probability of failure is based on the structure condition assessment and estimates the likelihood of a deficiency causing the structure to fail. Structure condition considers the overall condition of the structure based on DSR studies and inspection results. Structures are scored from one (1) to five (5). A structure with a score of one (1) is in very good condition with a low probability of failure. A structure with a score of five (5) has a very poor structure condition rating and therefore a very high likelihood of failure. Structure condition ratings are described in Table 8.7.

Table 8.7 - Structure Condition Assessment/Probability of Failure Criteria

Condition Rating Score	Condition	Structure Condition Assessment Definition	Probability of Failure
1	Very Good	Well maintained, good condition, new or recently rehabilitated.	Improbable
2	Good	Good condition, few elements exhibit deficiencies.	Not Likely
3	Fair	Some elements exhibit significant deficiencies. Asset requires attention.	Possible
4	Poor	A large portion of the structure exhibits significant deficiencies. Asset mostly below standard and approaching end of service life.	Likely
5	Very Poor	Widespread signs of deterioration. Service and safety are affected.	Very Probable

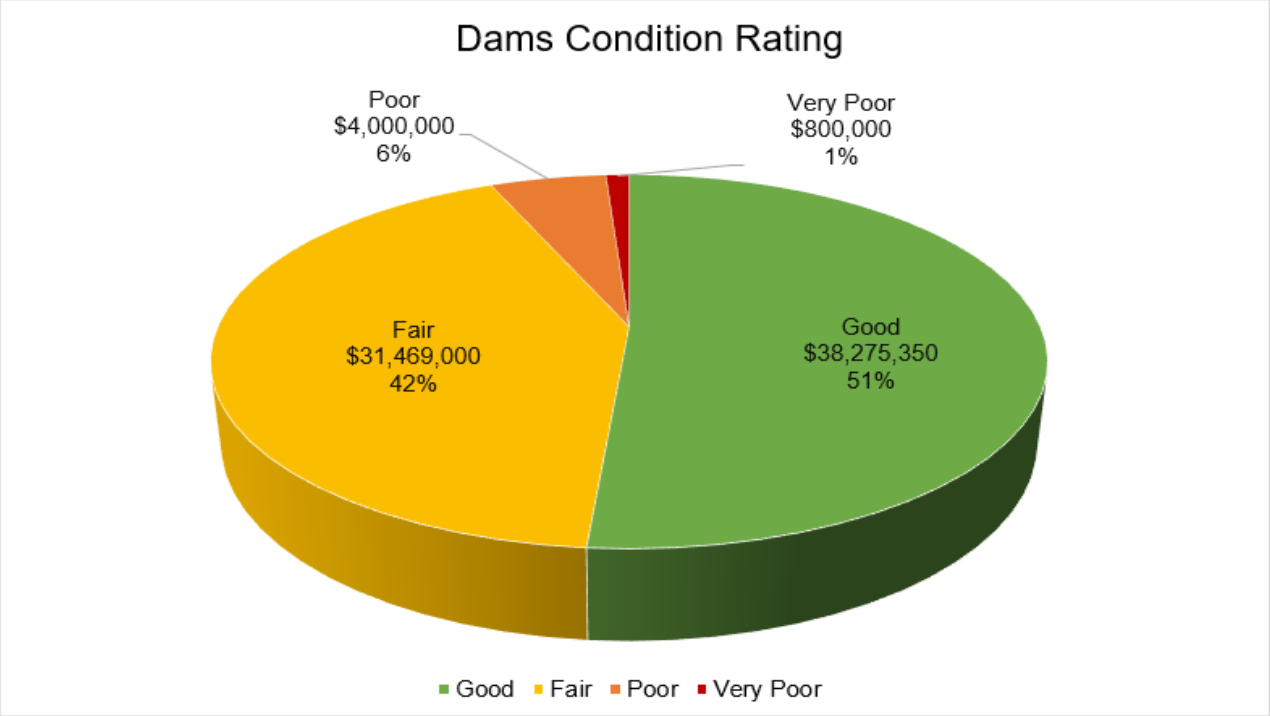
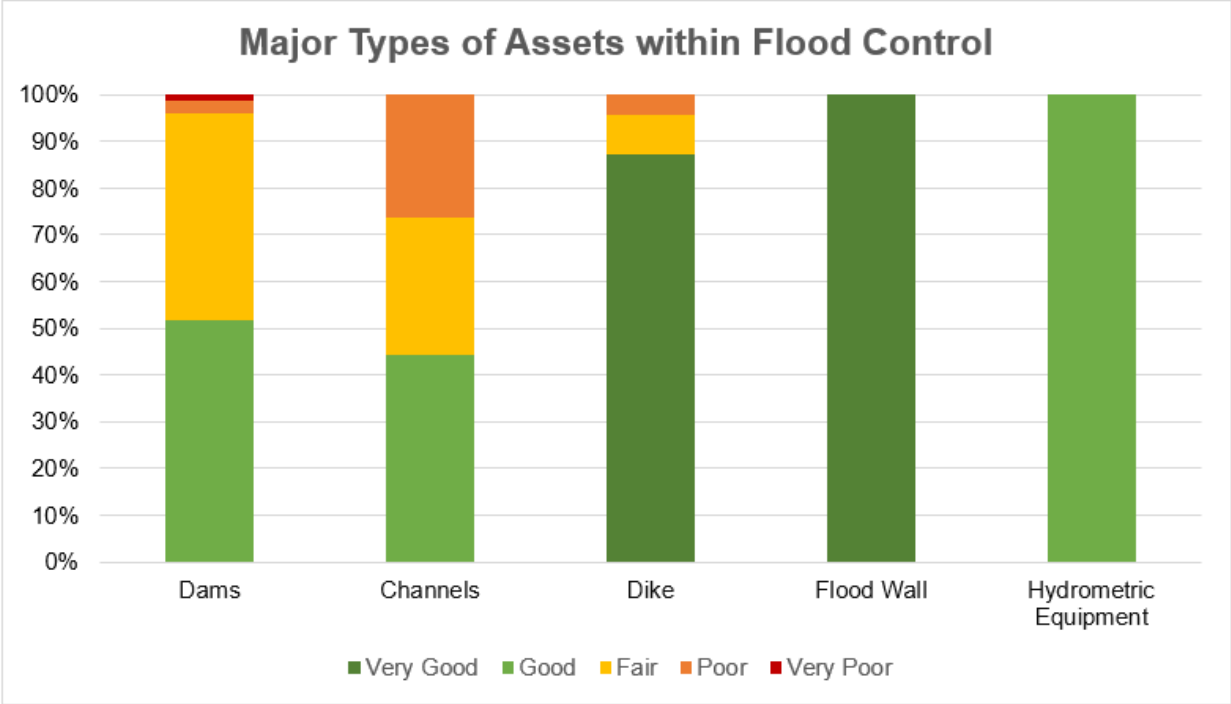


Figure 8.8 – Dams Condition Rating



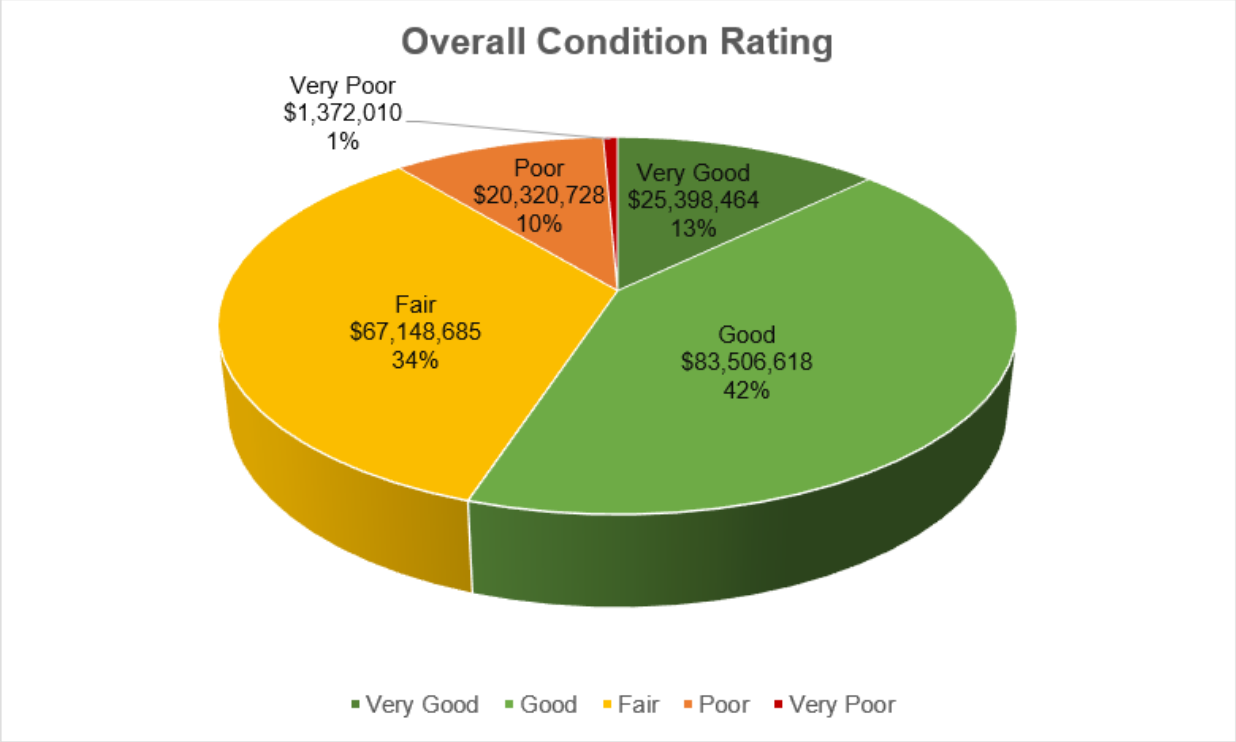


Figure 8.9 – Overall Condition Rating for Flood Control Infrastructure

In addition to the condition rating score, TRCA also considers the consequence to public safety and property should the structure fail or perform below expectations. Known as the consequence score, the consequence score is determined by estimating property and risk to life during a failure. The score is estimated on a scale between one (1) and five (5). The higher the score, the higher amount of damage would be expected if the structure fails. See Table 8.8 for a description of consequence rating score criteria.

Table 8.8 - Consequence Rating Score Criteria

Consequence Rating Score	Consequence Rating Definition
1	Insignificant damage to property.
2	Minor/slight damage to property.
3	Limited damage to property.
4	Significant damage to property. Possible public safety risk.
5	Major risk to property and public safety.

The consequence rating score is multiplied by the condition rating score to determine an overall state of repair/risk ranking score. This score is then placed on a risk ranking matrix to determine the overall risk of the structure. See Table 8.9 for the risk ranking matrix. The results of the risk ranking matrix are included in Table 8.10 for dams, Table 8.11 for channels and Table 8.12 for dikes. Risk ranking is comprised of four (4) categories:

- Low Risk (1-5, green shading)
- Moderate Risk (6-10, yellow shading)
- High Risk (11-15, orange shading)
- Extreme Risk (16-25, red shading)

This assists TRCA in understanding where to focus limited capital funds for repairs. Structures with a risk ranking in the High and Very High Category require priority attention to repair the deficiency.

It should be noted that there are limitations to determining risk. The complexity of forces acting on a structure is difficult to quantify and therefore determining the probability of failure is difficult. Experience, training, and engineering judgment are used to assess the stability and performance of flood infrastructure. Regardless, the process for evaluating structures is somewhat subjective. With the limitations of current inspection techniques, it is not possible to say with certainty that a structure will or will not fail. Inspections can identify potential failure modes, but the complexity of the loads and stresses placed upon structures cannot be precisely measured and so there is a degree of unpredictability in evaluating them.

Table 8.9 - Risk Ranking Score Matrix

CONSEQUENCE RATING					
CONDITION RATING/RISK OF FAILURE	**Insignificant damage to property. 1**	**Minor, slight damage to property. 2**	**Limited damage to property. 3**	**Significant damage to property. Possible public safety risk. 4**	**Major damage to property. Major risk to public safety. 5**
Very poor condition Very probable risk of failure 5	5	10	15	20	25
Poor condition Failure likely 4	4	8	12	16	20
Fair condition Possible failure 3	3	6	9	12	15
Good condition Failure not likely 2	2	4	6	8	10
Very good Improbable 1	1	2	3	4	5

Extreme Conditions – Dams

Additional analysis may be required to evaluate risks for rare conditions such as extreme floods or earthquakes. Extreme floods may overtop dams causing failures. Earthquake events could cause structural failures in dams. To understand how a risk is affected by extreme events, the structure condition assessment score is increased. For example, a dam that is considered safe under normal conditions but may fail during an earthquake, the structure condition assessment score is increased to account for the inability of the dam to withstand ground movement during a seismic event. This increases the risk score of the structure. The consequence score remains the same because the same area is affected by a dam failure. Risk rankings for extreme conditions at dams are included in Table 8.10.

Dam safety guidelines consider extreme events in their criteria for determining safe structures; however, it is difficult for dam owners to meet all the guidelines because standards keep evolving. For example, a dam built in 1970 would meet the guidelines for that time period. As engineering knowledge progresses the standards change, and the dam built in 1970 would not meet standards in 2020. This creates difficulties for dam owners in that dams need to be constantly upgraded and modified to meet

the most current safety guidelines. Often these repairs are very costly and difficult to implement. However, because the probability of these extreme events is so low, the priority to mitigate the risk is lower. Priority repairs are focused on deficiencies for normal conditions, however, TRCA is undertaking studies to implement repairs for extreme events as well.

Table 8.10 - Dam Risk Ranking for Normal, Flood and Seismic Conditions

Dams							
Dam Name	**Consequence Rating Score[1]**	**Asset Condition/ Probability of Failure – Normal Conditions[2]**	**Risk Rating - Normal Condition[3]**	**Asset Condition/Probability of Failure – Extreme Flood Conditions[4]**	**Risk Rating – Extreme Flood Conditions[5]**	**Asset Condition/Probability of Failure – Extreme Seismic Condition[6]**	**Risk Rating – Extreme Seismic Condition[7]**
G. Ross Lord Dam	5	1	5	2	10	1	5
Claireville Dam	5	1	5	3	15	2	10
Stouffville Dam	5	2	10	3	15	2	10
Milne Dam	5	2	10	4	20	2	10
Palgrave Dam	5	3	15	5	25	3	15
Black Creek Dam	2	1	2	1	2	1	2
Secord Dam	2	4	8	5	10	3	10
Osler Dam	2	5	10	5	10	5	10
Glen Haffy Dam West	1	2	3	3	3	3	3
Glen Haffy Dam East	1	2	3	3	3	3	3
Glen Haffy Fly Fishing Upper Dam	2	5	10	5	10	5	10
Glen Haffy Fly Fishing Lower Dam	2	5	10	5	10	5	10

- Consequence Rating Score – expected damage should the dam fail based on risk to life, property, and the environment. See Table 8.8 in the report.
- Probability of Failure/Structure Condition Score – based on the dam's ability to withstand typical floods and normal loading conditions. See Table 8.7 in the report.
- Risk Rating – Normal Conditions – This is the Consequence Rating Score multiplied by the Probability of Failure/Structure Condition Score. See Table 8.9 in the report.
- Probability of Failure – Extreme Flood Conditions - This is based on the dam's ability to safely pass extreme floods.
- Risk Rating – Extreme Floods - This is the Consequence Rating Score multiplied by Probability of Failure score. See Table 8.9 in the report.
- Probability of Failure – Extreme Seismic Condition - The is based on the dam's ability to withstand an extreme earthquake.
- Risk Rating – Extreme Seismic Event - This is the Consequence Rating Score multiplied by the Probability of Failure score. See Table 8.9 in the report.

Figure 8.10 - Stouffville Dam seismic study

Flood Control Channels and Dikes

TRCA undertakes annual inspections and engineering studies to determine the current asset condition for dikes and flood control channels. Dikes are assessed similarly to dams because during high flow events they impound water. Therefore, TRCA inspectors look for conditions that could cause the Dike to fail such as slumping, erosion, seepage, sinkholes, and other deficiencies. Flood control channels are inspected for blockages that reduce the capacity of the channel. Channel linings are also inspected for erosion that could lead to slope failure or damage to concrete panels. Channels and Dikes are not assessed for performance during extreme events. For example, extreme floods can overtop channels,

but overall stability may not be affected. Additionally, seismic activity would have minimal impact to a channel's stability. Dikes typically are not assessed for seismic activity because the dike is only under load during high flow events. The probability of a flood and a large earthquake occurring at the same time is very low.

Table 8.11 - Risk Ranking for TRCA Flood Control Channels

Flood Control Channels			
Channel Name	**Consequence Rating Score[1]**	**Asset Condition/ Probability of Failure – Normal Conditions[2]**	**Risk Rating -Normal Condition[3]**
Yonge/York Mills Channel	4	1	4
Woodbridge Channel	3	1	3
Stouffville Channel	3	4	12
Black Creek Channel	4	1	4
Scarlett Channel	4	1	4
Brampton Channel	4	1	4
Sheppard Channel	3	2	6
Malton Channel	4	1	4
Oak Ridges Channel	4	1	4
Bolton Channel	4	1	4

- **Consequence Rating Score** – expected damage should the channel fail based on risk to life, property, and the environment. See Table 8.8 in the report.
- **Probability of Failure/Structure Condition Score** – based on the channel's ability to withstand typical floods and normal loading conditions. See Table 8.7 in the report.
- **Risk Rating – Normal Conditions** - This is the Consequence Rating Score multiplied by the Probability of Failure/Structure Condition Score. See Table 8.9 in the report.

Table 8.12 - Risk Ranking for TRCA Dikes

Dikes			
Dike Name	**Consequence Rating Score[1]**	**Asset Condition/ Probability of Failure – Normal Conditions[2]**	**Risk Rating -Normal Condition[3]**
Pickering Dike	4	4	16
Ajax Dike	4	4	16
Bolton Berm	4	2	8
Etobicoke Dike	4	1	4
West Don Flood Protection Landform	5	1	5
Tyndall Flood Wall	3	1	3
Bolton Flood Wall	3	1	3

- **Consequence Rating Score** – expected damage should the Dike fail based on risk to life, property, and the environment. See Table 8.8 in the report.
- **Probability of Failure/Structure Condition Score** – based the Dike's ability to withstand typical floods and normal loading conditions. See Table 8.7 in the report.
- **Risk Rating – Normal Conditions** - This is the Consequence Rating Score multiplied by the Probability of Failure/Structure Condition Score. See Table 8.9 in the report.

8.5 Asset Deficiencies

Through TRCA's inspections and studies, deficiencies with dams, flood control channels and Dikes have been identified. Deficiencies are defined as structural, mechanical, geotechnical and hydrotechnical flaws in a structure that do not meet regulatory requirements, industry guidelines or operational criteria and could cause the structure to fail. TRCA has compiled a list of deficiencies and their expected repair costs in order to prioritize repairs and to take advantage of potential funding opportunities. The list of known deficiencies with TRCA's flood infrastructure is presented in Table 8.13. Current estimates for addressing deficiencies with TRCA flood infrastructure total approximately $34.1 million. As demonstrated in the Financial Strategy section of this AMP, current funding is not adequate to implement repairs. TRCA is currently looking to access federal and provincial government infrastructure grant funding and to secure matching funding from municipal partners.

Table 8.13 - TRCA Flood Infrastructure Deficiencies and Estimated Cost

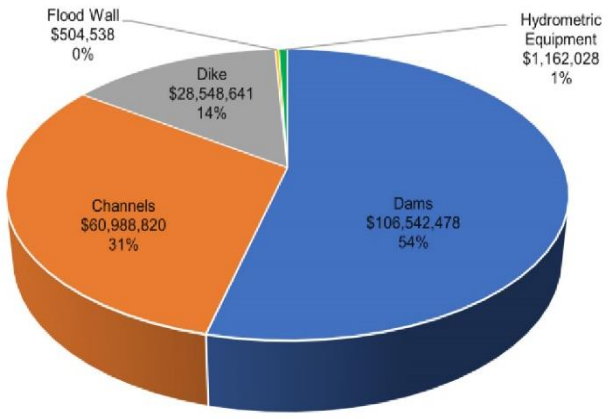
Project Name	Structure	Priority	Estimated Cost (2023 dollars)	Description
Stouffville Dam Embankment and Emergency Spillway Repair	Stouffville Dam	High	$505,000	Embankment requires rip rap buttressing on downstream slope to increase the factor of safety. Emergency spillway requires erosion protection.
Palgrave Dam Major Maintenance and Overtopping Protection	Palgrave Dam	High	$1,125,000	Dam requires repairs to install overtopping protection on the embankment. Stop log deck and hoisting system require upgrades to allow installation and removal of stop logs.
Glen Haffy Extension Dams Decommissioning	Glen Haffy Extension Upper Dam and Lower Dam	High	$1,687,000	Engineering study for decommissioning approvals. Implementation of decommissioning.
Stouffville Dam Embankment Repair	Stouffville Dam	Medium	$281,000	Emergency spillway requires erosion protection. Earthen embankment does not meet factor of safety requirements.
Stouffville Channel Major Maintenance and Naturalization	Stouffville Dam	High	$1,012,000	Removal of existing gabion basket lining and replace with natural channel materials.
Pickering/Ajax Dyke Reconstruction	Pickering Dyke/Ajax Dyke	High	$14,175,000	Reconstruct dykes to meet current engineering guidelines.
Black Creek Dam Spillway Pipe Modification	Black Creek Dam	Medium	$1,125,000	Modify spillway pipe to eliminate debris blockages.
G. Ross Lord Dam Gate Optimization and Operational Study	G. Ross Lord Dam	Medium	$393,000	Engineering study to maximize G. Ross Lord Dam's reservoir storage for short duration, high intensity storms.

Project Name	Structure	Priority	Estimated Cost (2023 dollars)	Description
Secord Dam Decommissioning	Secord Dam	Medium	$1,237,000	Engineering studies and dam decommissioning works.
Osler Dam Decommissioning	Osler Dam	High	$337,000	Engineering studies and dam decommissioning works.
Woodbridge Grade Control Structure Removal (Board of Trade Weirs)	Woodbridge Channel	Low	$1,125,000	Engineering study and removal of two grade control weirs.
G. Ross Lord Dam Safety Review	G. Ross Lord Dam	Low	$191,000	Undertake Dam Safety Review
Claireville Dam Major Maintenance	Claireville Dam	Low	$7,875,000	Enlarge spillway apron for extreme flows. Upgrade gate hoisting systems and repaint gates. Repair spillway wall.
Milne Dam Major Maintenance	Milne Dam	Medium	$3,037,000	Install overtopping protection to earthen embankment. Enlarge spillway apron for extreme flows. Increase factor of safety for spillway and wing walls.
			$34,105,000	

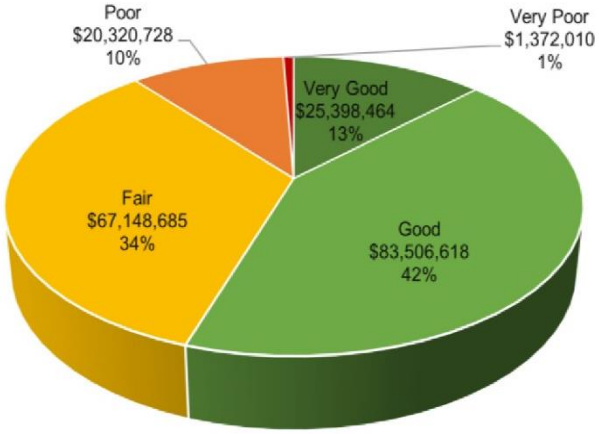
Total Asset Replacement Value:	**$197,746,505**
Current Condition:	Good
Future Condition Trend (next 10 years):	Increasing
TRCA Strategic Plan:	Reduction or elimination of existing flood risks within our jurisdiction.
Assets Included in this Category:	Dams, Channels, Dike, Flood Wall and Hydrometric Equipment
Data Confidence and Reliability:	Condition Based: Medium

The total replacement value of TRCA Flood Control infrastructure is $197,746,505 million. The 50% of the assets are in Good to Very Good condition, and 34% are in Fair condition, with the remaining assets close to, or past, the end of Service Life. As the TRCAs Flood Control services assets are overall in Good condition, these assets are meeting current needs but aging and may require attention.

REPLACEMENT VALUE BY ASSET TYPES



CONDITION OF FLOOD CONTROL INFRASTRUTURE ASSETS



8.6 Levels of Service

The regulation requires a description of levels of service (LOS) for core infrastructure assets, in accordance with the metrics provided in the regulation. Table 8.14 provides a summary of TRCA's core objectives based on the three different types of LOS.

8.6.1 Corporate LOS

The corporate LOS, as the corporate objective, is based on the core mandate of the Flood Risk Management (FRM) group, which is to protect life and property against the hazards of flooding and erosion, a core objective of Conservation Authorities (CA) under the *Conservation Authorities Act.*

It is important to note that Conservation Authorities generally work to achieve this mandate through the application of Ontario Regulation 166/06 (O. Reg. 166/06), which aims to protect *new* development from the hazards of flooding and erosion through the planning process, while TRCA's FRM aims to protect *existing* development from these hazards through the operation of flood infrastructure, flood forecasting and warning, and implementation of remedial works on existing infrastructure.

Managing flood risk through the installation and operation of flood infrastructure is part of the core mandate as described in the Conservation Authorities Act. Specifically, Section 21 empowers Conservation Authorities to:

- erect works and structures and create reservoirs by the construction of dams or otherwise.
- control the flow of surface waters in order to prevent floods or pollution or to reduce the adverse effect thereof.

Therefore, the Corporate LOS is aligned to meet the requirement for TRCA to meet its obligations under the CA Act, which being the installation, operation, and maintenance of flood infrastructure to protect areas at risk of flooding to the limit of available funding each year.

8.6.2 Customer LOS

The Customer LOS defines the services that the flood control assets provide to TRCA's municipal partners and residents within its jurisdiction.

As the very objective of the flood control structures is to protect life and property, the customer LOS is primarily qualitative because it has high social value. Additionally, TRCA smaller dams provide recreational activities such as fishing and boating. The Customer LOS for both the flood protection and recreational opportunities is difficult to quantify. For the benefits of flood protection, extensive studies are required to determine the social and economic benefit TRCA's flood infrastructure provides. There is high economic value of this infrastructure because of the value of the land and/or structures that it protects (e.g., commercial centers, critical infrastructure, schools, housing, etc.); unfortunately, the total market value of the structures and land that TRCA's flood control assets protect has not been determined. However, it can be assumed that TRCA's inventory of flood infrastructure prevents hundreds of millions in flood damage and protects thousands of people from flood risk.

There is limited asset-specific information that provides an idea of the economic value of flood control structures. However, one example of the level of risk presented by TRCA's flood infrastructure is G. Ross Lord Dam. As discussed earlier in this report, failure of the dam would result in a potential loss of life of up to 3000 persons and $1.3 billion in property damage. While this site would be an extreme case, more

site analyses are needed to determine the average Return on Investment (ROI) for TRCA's erosion control assets. Undertaking these studies is costly and TRCA will have to weigh the benefits of undertaking these investigations.

The customer level of service objective is therefore to maintain flood control works on a priority basis in a manner that is clear, consistent, and defensible, to the limit of available funding provided by the benefiting municipality. Priorities are to be based on TRCA's evaluation criteria and further refined based on input from the benefiting municipalities to ensure that additional factors are taken into consideration when prioritizing the timing of implementation for maintenance works. Potential collaboration opportunities on larger restoration works that address the erosion hazard as well as achieving other strategic priorities (e.g., habitat preservation or enhancement, improved public access, etc.) may also be realized.

8.6.3 Technical LOS

The technical LOS defines the technical standards, regulatory requirements and industry guidelines needed to achieve level of service objectives through the use of quantifiable metrics and technical expertise.

TRCA utilizes a technical LOS for prioritizing the monitoring and maintenance of flood control assets. There are numerous agencies in North America that provide guidelines for the construction, operation, maintenance, and surveillance of flood infrastructure assets. Flood Infrastructure and Hydrometric staff use these guidelines to develop protocols for ensuring a good state of repair for flood infrastructure assets.

Resources for the safe management of flood infrastructure at TRCA include:

Dams[1]:

- Lakes and River Improvement Act (Ministry of Natural Resources and Forestry)
- Canadian Dam Safety Guidelines (Canadian Dam Association)

For Dikes and Flood Walls:

- Design and Construction of Levees, United States Army Core of Engineers (USACE)
- International Levee Handbook, USACE

For Flood Control Channels:

- Structural Design of Concrete Lined Flood Control Channels (USACE)

8.6.4 Levels of Service Metrics

The following table outlines the Level of Service (LOS) for TRCA flood infrastructure assets using Customer, Corporate, and Technical criteria.

[1] For information on these documents, please see Asset Inventory, Dams in Ontario section above.

Customer Level of Service

Customer Value	Customer LOS Objective	Customer LOS Measure	Customer LOS Performance	Customer LOS Target	Customer LOS Target
Flood Protection	Flood protection provided by infrastructure maximized	% of flood structures that are providing the level of protection as per design	76% of structures are providing their design level of protection	Structures should be providing 100% of the design criteria flood protection	
Safety	Flood infrastructure is operated and managed safely.	% of flood structures with an asset condition of "Poor" or "Very Poor"	13% of structures have a conditin assessment of "Poor" or "Very Poor"	100% of structures should be "safe" for communities	
Flood Warning	Hydrometric instrumentation provides timely flood warning	% uptime for real-time hydrometric equipment	95% Uptime for hydrometric network.	Hydrometric equipment should be operable 100% of time	

Corporate and Technical Level of Service

Corporate LOS Objective	Technical LOS Measure	Technical LOS Performance	Technical LOS Trend	Technical LOS Target
Environmental Hazard and Hazard Management: Identify and map flood hazards, provide flood forecasting and warning services, and operate flood mitigation infrastructure	% of structures meeting applicable industry standards for safety	65% of flood infrastructure meets applicable industry standards for safety		100%
Service Excellence: Complete asset management and state of good repair assessments and improvements	Number of required inspections per year are undertaken	440 inspections per year on all flood infrastructures		440

Corporate LOS Objective	Technical LOS Measure	Technical LOS Performance	Technical LOS Trend	Technical LOS Target
Environmental Hazard and Hazard Management: Identify and map flood hazards, provide flood forecasting and warning services, and operate flood mitigation infrastructure	% uptime for hydrometric equipment	>95% Uptime for the hydrometric network		100%

	**Positive Upward**		**Positive Downward**		**No Change**

8.7 Asset Management Strategy

The effective management of TRCA's critical infrastructure assets can have tremendous consequences on the safeguarding of life, health, or property along with savings for municipal and regional partners. As part of its asset management strategy, TRCA has many facets when it comes to its flood control AMP.

8.7.1 Continual Improvement and Innovation

AMPs should be continuously evaluated and improved through clearly defined actions such as:

- Review of asset performance;
- Up-to-date inventories;
- Updates to asset information;
- The inclusion of unplanned corrective maintenance expenditures;
- Updates to preventative maintenance plans;
- Performance metric reviews;
- Return on Investment reviews (ROI is a data gap in the flood infrastructure program);
- Life Cycle Costing Index reviews; and
- Review of latest trends and technologies.

Flood Infrastructure and Hydrometrics is slowly shifting its strategy towards a more effective AMP through focused preventative maintenance and enhanced monitoring of its assets. The following is a summary of monitoring activities and documentation to reduce risk from TRCA's flood infrastructure.

Flood infrastructure is designed to protect life and property, but also carries risk. The failure of structures designed to create storage and divert flood water can cause an uncontrolled release of water into developed areas. As an owner of dams, channels, and Dikes, TRCA must strive to ensure these structures are managed safely.

The following sections outline:

a. the framework in which TRCA operates, maintains, and inspects flood infrastructure;
b. the current condition and associated risk of TRCA flood infrastructure;
c. major studies and repairs from 2016 to 2020;
d. future work to ensure long-term safety and stability of existing flood infrastructure;
e. funding details and grant opportunities.

8.7.2 Dam Safety in Ontario

Dam safety in Ontario is regulated by the Ministry of Natural Resources and Forestry (MNRF) under the Lakes and Rivers Improvement Act (LRIA). They are responsible for developing the criteria that dams must meet and regulating dam owners in the safe operation and maintenance of dams. The Canadian Dam Association (CDA) is an advisory body comprised of voluntary dam safety experts supported by dam owners in Canada, including TRCA. The CDA provides technical and management guidance for dam owners using internationally recognized best practices. TRCA uses a combination of both MNRF and CDA guidelines for managing structures. This is because there are cases where one set of guidelines do not cover specific topics. For example, LRIA guidelines do not address emergency management of dams and therefore TRCA uses the CDA Emergency Management for Dam Safety Technical Bulletin.

Lakes and Rivers Improvement Act

In 2011, the Ontario Ministry of Natural Resources and Forestry (MNRF) introduced the *Lakes and Rivers Improvement Act* Administrative Guide, Technical Bulletins and Best Management Practices Guide (LRIA). These documents are based on criteria developed by MNRF and the Canadian Dam Association (CDA), and provide guidelines for the safe design, construction, management, operation, and repair of dams in Ontario. It is a resource for engineers, operators, and owners to use when assessing the safety of a dam. The LRIA Guidelines are not legislated but define best management practices and therefore the minimum standard of safety for dam owners in Ontario.

A critical component of the LRIA is the Dam Safety Review (DSR). The DSR is an in-depth engineering study of a dam. Components of a DSR include geotechnical analysis of stability, a public safety review, hydro-technical analysis, structural inspection, and other investigations. Based on the results of the DSR, the dam receives a Hazard Potential Classification (HPC). The HPC determines the risk to the public if a dam were to fail. Dams with higher risks are required to meet more stringent and conservative engineering standards. For example, a dam failure that is estimated to cause a loss of life greater than 11 persons would have an HPC of Very High. Dams with an HPC of Very High would have to meet the strictest guidelines for dam safety including safely passing the largest theoretical flood that can occur in southern Ontario (which, for reference, is larger than Hurricane Hazel). Note that safely passing a flood flow does not equate to storing the volume of that flood in a reservoir. Safely passing a flood means that the resulting flows can pass through the dam and reservoir without causing a dam failure.

Canadian Dam Association Dam Safety Guidelines

The CDA is a volunteer body of dam safety experts who create dam safety guidance documents using the best industry standards developed by various international organizations. CDA also develops training and workshop programs that offer hands-on experience for dam professionals. Particularly important recommendations from CDA include the development of emergency management guidelines. These provide a framework for responding to dam failures. TRCA assisted in the development of the emergency management guidelines and was an early adopter of CDA's recommendations for developing emergency management protocols. All TRCA high risk dams have emergency response plans in place. Additionally, TRCA is in the process of developing emergency response plans for dams with lower risks.

8.7.3 TRCA Flood Infrastructure Management Program - Dams

Dam Safety Management

TRCA's four largest dams are in urban areas. As such, a failure of one of these dams would have a significant impact on downstream communities. For example, the 2011 Dam Safety Review of G. Ross Lord Dam determined that a failure of the dam could place up to 3,000 persons at risk and cause up to approximately $1.3 billion in property damage. Proper management and maintenance of these dams is critical for public safety.

TRCA has adopted LRIA and CDA guidelines into its dam safety program and is in the process of upgrading each structure to meet the criteria required, where possible.

Inspection Program

Each dam in TRCA's inventory is inspected monthly and annually. TRCA's two largest dams (Claireville Dam and G. Ross Lord Dam) also undergo daily inspections to further reduce the risk of safety or stability issues. The total number of inspections on TRCA dams is approximately 550 each year.

- Daily inspections are visual inspections to note the condition of the earthen embankment, control structures and site security.
- Monthly inspections are more detailed. Emergency generators are exercised, gate motors are tested, back-up systems tested, communications equipment checked, dam instrumentation is calibrated, and embankments are inspected.
- Annual inspections are detailed assessments of each dam. Each component is thoroughly checked for correct operation:
    - earthen embankments are thoroughly inspected
    - gates are fully opened and closed
    - concrete spillways are inspected
    - gates are operated on emergency power
    - tunnels and shafts are entered and inspected
    - emergency generators serviced
    - gates and motors are lubricated and serviced
    - back-up gate operation systems tested

Operation, Maintenance and Surveillance Manuals

Each dam owned by TRCA has an Operation, Maintenance and Surveillance (OMS) manual. The OMS manual is a stand-alone document that describes all the activities necessary to manage the dam. Sections of an OMS include:

- roles and responsibilities with contact information
- how to operate the dam gates
- operation of emergency generators
- preventative maintenance procedures
- communications
- dam storage and discharge data
- emergency procedures
- inspection criteria

Each OMS is reviewed and updated each year to ensure the document is current.

Emergency Preparedness and Response Plans

TRCA uses CDA's Emergency Management for Dam Safety Technical Bulletin for guidance on drafting emergency response plans specific to each structure. There are two types of emergency management plans for dams. Emergency Preparedness Plans (EPP) are developed for external responding agencies that are responsible for public safety. In the event of a dam emergency, the responding agency can use the EPP to coordinate resources using the EPP's inundation maps. Inundation maps depict the expected flooded areas should a dam fail and can help first responders coordinate evacuations and road closures if required. Emergency Response Plans (ERP) are internal documents for TRCA use. Contact information for staff, roles and responsibilities, organizational flowcharts, equipment/aggregate supplier information, emergency dam repair documentation, and other critical information for managing dam emergencies are included in the ERP. TRCA maintains EPP's and ERP's for all High and Very High HPC dams.

8.8 Studies, Repairs and Preventive Maintenance

Due to the complexity of dam construction and risk, TRCA undertakes numerous engineering studies to investigate the condition of the structures. Dam Safety Reviews (DSR's) are the most common study, but other investigations can be required as well. It may be necessary to design a repair or to further investigate a deficiency. For example, a DSR at Stouffville Dam found that the dam may be at risk of failure during an earthquake, warranting either further study on seismic risk, or alternatively a costly stabilization project. A specialized study was initiated using the latest seismic risk investigations to confirm whether a costly repair was warranted. The study found that the risk of failure due to an earthquake was minimal and modifications to the dam were not required.

When inspections or studies find that repairs are required, TRCA retains qualified consultants and contractors to undertake the repair. Most common repairs include electrical upgrades at dams, dredging of flood control channels, and minor concrete repairs. Major deficiencies require extensive design, complex approvals, and significant capital funds. TRCA is investigating opportunities to obtain adequate funding to undertake some of the major work required to make TRCA infrastructure fully compliant with

current guidelines.

Preventative maintenance is a critical part of TRCA's management of dams. In 2019, TRCA assigned a field crew to specifically undertake preventative maintenance activities on flood infrastructure. Preventative maintenance on dams is primarily geared toward removing vegetation from embankments. Removing vegetation on a regular basis prevents large trees from establishing root systems that can damage the embankment. Trees on dams can also lead to seepage issues and impair an inspector's ability to see the condition of the embankment. Preventative maintenance activities on dams can also include minor concrete repairs, debris management at dam intakes, and painting of gate components.

Public Safety Around Dams

Dams in Ontario are required to follow the Public Safety Around Dams (PSAD) Technical Bulletin from the LRIA. Statistically, it is far more likely to have serious injury or death around a dam due to falls or drowning than from a dam failure. The PSAD evaluates all the hazards around a dam and prescribes mitigation measures to ensure that all areas of the dam are safe. Mitigation primarily includes barriers (fencing, guardrails, and safety booms) and warning signage. PSAD documents are reviewed annually to ensure all hazards are properly mitigated.

Dam Decommissioning

There are technical difficulties in bringing older dams into compliance with modern design guidelines. Older flood control dams were constructed using the engineering principles of the period in which they were built and cannot meet newer requirements unless substantial modifications are made. Historic, legacy dams such as mills, and recreational dams were built without any proper engineering or construction techniques and may never be able to meet LRIA guidelines. In these cases, options are limited to decommissioning the dam or increased risk management and tolerance. TRCA has decommissioned several dams in the past. Most recently, Albion Hills Dam was decommissioned in 2017 because the structure was in poor condition and unrepairable. There are several other dams in TRCA's inventory that will need to be decommissioned or replaced because their poor condition puts them at risk of failing. These include:

- Secord Dam
- Osler Dam
- Glen Haffy Extension Upper Dam
- Glen Haffy Extension Lower Dam

Removing these structures reduces TRCA liability and long-term costs. Even small dam failures can cause large amounts of property and environmental damage. Additionally, removing dams restores the river's natural functions and improves habitat and water quality.

8.9 TRCA Flood Infrastructure Management Program – Flood Control Channels and Dikes

Annual Inspections

As part of TRCA's Flood Infrastructure Management Program, channels and Dikes are inspected annually. TRCA staff walk the entire length of each structure each year. Flood control channel inspections ensure that the channels are free from sediment and large vegetation. Channel linings are

inspected to ensure that they are not eroding. Concrete is checked to ensure that structures are not at risk of failing during large events. The Dikes' earthen embankments are inspected to make sure the structures are not eroding, settling, or failing. Culverts and flap gates are checked to make sure that flood water cannot surcharge to the dry side of the Dikes. Information obtained during the inspection is used to direct preventative maintenance activities and, in the case of more serious deficiencies, design repairs for capital works projects. Dikes and channels are also inspected after flood events to confirm that they were not damaged.

Maintenance

TRCA's flood control channels and Dikes require maintenance activities to ensure that the structures are functioning correctly. Channels require dredging of sediment and removal of vegetation to ensure the capacity is maximized for flood events. Dikes should remain free of trees and large bushes to allow inspections of the earthen embankments. Large trees can also topple during large storms causing root systems to damage large sections of the Dike, possibly leading to failure. In the past, TRCA's flood control channels and Dikes have received sporadic maintenance which has led to costly, large-scale sediment and vegetation removal projects. In 2019, TRCA dedicated a full-time maintenance crew to conduct small-scale maintenance on the channels and Dikes. By undertaking annual maintenance on these structures, the need for expensive large-scale projects is greatly reduced. Operations were suspended for several months in 2020 due to COVID-19, but the crew is now working full-time to continue maintaining these structures.

Figure 8.11 - Geotechnical drilling at Claireville Dam's downstream wing wall

8.10 Financial Strategy

Funding for inspecting, maintaining, and operating TRCA's flood infrastructure and hydrometric networks comes from several sources including municipalities and the province. Funding has remained static for many years and current levels are not sufficient to address the major deficiencies associated with TRCA's dams, channels, and Dikes. The priority deficiencies with TRCA's flood infrastructure currently totals around $30 million. The hydrometric assets replacement estimates also require investments to ensure the networks are functioning reliably. Funding for the operation, maintenance, inspection, and repair of TRCA flood infrastructure is from several sources, as outlined below.

MNRF Section 39

MNRF Section 39 grant funding is provided to Conservation Authorities for natural hazard management. TRCA receives approximately $165,000/year for operation and maintenance of flood infrastructure. This is matched by municipal levy. This funding is targeted to operations and maintenance which includes program management, inspections, utilities, vehicles, communications, and dam operator housing subsidies. These funds are not available for capital repair projects.

Capital Levy

Municipal levy capital funding is provided for flood infrastructure maintenance repair works. This funding remains relatively stable year over year. Approximately $200,000 of these funds are used for preventative maintenance. Preventative maintenance costs include salary costs for field crews, vehicles, and equipment. This leaves approximately $469,000 per year for capital repair projects. Capital funding by municipality is presented in Table 8.14.

Table 8.14 - Municipal Capital Levy for Flood infrastructure 2022

Municipality	Funding
Durham Region	$22,000
York Region	$71,000
Region of Peel	$309,000
City of Toronto	$267,000 (includes Flood works Enhanced Capital)
Sub-Total	$669,000
Subtract Preventative Maintenance Costs	($200,000)
Total Funds Available for Capital Repair Projects	$469,000

While funding to address the major deficiencies is not available, TRCA leverages existing capital and grant funding to reduce the risk of asset failure as much as possible. Recent TRCA dam capital projects from 2016-2020 are presented in Table 8.15. Recent TRCA flood control channel and Dike capital projects from 2016-2020 are presented in Table 8.15.

Table 8.15 - Major Dam Safety Projects 2016-2024

Structure	Year	Project	Project Cost
G. Ross Lord Dam	2024	Dam Safety Review • **New Dam Safety Review required.**	$150,000
Palgrave Dam	2023-2024	Stop Log Gantry Installation • **Design and installation of new stop logs and hoisting system.**	$75,000
Claireville Dam	2023	Gate Decommissioning • **Implementation of gate repair.**	$50,000
Claireville Dam	2023	Wing Wall Repair • **Implementation of repair to wing wall.**	$150,000
G. Ross Lord Dam	2023	Seepage Study Phase 2 • **Continued investigation into dam's drainage system.**	$80,000
Palgrave Dam	2022	Deficiency Repair Design Study • **Design of repair to address deficiencies.**	$148,000
Claireville Dam	2022	Gate Decommissioning Study • **Study to decommission unused gate.**	$40,000
Glen Haffy Dams Safety Review	2022	Dam Safety Review and Feasibility Study • **Investigation of four dams within the Glen Haffy Conservation Area.** • **Decommissioning feasibility study.**	$160,000
Claireville Dam	2022	Wing Wall Repair Design Study • **Study to investigate wing wall settlement.**	$85,000
G. Ross Lord Dam	2021	Emergency Spillway Seepage Study Phase 1 • **Investigation into possible seepage risk**	$225,000
Claireville Dam	2021	Gate Motor Housing Repair • **Repair weather enclosures for gate hoisting equipment.**	$33,000

Structure	Year	Project	Project Cost
Stouffville Dam	2021	Concrete Repair • **Repair cracked and spalling concrete in spillway.**	$48,000
Claireville Dam	2020	Control Building Roof Repair • **Replace roof on control building.**	$30,000
Claireville Dam	2020	HVAC Repair • **Decommission boiler and install electric heaters throughout control building.**	$35,000
Stouffville Dam	2020	Concrete Repair and Emergency Spillway Repair Design Study • **Design for concrete and emergency spillway repairs.**	$90,000
G. Ross Lord Dam	2019	Hydrogeological Study • **Study to examine the dam's drainage and pressure relief systems.**	$85,000
Stouffville Dam	2018	Liquefaction Study • **Study to determine earthquake risk to dam.**	$63,000
Palgrave Dam	2018	Dam Safety Review • **Engineering review of the dam.**	$59,000
Milne Dam	2018	Deficiency Study • **Investigate overtopping mitigation options.** • **Investigate structural sliding deficiency.** • **Confirm uplift resistance of spillway.**	$84,000
Black Creek Dam	2018	Dam Safety Review • **Engineering review of the dam.**	$61,000
Black Creek Dam	2018	Reservoir Dredging • **Remove sediment and debris from dam spillway intake and restore capacity of reservoir.**	$1,760,000

Structure	Year	Project	Project Cost
Albion Hills Dam Decommissioning	2017-2018	Dam Decommissioning • **Remove existing dam and construct bridge over restored creek.**	$1,820,000

Table 8.16 - Channel and Dike Projects 2016-2023

Structure	Year	Project	Project Cost
Stouffville Channel	2023	Proposed Feasibility Study • **Study to investigate the feasibility of replacing existing gabion basket lining with a natural lining.**	$50,000
Mimico Malton Channel	2023	Proposed Vegetation Removal • **Preventative maintenance to remove vegetation.**	$40,000
Etobicoke Dike	2023	Proposed Embankment Repair • **Minor repair to eroded area of dike.**	$20,000
Sheppard Channel	2023	Proposed Vegetation Removal • **Preventative maintenance to remove vegetation.**	$15,000
Stouffville Channel	2022	Vegetation Removal • **Preventative maintenance to remove vegetation.**	$14,000
Etobicoke Dike	2022	Dike Stability Assessment • **Study to ensure dike meets stability requirements.**	$25,000
Bolton Dike	2021	Bolton Dike Major Maintenance • **Repairs to dike, including raising dike and installing new erosion protection.**	$1,820,000
Yonge York Mills Channel	2020	Concrete Channel Repair • **Concrete panel repair and underpinning.**	$65,000

Structure	Year	Project	Project Cost
Bolton Berm (Dike)	2019	Bolton Berm Ice Jam Study • **Engineering assessment of the 2019 Bolton ice jam.**	$55,000
Bolton Berm (Dike)	2019	Bolton Berm Major Maintenance Design Project • **Final Design drawings for Bolton Berm upgrades including erosion protection and raising of crest.**	$160,000
Scarlett Channel	2019	Scarlett Channel Erosion Project • **Repair erosion damage at outfall to Humber River.**	$200,000
Bolton Berm (Dike)	2018-2019	Bolton Berm Drainage Upgrades • **Flap gate installation and maintenance**	$20,000
Pickering Dike/Ajax Dike	2018-2020	Pickering/Ajax Dike Rehabilitation • **Conservation Class Environmental Assessment**	$450,000
Pickering Dike/Ajax Dike	2016	Pickering/Ajax 2D Modeling and Dike Assessment Project • **Flood assessment and structural investigation of Dike.**	$75,000
Malton Channel	2016	Channel Major Maintenance Dredging Project • **Removal of sediment and vegetation from channel**	$500.000
Bolton Berm (Dike)	2016	Bolton Berm Hydraulic Assessment and Remediation Study • **Flood assessment of berm and structural investigation of Dike.**	$102,000

Water and Erosion Control Infrastructure Funding

The Ministry of Natural Resources and Forestry supports conservation authorities to undertake maintenance activities throughout Ontario with the Water and Erosion Control Infrastructure Program (WECI). Under this program, repairs and studies undertaken on structures are eligible for 50% matching funds from the Province of Ontario. Projects are reviewed and prioritized by MNRF and only the highest ranked projects are awarded grants. TRCA applies for WECI funding every year for both repairs and studies. The WECI program has become a critical tool for funding capital improvement projects.

Table 8.17 - WECI Funding 2016-2023

WECI Funding received by TRCA 2016-2023	
2016/2017	$230,425
2017/2018	$218,802
2018/2019	$128,023
2019/2020	$126,045
2020/2021	$280,000
2021/2022	$653,000
2022/2023	$654,000
Total	**$2,290,295**

National Disaster Mitigation Program (NDMP)

The NDMP is focused on flood risk studies, flood plain mapping, non-structural or small-scale structural risk reduction measures, and not toward maintenance and upgrade projects for existing flood infrastructure. However, TRCA was successful in obtaining funding to optimize gate operations at G. Ross Lord Dam and to examine flood risk at Claireville Dam and Stouffville Dam. Total contribution to these projects from NDMP was approximately $211,000. TRCA has been informed that there may be future intakes for infrastructure projects.

Disaster Mitigation and Adaptation Fund (DMAF)

DMAF was created to fund large-scale infrastructure projects to implement projects that increase resiliency and reduce risk to the public. It is specifically geared towards risks associated with flooding, wildfires, and droughts. TRCA intends to pursue DMAF funding to address the major deficiencies with TRCA's flood infrastructure. Because the program has a minimum investment of $20,000,000, TRCA is bundling many flood infrastructure projects to meet this requirement. As a cost-sharing program, DMAF would still require matching funding contributions. Considering the significant capital costs of these projects, TRCA is initiating discussions for these future projects with funding partners.

TRCA has made several unsuccessful applications for DMAF funding but will continue to apply for future projects.

Future Renewal Need

Future Renewal Need in Asset Management Plans is used to predict funding requirements to rebuild infrastructure to maintain the existing Level of Service requirements. At this point in TRCA's asset management strategy, the investigation required to determine future renewal needs has not advanced. The backlog of capital projects is receiving priority attention. However, given the nature of dams, channels, and Dikes, it is possible to keep these existing structures operating in a reasonable state of repair for decades or longer. As long as preventative maintenance and capital upgrades continue to be undertaken, TRCA flood control assets can be maintained for many generations. Of course, deficient

structures that cannot be upgraded to meet current guidelines may have to be removed and, given the cost of replacement and changing attitudes to managing rivers, will not be rebuilt. More investigation is required to understand the long-term requirement of TRCA's flood infrastructure.

Note that the estimated need does not reflect any improvements to current asset management practices, such as optimized operational maintenance, adjustments to LOS, or use of other innovative techniques or the application of other funding sources (grants and subsidies). By optimizing approaches to maintain assets, TRCA's partners could realize significant cost savings over the useful life of its infrastructure. Should unplanned revenues become available, it would be prudent to apply them towards mitigating the backlog of unacceptable deficiencies associated with various structures. As further information becomes available, these financial projections will be improved.

8.11 Risks and Assumptions

This section of the asset management plan highlights all the current and foreseeable risks along with the assumptions made to forecast the future need.

Risks

The following risks that can impact the timing and value of renewal needs:

- Weather and climate change
- Changes to LOS targets
- External Pressures
- Economic conditions
- Legislative requirements
- Affordability

Weather Impacts

Severe weather events can significantly impact the stability and lifespan of flood control structures. Extreme weather events can overwhelm structures and cause failure. The unpredictable nature of climate change can have an effect on the safety of a structure as well. For example, structures designed to protect against the 100-year flood event may provide a lesser amount of flood protection if statistical analysis finds that the 100-year event is expected on a more frequent basis.

Changes to LOS targets

Flood Infrastructure and Hydrometrics utilizes a technical LOS for prioritizing the construction, monitoring, and maintenance of flood control assets. It is certain that, as the state of practice advances, the guidelines for maintaining safe structures may become more restrictive as well. This is certainly happening in dam safety engineering. As causes of dam failure become more well understood, guidelines are upgraded to more conservative requirements.

External Pressures

Some external pressure from city or regional governments may change the timing of maintenance and renewal needs. This may come in the form of pressure to undertake capital improvement from local governments and residents.

Legislative Requirements

Several legislative acts can potentially impact the timing of maintenance/renewal needs of flood control structures. In particular, Lakes and Rivers Improvement Act can change over time and could affect capital projects.

Affordability

Large, complex construction projects, dams in particular, can require large amounts capital funding. Market competition can drive up prices of engineering, contractors, and materials especially during times of major government spending on infrastructure programs. There are a finite number of professionals available to work on flood infrastructure projects.

Assumptions

The following are assumptions made throughout this report when compiling data for the AMP:

- Replacement values and plan assumes like-for-like with no expansion of the asset or major change in material type;
- Replacement costs include planning, permits/approval, legal, construction, post-construction monitoring, and other miscellaneous costs;
- Asset replacement value does not account for the value of the asset it is protecting;
- Essential assets that TRCA's flood control infrastructure protect have not been thoroughly reviewed, therefore, it can be assumed that the customer LOS performance measures is potentially larger than reported;
- The asset condition rating and deficiency table (Table 8.12) uses the most recent inspection data at the time the report was prepared (prior to September 25, 2020).

8.12 Importance of Full Life Cycle Costing

Life cycle costs should include all costs that are anticipated to occur during the ownership of an asset. This includes capital, operating and maintenance, and disposal expenditures. Unless these full life cycle costs are defined, it is difficult to effectively plan for complete infrastructure costs going forward. Once these expenditures are further understood, TRCA can utilize cost-effective management strategies by repairing or replacing the right assets at the optimal time. TRCA is working to better understand both the type and timing of treatments that lead to optimal infrastructure management. It is important that TRCA continues to analyze projects and manage existing assets based on full and optimal life cycle costing. This will ensure that current and future infrastructure will have sufficient funds available when needed. Plans for the ongoing improvement of information quality and the planning process will be an integral part of TRCA's Asset Management system going forward.

Administrative Buildings

SECTION 9: BUILDINGS - ADMINISTRATIVE

Introduction

The Toronto and Region Conservation Authority owns five administration buildings as below :

- The New TRCA Head Office,
- Boyd Centre,
- Restoration Services Centre,
- Dave Barrow Centre for Conservation, and
- Eastville

As of the writing of this report, sufficient data including the Building Condition Assessment (BCA) report is not available to include the Eastville facility in-scope within this AMP. Future updates to this section will be made as new BCAs are completed or existing BCAs are updated.

TRCA new Head Office

The building at 5 Shoreham Drive is a 4 story, 86,000 sq ft (8,000 sq m) mass timber office building. It is sized to support 400 full-time staff and designed to:

- Reduce operational costs.
- Provide a healthy workplace for employees and visitors.
- Set a high-water mark for office building development.
- Positively influence others engaged in designing and building communities in our jurisdiction and beyond.

TRCA is committed to applying best practices in green building and sustainable design. The building structure is a low-carbon wood which compliments the recent changes to the Ontario Building Code to permit wood structured buildings.

At minimum, the building will strive to achieve Leadership in Energy and Environmental Design (LEED) platinum certification and WELL Building certification.

Boyd Centre

This property consists of the main Boyd Centre building and two additional structures built in 2009 and a Cover-all built in 2016.

The Boyd Centre building is a two story plus partial basement, and was reportedly constructed in two phases (Original, and Addition). The Original building was constructed in 1930, and the Addition was constructed in 2005. It has since undergone several expansions and renovations and now serves as part of the Restoration and Infrastructure Campus and Field Investigation Storage Facility.

The property includes site development associated with the buildings including hard surface roadways and parking, soft landscaped areas, site improvements, septic system and the municipal site services and connections for the building.

Restoration Services Centre

This property consists of the main Restoration Services building built in 2007 and additional structures being a Cover-all, a Cold Storage, a Nursery Pole Barn, and a Nursery Workshop.

The Restoration Services building is a two story plus partial basement. The building has many sustainability features incorporated as it was designed to be a showcase for sustainable building design. It has LEED Platinum Certification.

The property includes site development associated with the buildings including hard surface roadways and parking, soft landscaped areas, site improvements, compostable toilet system and the municipal site services and connections for the building.

Dave Barrow Centre for Conservation

Dave Barrow Centre for Conservation is a two story plus partial basement structure including a detached two-story Coach House. It was initially built as a private residence, and after being purchased by TRCA, it has undergone extensive renovations completed in 2015. It now serves as an administrative and field office for TRCA, with a portion of the facility being leased to the York Region District School Board for outdoor education purposes.

The property includes site development associated with the buildings including hard surface roadways, parking and works yard, soft landscaped areas, and site improvements.

State of TRCA's Administration Facility Assets

9.1 Asset Data Inventory

TRCA owns and operates 5 Administrative Facilities, of which 4 listed in the Table 9.1 are in-scope for this report. The asset data inventory for buildings is managed in the Enterprise Asset Management (EAM) application. The original data was populated through the completion of third-party building condition assessment (BCA). The TRCA Head Office is currently in the last stages of construction with an expected Occupancy date of Fall 2024.

Table 9.1 – Administrative Buildings by Gross Floor Area (inclusive of miscellaneous structures).

Building Name	Gross Floor Area (Square Feet)	Unit	Structures
TRCA Head Office	86,000	Each	1
TRCA Boyd Centre	23,546	Each	3
Restoration Services Centre	33,204	Each	6
Dave Barrow Centre for Conservation	10,295	Each	2

9.2 Asset Valuation

The current valuation of TRCA's Administration Buildings is based on a combination of datasets. The New Head Office, currently under construction, is assigned a replacement value based on the incurred and anticipated construction costs as well as the insured value.

Excluding the New Head Office, the other three Administrative Facilities were assigned their replacement values following the completion of the Building Condition Report (BCA) in Q4 2023. Individual building components or system-level assets (e.g., HVAC system) are added together to generate an overall building system cost. These costs are used to develop condition scoring or Facility Condition Index (FCI) analysis.

To forecast capital funding requirements of an entire building more accurately, soft costs, current legislative and regulatory requirements are also included as necessary to determine an overall replacement value for the building. This replacement value is used to develop long-term funding needs.

Table 9.2 - Breakdown of TRCA's Administration Buildings inventory and replacement cost.

Service	Asset	Structures	Unit	Replacement Value
Administration Buildings 	TRCA New Head Office	1	Each	$ 72,318,592
	TRCA Boyd Centre	3	Each	$ 5,802,032
	Restoration Services Centre	6	Each	$ 6,168,821
	Dave Barrow Centre for Conservation	2	Each	$3,345,985
TOTAL				**$ 87,635,430**

9.3 Asset Useful Life

In reference to a typical useful life of 50 years, 83 % (by replacement value) of TRCA's Administration Buildings are less than 10 years old. This is due to the fact that the majority of the replacement value of the Administration Buildings portfolio can be attributed to the New Head Office. However, these assets will still require annual maintenance and periodic major maintenance activities, so they continue to provide the intended level of service throughout their service life.

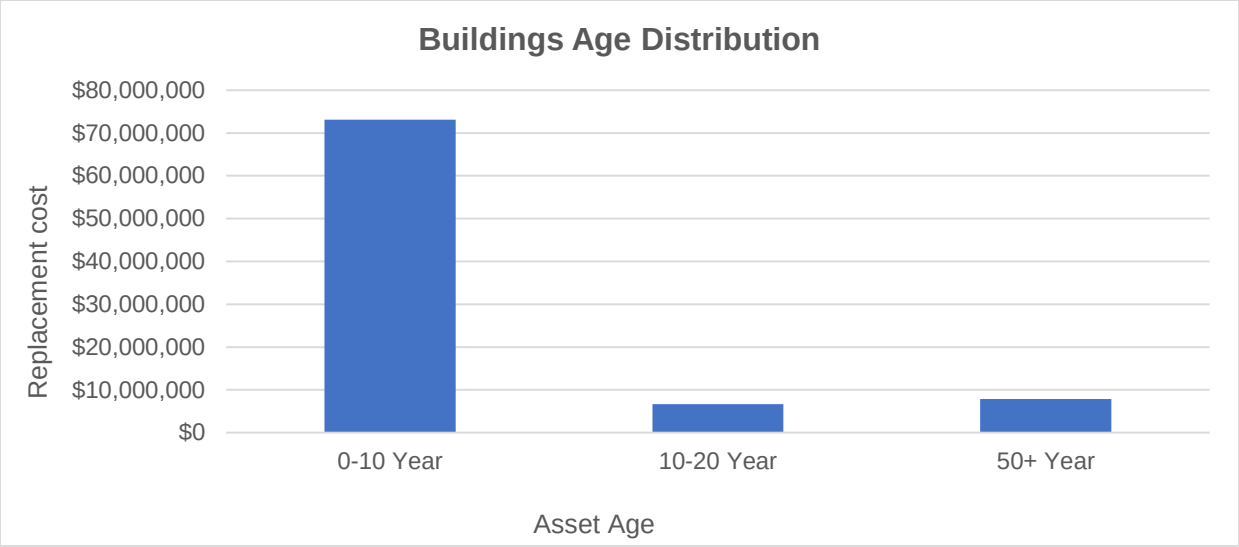


Figure 9.1 – TRCA Administrative Buildings Age Distribution

9.4 Asset Condition

Facility Condition Index (FCI) is the standard metric used for benchmarking building condition across a portfolio of buildings. FCI is a ratio of the repair/renewal needs to replacement value expressed in percentage terms.

Table 9.3 – Facility Condition Index and Condition Rating

Calculated FCI	Description	Overall Building Condition
0%-0.9%	The Facility and its components are functioning as intended; limited (if any) deterioration observed on major systems.	**Very Good**
1%-5%	The Facility and its components are functioning as intended; for most infrastructure assets, this would infer that no repairs are anticipated within the next five years.	**Good**
5%-10%	The Facility and its components are functioning as intended. normal deterioration and minor distress observed; repairs will be required within the next five years to maintain functionality.	**Fair**
10%-30%	The Facility and its components are not functioning as intended; significant deterioration and distress observed; repairs and some minor rehabilitation required within the next year to restore functionality.	**Poor**
>30%	The Facility and its components are not functioning as intended; significant deterioration and major distress observed; possible	**Very Poor**

Table 9.4 – TRCA Administrative Buildings – FCI

Building Name	Facility Condition Index (FCI)	Condition Summary	Condition Description
TRCA Head Office	N/A	Very Good	Building elements are like new, functioning as designed, minor / superficial deterioration. Minimal to no deterioration of major building systems.
TRCA Boyd Centre	5.2%	Fair	Building elements are functional and have experienced normal deterioration as expected given the age of the elements and expected service life. Minor distress of major building systems is observed indicating repairs and replacements will be required within the next five years.
Restoration Services Centre	0.9%	Good	Building elements are functioning as designed with regular preventative maintenance occurring. Majority of major building systems are not requiring replacement within the next 5 years.
Dave Barrow Centre for Conservation	9.35%	Fair	Building elements are functional and have experienced normal deterioration as expected given the age of the elements and expected service life. Minor distress of major building systems is observed indicating repairs and replacements will be required within the next five years.

The FCI rating translated to a 5-point rating scale allows TRCA's assets to standardize reporting and enables benchmarking against municipalities. The rating scale ranges from Very Good to Very Poor, as described in Table 9.3, and reflects the physical condition of the given assets.

83 % (based on replacement values) of TRCA's administration buildings are rated to be Very Good. This again can be attributed to the recently constructed New Head Office. The Restoration Services Centre building is relatively new and in good condition. Since the Dave Barrow Centre for Conservation building has been recently renovated there have been minimal life cycle capital replacements undertaken to date, and the building is in relatively good condition.

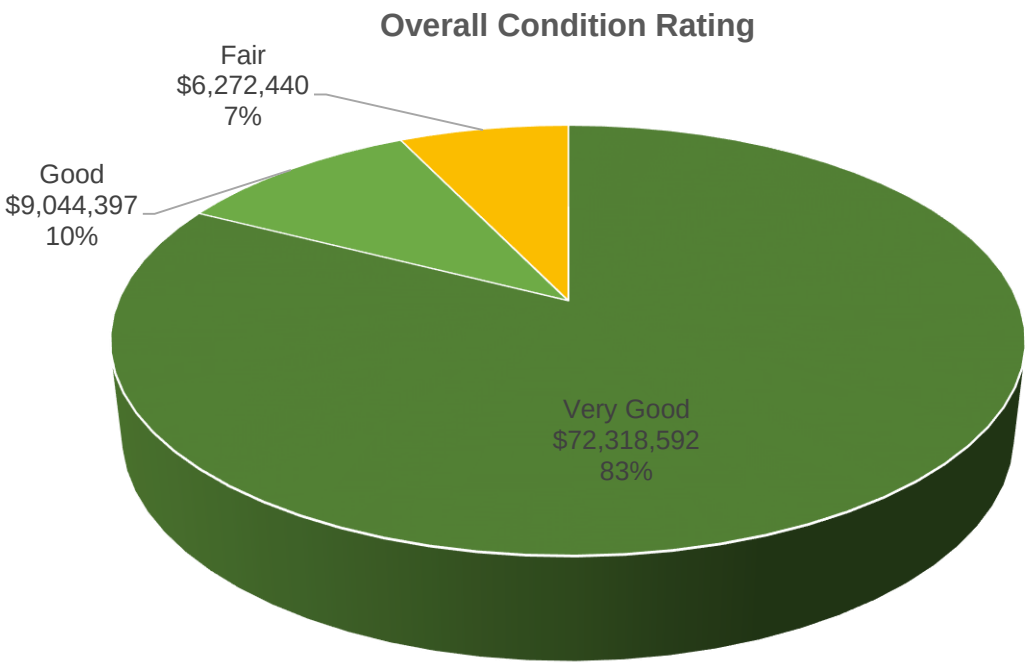


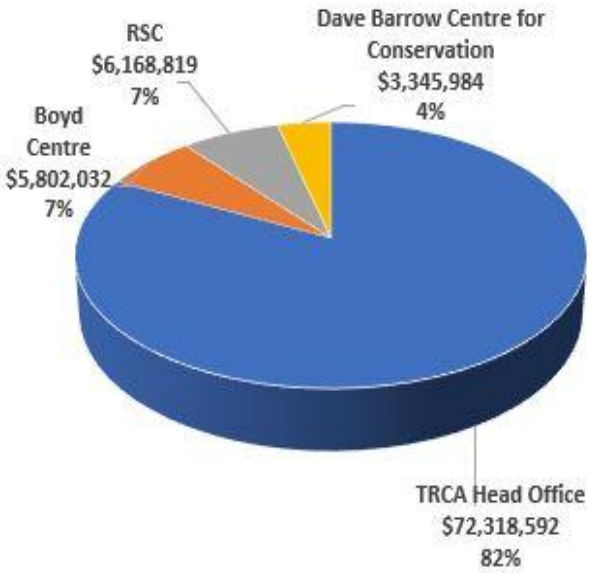
Figure 9.3 – TRCA Administrative Buildings condition

More broadly, based on the current asset data excluding the New Head Office and Eastville building, the portfolio is considered to be in **Good** condition.

Total Asset Replacement Value:	**$ 87,635,430**
Current Condition:	Good
Future Condition Trend (next 10 years):	increasing
Asset Management Policy:	Create complete communities that integrate nature and the built environment the Toronto region's economy.
Assets Included in this Category:	New TRCA Head Office, Boyd Centre, Restoration Services Centre and Dave Barrow Centre for Conservation
Data Confidence and Reliability:	Condition Based: Medium

The condition grades assigned to each building pertains to the building as a whole 93 percent (based on replacement values) of the TRCA's administration buildings are rated to be Very Good and Good. Based on the current asset data, the portfolio is considered to be in 'Good' condition.

REPLACEMENT VALUE BY ASSET TYPES



CONDITION OF ADMINSTRATION BUILDING ASSETS

9.5 Level of Service

Level of Service (LOS) performance measures are related to cost efficiency, safety, accessibility/ legislative, comfort, and sustainability.

Legislatively, TRCA's Administration Buildings are expected to comply with various codes and acts such as:

- Ontario Building Code
- Ontario Fire Code
- Accessibility for Ontarians with Disability Act
- Occupational Health and Safety Act

9.5.1 Customer LOS

Administration Buildings are primarily utilized by TRCA's staff, some of whom provide public facing services. Hence, the Customer Levels of Service for these assets would be the maintenance of these assets to an appropriate standard to provide a safe, secure, and functional environment for TRCA's staff and members of the public.

TRCA's LOS measures are outlined in table 9.4 below.

Table 9.5 - Customer LOS

Asset Class	LOS Objective	Value	Measure	Performance	Target
Facilities	Investing in existing infrastructure to provide safe, accessible, and functional facilities to the public.	**Quality**	Providing facilities in acceptable condition in fair or better condition	100%	
		Environmental Stewardship	Sustainability; Minimize energy usage and costs. Providing facilities that are environmentally conscious	3 Buildings	
		Safety	Annual Inspection of Fire System	100%	
		SOGR project	% of completed construction projects which meet total budget and cost	100%	

	**Positive Upward**		**Positive Downward**		**No Change**

9.5.2 Technical LOS

The technical LOS defines the technical requirements needed to achieve the level of service objectives through the use of quantifiable metrics and technical expertise.

One such indicator of the Technical LOS is the Facility Condition Index (FCI), which is the percentage of deferred maintenance of the overall replacement cost of the asset. TRCA aims to maintain its Administration building within Good to Fair rating.

Based on current information, Administration Buildings are generally in good condition; however, as they age there would be an expected deterioration in the FCI level necessitating expensive rehabilitation.

Table 9.6 - Technical LOS

Asset Class	LOS Objective	Values	Measure	Performance	Target
Facilities	Investing in existing infrastructure to provide safe, accessible, and functional facilities to the public.	**Quality**	FCI of facilities	2.37 %	
		Environmental Stewardship	Annual electricity consumption per kWh	106.26	
			Annual natural gas consumption per m^3	3.25	
			Annual water consumption per m^3	0.19	
			Annual propane consumption per square meter (L/sq.m)	0.085	
		Safety	Perform Annual Inspection and Certification as per Building code	100%	
		SOGR project	% of completed construction projects delivered on schedule	95%	

	**Positive Upward**		**Positive Downward**		**No Change**

External trends and issues that could affect TRCA's ability to meet defined levels of service include:

- Infrastructure is failing prematurely due to environmental factors and/or construction practices.
- Availability of external funding (such as federal, provincial, and municipal infrastructure programs)
- Potential changes in federal or provincial legislation that must be incorporated as part of ongoing service delivery.

9.6 Asset Management Strategy

In addition to the annual Facilities Condition Index (FCI) update, TRCA aims to conduct comprehensive building condition assessments (BCA) to better understand the condition of all building systems and their components on a 5-year rolling schedule. Preventative maintenance activities by staff are carried out to ensure assets are well maintained and performing to targets.

These strategies utilize a combination of lifecycle activities for buildings such as maintenance, renewal/rehabilitation, replacement and decommissioning or disposal.

Outside of the legislated requirements, most lifecycle activities are funding dependent with critical projects such as health and safety, mitigating high consequence of failure, etc. taking precedence over preventative projects such as cosmetic upgrades.

9.7 Financial Strategy

Table 9.7 below outlines the long-term year-over-year financial expenditure outlook for the Administration Building portfolio. The financial figures for the three Administrative Buildings (Boyd, Restoration Services and Dave Barrow Centre for Conservation for Conservation) excludes the New Head Office building given that it is currently under construction and Eastville.

Table 9.7 - The long-term financial outlook for Admin buildings

Location	Backlog to 2024	Future Years (2025-2034)	Total	AARI
Boyd Center	$246,625	$1,614,585	$1,861,210	$186,121
Restoration Services	$37,500	$1,473,105	$1,510,604.96	$151,061
Dave Barrow Centre for Conservation	$71,040	$925,086	$996,126	$99,613
Total	**$355,165**	**$4,012,776**	**$4,367,942**	**$436,795**

Cumulatively, the average annual required investment (AARI) of $436,795 is in line with the estimated budget of $500,000 allocated to the Administrative Facilities. However, the actual annual expenditures would vary by year depending on the planned projects. Figure 9.4 provides a visual breakdown of the expenditures by year against the allotted annual budget.

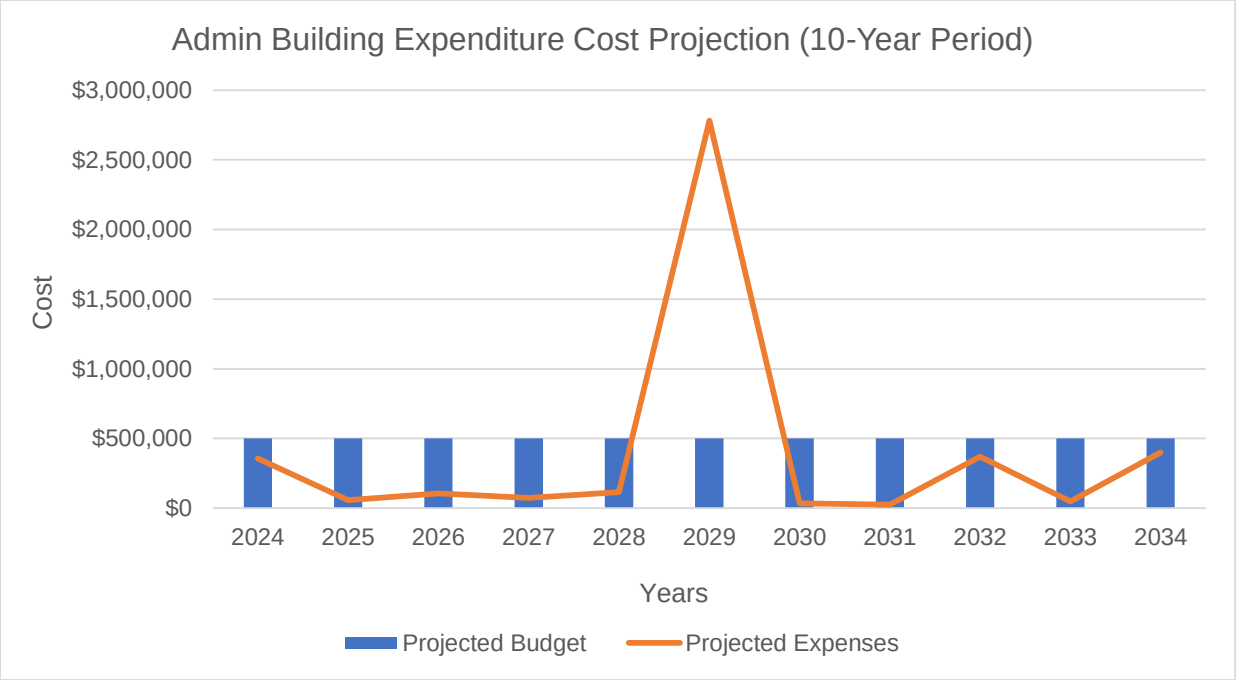


Figure 9.4 - Admin Building Expenditure Cost Projection

Based on the above figure, it is evident that a funding shortfall will occur in the year 2029. This could lead to a significant deterioration in the condition of the Administrative Buildings. If not planned effectively the deterioration can lead to significant negative impacts on the expected service levels of these assets.

A combination of the below mitigation measures can be used to ensure that the condition of the Administration Buildings portfolio remains within the target range of Good – Fair.

- Undertake certain capital projects, based on criticality, prior to 2029 to take advantage of the budget surplus.
- Alternatively, support the capital reserves from the surplus budget in anticipation of the funding shortfall in 2029.
- A combination of the above measures to align the budget to the expected annual expenditure, via long term capital planning, to avoid large funding gaps/surpluses year after year.

9.10 Sustainability

TRCA is actively committed to the pursuit of construction excellence while balancing sustainability and environmental stewardship.

The new TRCA Head Office building is a project that will set a benchmark for sustainable design in commercial buildings. Construction of the 8,100 square meter, four-story office building with a mass timber structural system will meet a number of environmental standards, including the Toronto Green Standard Tier II (v3) certification, the Leadership in Energy and Environmental Design (LEED) Platinum certification and the WELL Silver certification (v2).

The project also achieved the Canada Green Building's Council's Zero Carbon Design Designation in

October 2023 and was also awarded the 2023 Ontario Embodied Carbon Award for new construction via the Carbon Leadership Forum.

The RSC has many sustainability features incorporated as it was designed to be a showcase for sustainable building design. It has LEED Platinum Certification.

Residential Buildings

SECTION 10: BUILDINGS - RESIDENTIAL

Introduction

TRCA's approximately fifty (50) residential properties are located at various areas within its jurisdiction, including as far north-east as the Township of Uxbridge; bordering the City of Toronto; and as far north-west as the Town of Caledon.

State of TRCA's Residential Assets

TRCA acquired its first residential property in approximately 1969, and leasing began shortly thereafter. Over more than 50 years, TRCA acquired greenspace lands with residential building structures situated on the properties that were tenanted during acquisition or subsequently leased to tenants in an effort to generate revenue and offset the maintenance and capital costs associated with state-of-good repair. While the cost-benefit analysis historically worked-out favorably for TRCA, the results of comprehensive residential building condition assessments suggest nearly **56 % of the residential building portfolio is in Fair to Good condition.**

10.1 Asset Inventory

The York Region has the largest concentration of TRCA's Residential Buildings followed by Peel, Durham, and Toronto. The Residential Buildings portfolio is outlined in the table below based on each jurisdiction.

Table 10.1 - Residential Building Inventory

Jurisdiction	Asset Count	Percentage of Portfolio
Durham	10	20%
Peel	15	30%
Toronto	5	10%
York	20	40%
Total	**50**	**100%**

It is important to note that the above inventory is inclusive of 1 building that is out of service, however it is yet to be demolished or decommissioned.

10.2 Asset Valuation

The Current Replacement Value (CRV) is used to calculate the replacement cost for each of the residential buildings. CRV rates are based on constructing a replacement building of similar size, type, and construction and do not include land value.

The CRV of TRCA's Residential Buildings Portfolio has been calculated using the Residential Construction indices from Statistics Canada as an escalation factor. Based on the available CRV data from Q3 2021, the replacement costs of the buildings have been escalated by a factor of 38.1% as of Q4 2023.

Table 10.2 - Residential Building – Replacement Cost

Jurisdiction	Asset Count	2023 Replacement Value ($)
Durham	10	$6,109,986
Peel	15	$11,338,361
Toronto	5	$1,776,094
York	20	$14,136,433
Total	**50**	**$33,360,876**

As outlined in Table 10.2, assets in York and Peel make up approximately 75% of TRCA's residential portfolio valuation at $14.13 million and $11.34 million, respectively.

The value of residential assets is heavily dependent on the market conditions and is much more responsive to the changes in interest rates as compared to other asset types. It is important to review the valuation of this asset class on a frequent basis to ensure the mitigation of insurance risks to the portfolio.

Table 10.3 - Residential Building Replacement Valuation

Service	Asset	Inventory	Unit	Replacement Value
Residential 	Residential Buildings	50	Each	$33,360,876.86
TOTAL				**$33,360,876.86**

10.3 Asset Age Summary

The average age of the assets within the Residential portfolio is approximately 68.5 years. From a jurisdictional perspective, on average, Durham Region has the oldest buildings and York Region has the newest buildings. Table 10.4 provides a summary of the average age of the residential assets.

Table 10.4 - Residential Building Inventory

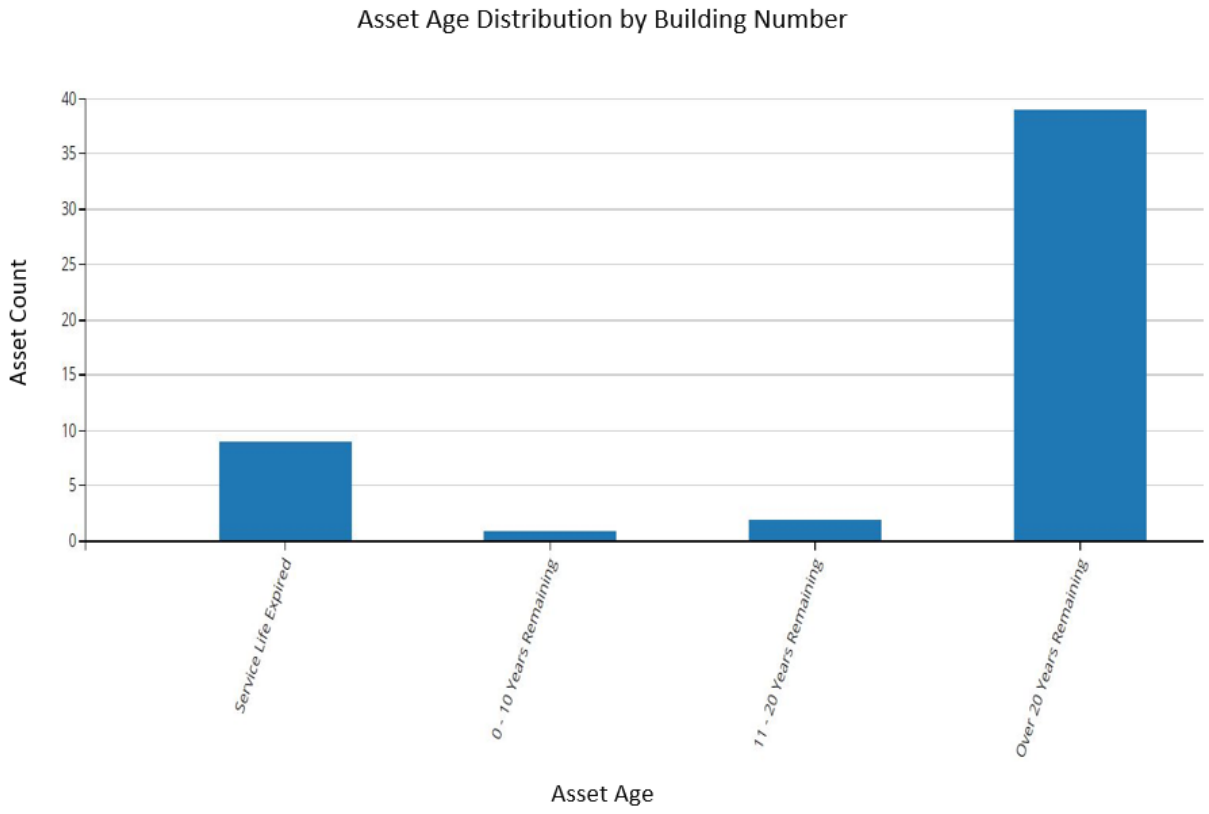
Jurisdiction	Average Age (Years)
Durham	79

Jurisdiction	Average Age (Years)
Peel	72
Toronto	69
York	61
Portfolio Average	**68**

In addition, using Building Condition Assessments, the Estimated Service Life (ESL) for Residential Buildings is used in order to benchmark against industry standard as well as determine a suitable asset management plan to maintain or improve the current conditions of these assets.

As shown in Figure 10.1, approximately 20% of the Residential Buildings are past or close to past their expected useful life while 80% of the portfolio has between 11 to over 20 years of useful life remaining.

Figure 10.1 - Estimated Service Life (ESL) for Residential buildings



10.4 Asset Condition

The Residential Buildings are maintained through condition assessments carried out by qualified assessors. A comprehensive condition assessment of the Residential Portfolio was completed in late 2021. A five-point Facility Condition Index (FCI) rating was used to assign an overall condition to each asset. The FCI Ratio is a combined maintenance costs and/or capital repairs over a three-year period (deferred maintenance), divided by the Current Replacement Value. The Ratio illustrates the global state

or condition of each asset at the time of inspection. Higher values represent increasingly degraded overall building conditions and as a result greater capital budget requirements to maintain each asset.

The breakdown of TRCA's Residential Portfolio by jurisdiction in reference to the FCI rating scale is shown in Table 10.5

Table 10.5 – Portfolio Condition by Jurisdiction

Jurisdiction	Condition Rating	Asset Count	Average of FCI Ratio
Durham	Fair	4	8%
	Good	2	3%
	Poor	4	13%
Peel	Fair	5	8%
	Good	3	4%
	Poor	7	15%
Toronto	Fair	3	8%
	Good	1	5%
	Poor	1	20%
York	Fair	3	7%
	Good	7	3%
	Poor	10	16%
Total		**50**	**100%**

56% of the assets are in **Fair to Good** condition indicating that they are meeting current requirements, but many are starting to show signs of deterioration with 44% of them in **Poor** to **Very Poor** condition, indicating significant investment will be required to maintain these assets at an acceptable level.

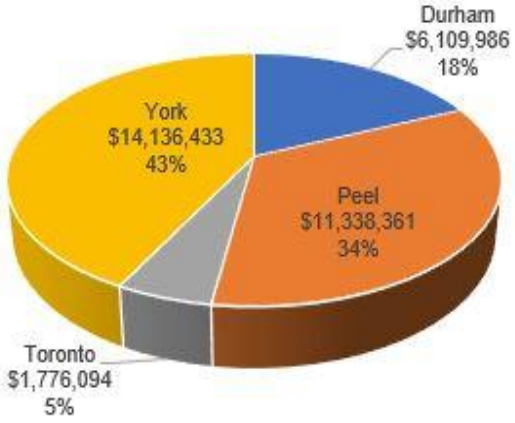
Without near-term investment, buildings with a poor rating, already near or at obsolescence, will quickly descend into the Very Poor category where safe occupation is no longer guaranteed. In other words, major elements and structures of these buildings are no longer functioning as designed. Having reached their life expectancy, major renovations, replacements, or demolition are required in the near term.

The overall current FCI rating for residential buildings is 10%. However, the overall FCI Rating over the next 10 years is expected to rise. High FCI ratings have a strong near-term level of service impact. Generally, large deferred maintenance amount correspond to worsening overall FCI Ratings, resulting in business case evaluations that likely to lead to removal from service or liquidation decisions.

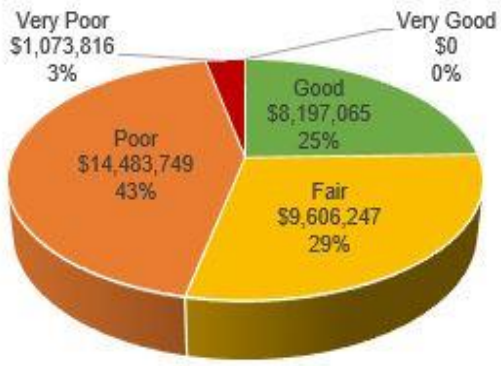
Total Asset Replacement Value:	**$ 33,360,876.86**
Current Condition:	Fair
Future Condition Trend (Next 10 years):	Decreasing
Asset Management Policy:	Create complete communities that integrate nature and the built environment into the Toronto region's economy.
Assets Included in this Category:	50 Residential Buildings
Data Confidence and Reliability:	Condition Based: Medium

FCI Ratios is largely attributable to early building construction dates (1906). Although several residential buildings exceed 100-years of age, the median construction date for the buildings in the residential portfolio is with an average age of 66 years. Fifty-four percent of residential buildings is rated fair or better.

REPLACEMENT VALUE



CONDITION OF RESIDENTIAL BUILDING ASSETS



10.5 Levels of Service

Residential building service levels, more generally – inhabitability, are assessed in a qualitative and quantitative manner. While qualitative results are based upon subjective observations, quantitatively LOS are evaluated through completed building condition assessments that produce a general state of good repair analysis. This approach is balanced against the TRCA's strategic livability and sustainability objective, which promotes reduced environmental impact and increase assets resilience.

The Legislative Levels of Service impacting TRCA's Residential Buildings is outlined below:

- **O. Reg. 517/06: Maintenance Standards**
    - Mandates the standard to which facilities are maintained i.e., the minimum condition
- **Residential Tenancies Act 2006**
    - Outlines roles and responsibilities of landlords and tenants, balance the rights and responsibilities of residential landlords and tenants, and provides for the adjudication of disputes and for other processes to informally resolve disputes.
- **Building code**
    - The Building Code Act is an Ontario regulation that describes the requirements for built facilities.

Table 10.6 – Customer Level of Services – Residential Buildings

Areas Classes	Corporate LOS Description	Values	Customer LOS Measure	Customer LOS Performance	Target
Facilities	Investing in existing infrastructure to provide safe, accessible, and functional facilities to the public.	**Quality**	Providing facilities in acceptable condition in fair or better condition	54%	
		Customer Service	% of Response times to On-Demand Requests for Facilities Maintenance	100%	

Table 10.7 – Technical Level of Services – Residential Buildings

Areas Classes	Corporate LOS Description	Values	Technical LOS Measure	Technical LOS Performance	Target
Facilities	Investing in existing infrastructure to provide safe, accessible, and functional facilities to the public.	**Quality**	FCI of facilities	9.84%	
		Customer Service	% of all demand maintenance work orders completed within standard (30 days)	100%	

	Positive Upward		Positive Downward		No Change

Provided the existing residential buildings continue to age as projected, and documented in building condition assessments, established levels of service provided currently to residential tenants is likely to continue. Strategic service level attributes are regularly reviewed, monitored, and maintained by TRCA maintenance personnel in a collaborative manner with customers. Still, the greatest impact to strategic service level attributes in the medium term is the financial viability of the residential building portfolio.

10.6 Asset Management Strategy

Table 10.8 below highlights five inter-connected elements that impact the Asset Management Strategy for the Residentail assets. Each section illuminates qualatative customer service desires while simultaneously guiding the applicant through a quantatitive analysis. Understanding customer needs, for instance, may lead to specific financially feasible building enhancements that impact service levels, building performance and ultimately measureable deliverables. Effective service level measurements contemplate service level developments, along with customer desires and expectations, and resource constraints.

Table 10.8 – Elements that impact Asset Management Strategy

Understand Customer Needs	Basic Maintenance Requirements What do Customers Value
Service Level Development	Expand, Maintain or Reduce Services to Tactical Considerations
Performance Measures	Create and Track Strategic Metrics Devise GAP Analysis
Customer Consultation	Bridge Expectation-Outcome Gap(s) Service Level Review

Understand Customer Needs	Basic Maintenance Requirements What do Customers Value
Deliver / Adjust Outcomes	Communicate Service Level Changes Communicate Deliverable Gaps

Utilizing a mix of the factors outlined in Table 10.8, lifecycle activities for the Residential Building Portfolio primarily includes the following:

Maintenance Activities

Including regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected breakdown events:

- Completing planned maintenance activities while managing the need to execute reactive maintenance activities.
- Have enough resources available to complete a series of unplanned, required urgent work requests that are submitted:
- Level 1 (Emergency): within 1 day (ex. Plumbing leak, no hydro, roof leak, no water etc.)
- Level 2 (Urgent Service): within 1-3 days (ex. Broken windows/doors, pest control, appliance repair etc.)
- Level 3 (Necessary Service): within 3-5 days (ex, filter change, electrical switches, fixtures)

Renewal/Rehab Activities

Significant repairs are designed to extend the life of the asset. Residential buildings are regularly evaluated through comprehensive condition assessments, which establish and update an industry-standard Facility Condition Index (FCI) score that accurately reflects the overall condition of each facility (divided into components of building envelope, mechanical and electrical systems, etc.). These condition assessments are used to determine the cost and timing of renewal requirements.

Disposal Activities

Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer required by TRCA or municipality. Appropriate and proper disposal occurs when assets are replaced or renewed. In 2023 two of the residential buildings are out of service, one of them is demolished and the other is out of use as it is not functioning as intended.

Service Improvement Activities

Planned activities to improve an asset's capacity, quality, and system reliability. Consultation with tenants and residential building end-users determines future service improvement needs.

10.7 Financial Strategy

As of 2023, the deferred maintenance for the portfolio stands at approximately $3.096 million. Furthermore, over the past three years (2021 -2023), on average, 38% of the nearly $900,000 in gross revenues was spent on preventative maintenance and lifecycle capital repairs.

Considering the quantum of deferred maintenance as well as the age of the buildings it is expected that the future repair cost trajectory will climb significantly on a year-over-year basis. This will have a direct impact on the expected service levels.

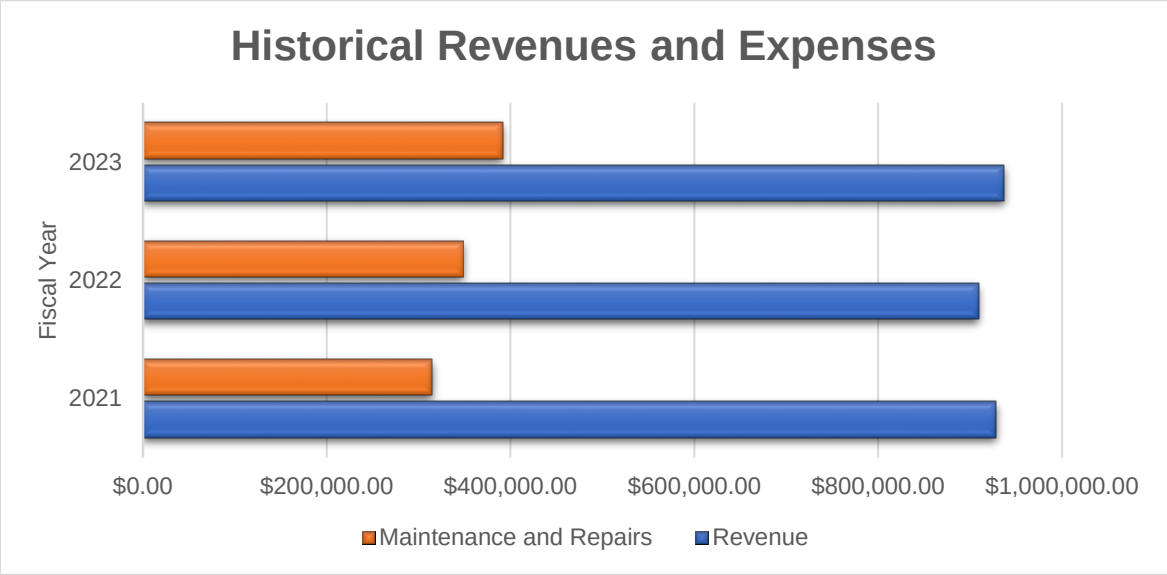


Figure 10.3 Historical Revenue and Expenses

The total maintenance expenditure from 2024 – 2034 is estimated to be $ 9.15 million. Since expenses are not uniform across all years, continuing to fund maintenance from annual aggregate building revenues ensures adequate cashflow for all repairs through annual budget plans. However, the building portfolio would likely experience intermittent budgetary challenges, based on revenue, in at least four of the next ten years.

Table 10.9 – Annual Capital requirement by Jurisdiction.

Fiscal Year	Durham	Peel	Toronto	York	Total
2024	$ 97,243	$ 156,850	$ 24,553	$ 234,009	**$ 512,655**
2025	$ 137,425	$ 164,027	$ 20,145	$ 536,614	**$ 858,211**
2026	$ 330,143	$ 558,453	$ 110,652	$ 747,853	**$ 1,747,101**
2027	$ 77,119	$ 192,627	$ 22,150	$ 251,537	**$ 543,433**

Fiscal Year	Durham	Peel	Toronto	York	Total
2028	$ 77,501	$ 328,373	$ 35,661	$ 384,303	**$ 825,838**
2029	$ 107,341	$ 225,831	$ 23,393	$ 266,386	**$ 622,951**
2030	$ 15,361	$ 212,003	$ 41,400	$ 228,675	**$ 497,439**
2031	$ 284,089	$ 668,104	$ 132,105	$ 1,011,238	**$ 2,095,536**
2032	$ 67,308	$ 257,824	$ 10,496	$ 282,386	**$ 618,014**
2033	$ 63,479	$ 209,332	$ 34,026	$ 263,833	**$ 570,670**
2034	$ 25,780	$ 65,410	$ 17,920	$ 151,913	**$ 261,023**
Total	**$ 1,282,789**	**$ 3,038,834**	**$ 472,501**	**$ 4,358,747**	**$ 9,152,871**

As shown in Figure 10.4, the long-term (2024-2034) year-over-year financial outlook for the residential building portfolio appears more challenging. The following chart indicates that maintenance and capital repair costs in 2026 and 2031 exceed gross revenues for those years.

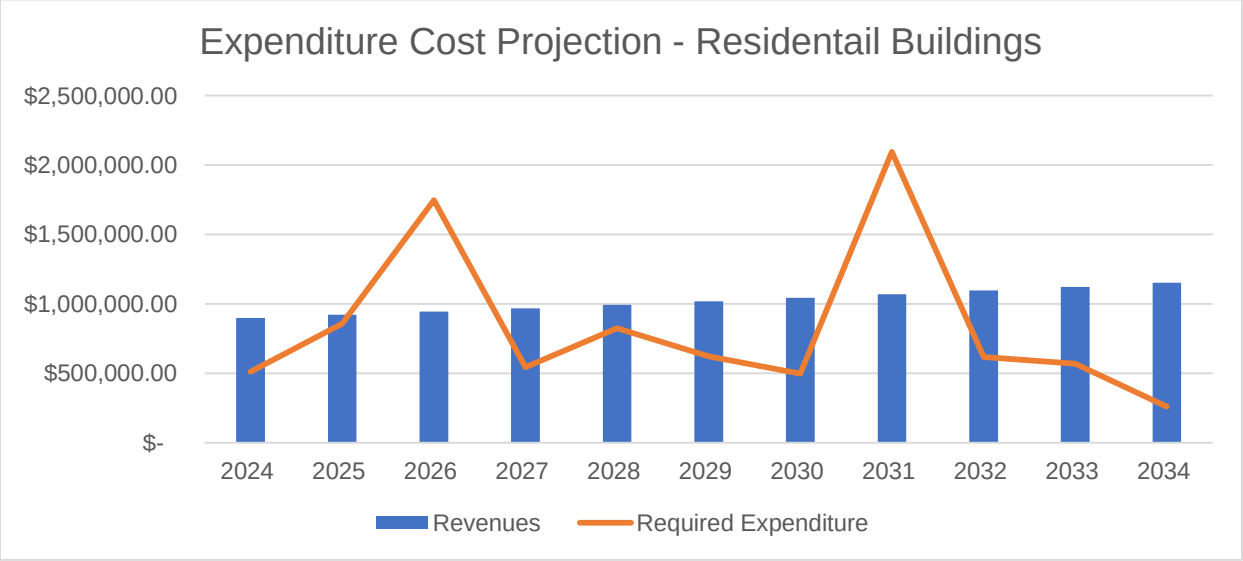


Figure 10.4 - Residential Building Expenditure Cost Projection

Over the period of 2024 – 2034, assuming the actual spend on repairs and maintenance remains constant at 38% of gross revenues with an 2.5% annual escalation, the total expenditure incurred would be approximately $4.37 million. In comparison, the required spending over the same period would be approximately $9.15 million. The deferred maintenance that currently stands at $3.06 million would increase by 56% to $4.78 million.

As a result, the existing stock of residential buildings may diminish over time particularly when resources are not applied judiciously to state of good repair maintenance across the entire portfolio. This in turn leads to revenue pressures on the portfolio which assumes the current revenues of approximately $900,000 escalated at a conservative 2.5% annually over the period of 2024 – 2034.

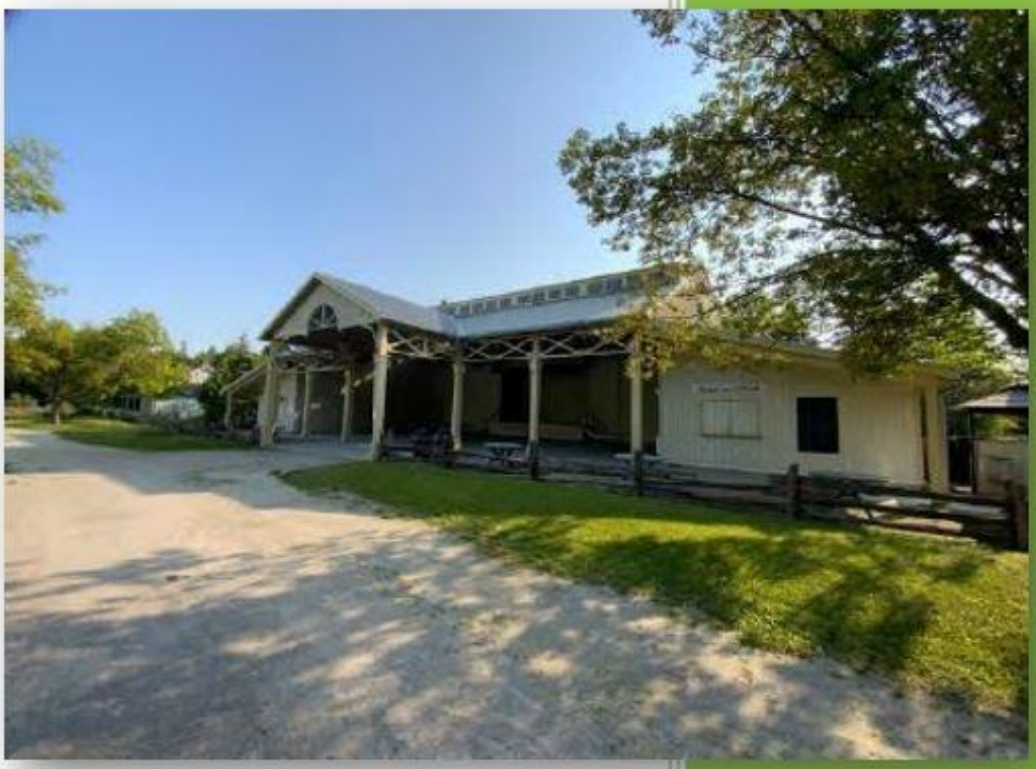
A generally accepted or best practice funding gap standard for either municipal or residential buildings remains largely unestablished. While most municipal funding is linked to local levies, non-municipal

entities who manage building assets for which municipal funding is unavailable often depend entirely upon end-user revenue to maintain existing service levels.

In the absence of periodic funding injections, a combination of the below mitigation measures can be used to ensure that the condition of the Residential Buildings portfolio remains within the target range of Fair.

- Undertake certain capital projects, based on criticality, prior to 2026 and 2031 to take advantage of the revenue surpluses in preceding years.
- Increase the percentage of spent on capital repairs and maintenance as a function of the annual revenues. Currently at 38%.
- Alternatively, support the capital reserves from the surplus budget in anticipation of revenue shortfalls.
- Undertake a holistic portfolio analysis to divest certain Residential assets via a phased approach to provide timely cash injections that can be invested back to minimize deferred maintenance and/or reduce the capital repair liabilities.

Parks Facilities



SECTION 11: BUILDINGS - PARKS FACILITIES

Introduction

TRCA's Park Facilities included in this AMP are located within 13 TRCA owned Conservation Parks that span over 3,209 hectares. They play an important role in contributing to healthier and greener communities, part of the outcomes achieved by actioning TRCA's Strategic Plan.

Park amenities include, but are not limited to, a network of trails and pathways, gardens and natural areas, a variety of sports fields and playground equipment, entertainment venues, pools, public facilities, and washrooms. Our investment in these assets helps to build community capacity, improve health and physical activity levels, and enhance the overall quality of life for watershed residents and visitors.

This section includes the Parks Facilities located across TRCA's jurisdiction with a specific focus on public-facing building assets.

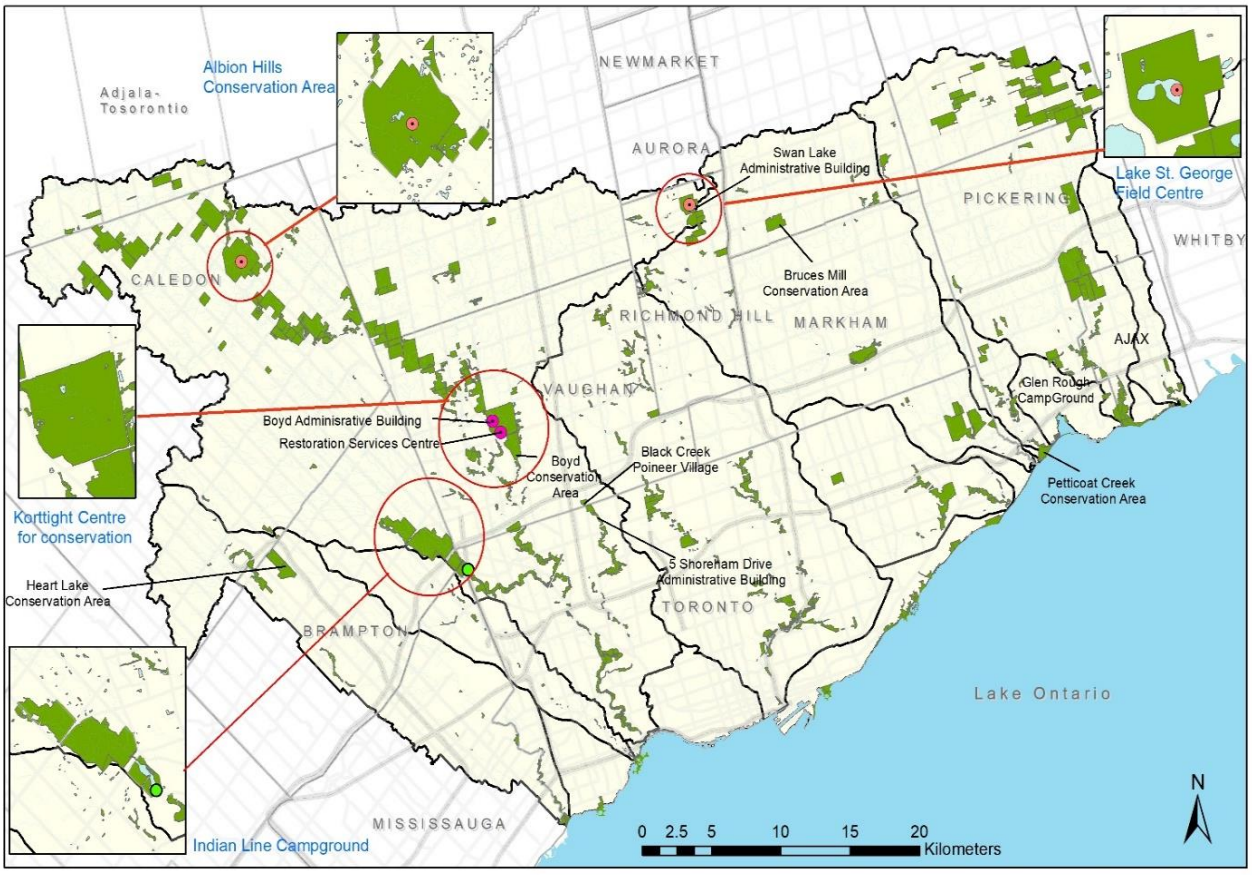


Figure 11.1 - Parks Facilities located across TRCA jurisdiction.

State of TRCA's Public Facing Parks Assets

11.1 Asset Data Inventory

TRCA Parks Facilities included in this AMP are permanent structures located throughout TRCA's Conservation Parks, and Campgrounds. The Park Facilities category includes Administration Gates, Field Centres, Education Centres, Chalets, Pool Buildings and Splash Pads, Maintenance Workshops, Pumphouses, Washrooms, Comfort Stations, Barns, Picnic shelters and Sheds (miscellaneous structures).

The Park Facilities are located in the below Conservation Parks:

• Albion Hills Conservation Park • Kortright Centre for Conservation • Indian Line Campground • Heart Lake Conservation Park • Boyd Conservation Park • Village at Black Creek • Petticoat Creek Conservation Park	• Glen Haffy Conservation Park • Claireville Conservation Area • Bruce's Mill Conservation Park • Claremont Nature Centre • Lake St. George Field Centre • Tommy Thompson Park

The asset data inventory for Parks Facilities is managed through an Enterprise Asset Management (EAM) database and in GIS databases. The data in the system was populated after the completion of third-party building condition assessment (BCA) reports in Q3 2021.

The make-up of the asset portfolio across 13 Conservation Parks spanning the entirety of TRCA's jurisdiction is outlined in Table 11.1

Table 11.1 - Parks Facilities – Asset Inventory across TRCA's jurisdiction

Jurisdiction	Park Name	Asset Count
Durham	Claremont Nature Centre	4
	Petticoat Creek Conservation Park	13
		17
Peel	Albion Hills Conservation Park	38
	Claireville Conservation Area	4
	Glen Haffy Conservation Park	17
	Heart Lake Conservation Park	19
	Indian Line Campground	7
		85
York	Boyd Conservation Park	17
	Bruce's Mill Conservation Park	12

Jurisdiction	Park Name	Asset Count
	Kortright Centre for Conservation	21
	Lake St. George Field Centre	10
		60
Toronto	Village at Black Creek not including the historical buildings	6
	Tommy Thompson Park	5
		11
Grand Total		**173**

11.2 Asset Valuation

The Current Replacement Value (CRV) rates are based on constructing a replacement building of similar size, type, and construction and do not include land value.

The CRV of TRCA's Parks Buildings Portfolio was identified at the completion of the BCAs commissioned in 2021. The valuation has been calculated using the Non-Residential Construction indices from Statistics Canada as an escalation factor. Based on the available CRV data from Q3 2021, the replacement costs of the buildings have been escalated by a factor of 24.9% as of Q4 2023.

Table 11.2 - Parks Facilities – Current Replacement Value

Region	Park Name	CRV
Durham	Claremont Nature Centre	$ 2,612,239.79
	Petticoat Creek Conservation Park	$ 2,476,883.16
		$ 5,089,122.94
Peel	Albion Hills Conservation Park	$ 25,102,168.84
	Claireville Conservation Area	$ 1,497,188.79
	Glen Haffy Conservation Park	$ 1,178,898.63
	Heart Lake Conservation Park	$ 2,602,928.49
	Indian Line Campground	$ 1,912,435.08
		$ 32,293,619.83
York	Boyd Conservation Park	$ 2,250,248.36
	Bruce's Mill Conservation Park	$ 4,705,323.98
	Kortright Centre for Conservation	$ 12,070,030.00
	Lake St. George Field Centre	$ 3,949,981.24

Region	Park Name	CRV
		$ 22,975,583.57
Toronto	Village at Black Creek	$ 14,846,863.00
	Tommy Thompson Park	$ 972,309.03
		$ 15,819,172.03
Grand Total		**$ 76,177,498.38**

11.3 Asset Age

As of the end of 2023, the average age of the Parks Facilities is approximately 36 years while the average expected useful life is approximately 49 years.

Table 11.3 – Parks Facilities – Average age by park

Park Name	Average of Current Age (Years)	Average of Estimated Useful Life (Years)	Average of Service Life Remaining (Years)
Albion Hills Conservation Park	36	42	6
Black Creek Pioneer Village	22	53	30
Boyd Conservation Park	36	44	7
Bruce's Mill Conservation Park	36	53	18
Claireville Conservation Area	38	64	26
Claremont Nature Centre	45	58	13
Glen Haffy Conservation Park	38	46	8
Heart Lake Conservation Park	27	42	14
Indian Line Campground	45	75	30
Kortright Centre for Conservation	33	49	16
Lake St. George Field Centre	66	63	- 3
Petticoat Creek Conservation Park	37	47	10
Tommy Thompson Park	13	53	40
Grand Total	**36**	**49**	**13**

A granular examination of the asset age highlights that approximately 24% of the assets within this portfolio are past their estimated useful life. Albion Hills Conservation Park has the largest concentration of these assets at 30%. As a percentage of the total assets by Park, Lake St. George has 40% of assets

that are past their expected useful life.

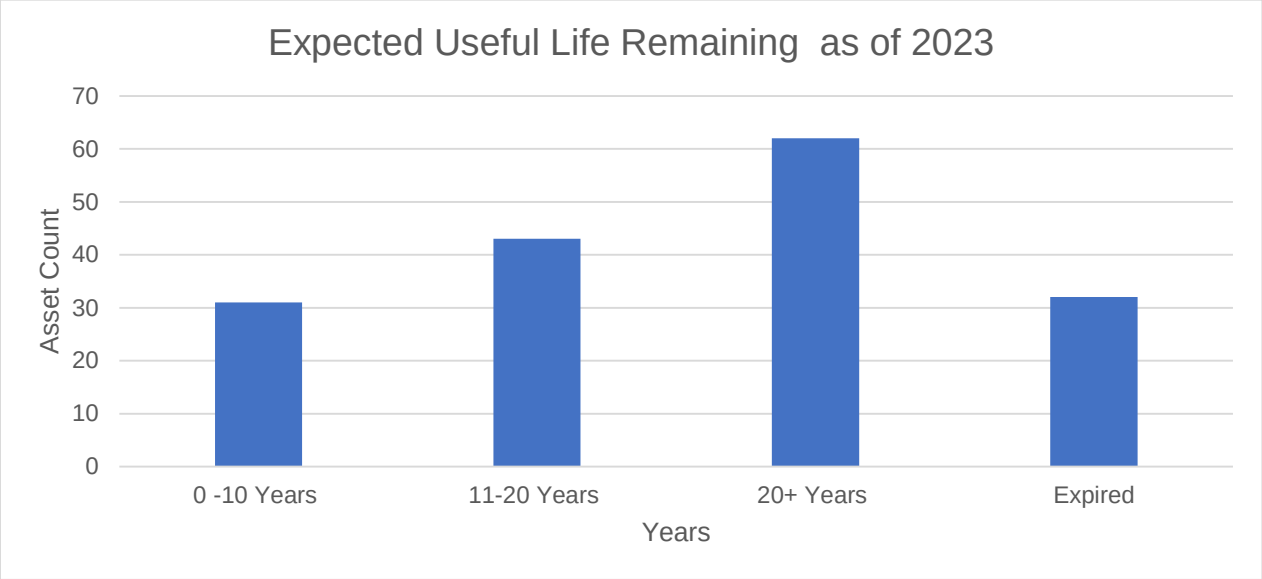


Figure 11.1 – Parks Facilities - Asset count by Expected Useful Life remaining

11.4 Asset Condition

Overall, the buildings within the Parks Facilities portfolio are in **Good to Fair Condition** based on the Facilities Condition Index (FCI) rating which is a ratio of deferred maintenance to current replacement value for an asset. This signifies that the assets and their components are functioning as intended with a normal rate of deterioration and minor distress is observed. It should be expected that the repair costs will increase steadily over the next 5 years due to continued wear and tear as a result of normal use.

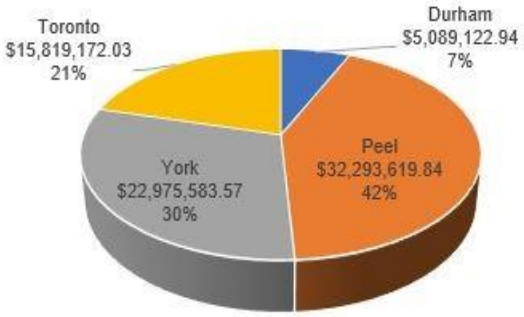
Table 11.4 - Parks Facilities Condition and associated Current Replacement Value

Asset Condition	Asset Count	Current Replacement Value
Very Good	4%	$ 6,229,847
Good	57%	$ 57,837,845
Fair	27%	$ 9,498,358
Poor	8%	$ 2,196,290
Very Poor	4%	$ 415,158
Grand Total	**100.00%**	**$ 76,177,498**

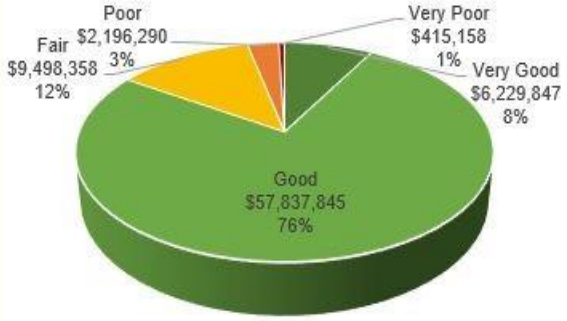
Total Asset Replacement Value:	$ 76,177,498.38
Current Condition:	Good
Future Condition Trend (Next 10 years):	
TRCA Strategic Plan:	"Healthy connected communities" and "Accessible nature".
Assets Included in this Category:	Field and Education Centre's, Chalets, Pool Buildings and Splash Pads, Workshops, Washrooms, Barns, Picnic Shelters, Sheds & Gate houses
Data Confidence and Reliability:	Condition Based: Medium

The total replacement value of TRCA Park Facilities is $76,177,498.38 million. The 84% of the assets are in Good to Very Good condition, and 12% are in Fair condition, with the remaining assets close to, or past, the end of Service Life. As the TRCAs Park Facilities assets are overall in Good condition, these assets are meeting current needs but aging and may require attention.

REPLACEMENT VALUE BY REGION



CONDITION OF PARK FACILITIES ASSETS



11.5 Level of Service

TRCA's strategic plan identified several objectives related to parks' facilities' levels of service. These objectives are to maintain, develop and upgrade parks facilities as community hubs, and to complete asset management and state of good repair assessments and improvements. Parks facilities' levels of service are influenced by many legislative and regulatory requirements such the Ontario Building Code and the Accessibility for Ontarians with Disabilities Act.

TRCA has developed its own set of unique level of service performance metrics that are used to reflect citizen values and needs. These metrics are classified below through service attributes (value) provided and summarize the type of service being provided to citizens and their wider communities.

11.5.1 Customer LOS

TRCA is developing a comprehensive desired LOS for its Parks facilities.

Based on current information, facilities and buildings generally range from "good" to "fair" condition; however, LOS can be impacted by external trends and building systems are influenced by legislative and regulatory requirements. As these changes occur, updates to the AMP will consider their impacts on LOS, which may also affect lifecycle strategies. Specific examples include:

- Future facility expansions and conversions that respond to future trends;
- Compliance with the Ontario Building Code (OBC);
- Conformity to the Accessibility for Ontarians with Disabilities Act (AODA);
- The Occupier's Liability Act requirements;
- Consideration of green building designs integrating energy and water conservation measures;
- Fire and Life Safety issues will be addressed immediately upon notification of the concern;
- Creative partnership opportunities in their construction and/or operation

From an asset management perspective, continuous monitoring of facility usage would allow for a better understanding of the needs of the community and the intended use of the facilities. This will be accomplished by tracking the use and availability metrics which would serve as an indicator to confirm that the asset service and maintenance are aligned to usage. Table 11.3 summarizes information on customer and technical measures for levels of service that relate to the operation, maintenance, and renewal of assets for the sustainment of Parks Facilities' current LOS.

Table 11.3 – Parks Facilities - Customer Levels of Service

Asset Class	Customer LOS Objective	Value	Customer LOS Measure	Customer LOS Performance	Target
Facilities	Connect communities to nature and greenspace. TRCA ensures that the public has access to accessible outdoor recreation and programming.	**Quality**	Providing facilities in in Fair or better condition	84%	⇔
		Customer Service	% of Response times to On-Demand Requests for Facilities Maintenance	100%	↑
		Environmental Stewardship	Minimize energy usage and costs. Providing facilities that are environmentally conscious.	13 CA	↑
↑	**Positive Upward**	↓	**Positive Downward**	⇔	**No Change**

11.5.2 Technical LOS

The technical LOS defines the technical requirements needed to achieve the level of service objectives through the use of quantifiable metrics and technical expertise. O. Reg. 588/17 also requires legislated technical levels of service for assets. Technical levels of service use metrics to measure the scope or quality of service being delivered by an asset. Legislation and regulations set standards, many relating to safety and reliability, which TRCA is legally obligated to meet and keeps information on regulatory inspections and compliance. Typically, the details are maintained at the operational level and confirmation of compliance is reported at a higher level.

Table 11.4 – Parks Facilities - Technical Levels of Service

Asset Class	Technical LOS Description	Value	Technical LOS Description	Technical LOS Performance	Target
Facilities	Connect communities to nature and greenspace. TRCA ensures that the public has access to accessible outdoor recreation and programming	**Quality**	FCI of facilities	21.41%	↓
		Customer Service	% of all demand maintenance work orders completed within standard (30 days)	95%	↑
		Environmental Stewardship	Annual electricity consumption (kWh)	3,595,417	↓
			Annual natural gas consumption (m3)	116,649	↓
			Annual water consumption (m3)	61,288	↓
			Annual propane consumption (Liters)	70,129	↓

↑	Positive Upward	↓	Positive Downward	↔	No Change

11.6 Asset Management Strategy

11.6.1 Lifecycle Management Strategy

This section focuses on specific activities to maintain the levels of service previously outlined. TRCA knowledge and understanding is continually improving through the collection and utilization of data that informs decision making related to asset lifecycle system and LOS performance metrics.

For Parks Facilities, risks relating to building infrastructure failure are mitigated through inspection and maintenance programs, which provide the necessary data to ensure that the work required to achieve the established LOS is identified. Renewal of assets is driven by BCAs, facility operator reviews on site,

planned site walk-through inspections, and input from the program department.

The development of appropriate and cost-effective strategies is foundational for ensuring service sustainability. Further, the lifecycle management activities reduce the risks to service delivery and performance. Some of the Parks Facility assets have a run-to-failure life cycle while others have a more complex approach to lifecycle which includes rehabilitation before a full reconstruction in order to sustain the asset to the end of its anticipated estimated service life.

11.6.2 Lifecycle Activities

Non-Infrastructure Solutions

- Encouragement of conservation of Parks Facilities and associated infrastructures assets through policy, procedures, public outreach, etc.
- Review the capital and operating costs and plans.
- Develop and maintain Parks and Facility Master Plans.

Maintenance Activities

- Maintenance is intended to prevent or mitigate the deterioration of performance of assets in service and manage risk of failures. Conducting routine and preventative maintenance activities contributes to ensuring preservation of existing assets; this includes inspections, testing, monitoring, and preventive maintenance regimes.
- A work order system and online interface exists for Parks TRCA employees to generate requests for Parks Facilities' maintenance and repairs.

Renewal/Rehab Activities

- Mid-life renewal of facilities and major overhauls and modernization of equipment to support department service.
- Changes to asset use and adjusting to changes in the number or type of customers and assets' Levels of Service.

Replacement Activities

- Demolition and replacement when the assets reach the end of useful life. As example, demolition of the existing maintenance shop building at Albion Hills Conservation Park and replacement with a newly constructed building.
- Coordinating multiple asset replacements through project bundling to reduce total costs where possible. For example, replacement of roof for the Chalet building and barn.
- Replacement may also be due to assets no longer meeting the service levels such as older windows at facilities that do not meet energy efficiency objectives with more energy efficient windows.

Expansion Activities

- Future facility upgrades and service enhancement based on demand and expected level of service.

Disposal Activities

- Decommissioning of abandoned or unused assets , some assets results in substantial cost at their end of life which may include demolition costs and land restoration costs and should be included in the total lifecycle costs of assets.
- A key aspect at this stage is how the financial, environmental, and social costs can be minimized during the disposal of an asset.

11.7 Current and Future Risks

Through workshops with Conservation Parks & Lands staff, asset types were placed into a framework based on the range of severity of the consequence of failure according to three types of impacts: social, environmental, and financial.

For this iteration of the asset management plan, risk was considered in terms of the impacts of asset failure that we recognize currently or have observed previously primarily related to the asset system or component failures due to age and lack of maintenance. Nevertheless, it is important to consider impacts from other risks in the future such as those from climate change.

We anticipate that climate change will impact our Parks Facilities assets in a variety of ways including increased demands for park use as a result of an increase in moderate temperatures throughout the year, and frequency or duration of extreme heat events that will place increased demand and reliance on parks for shade and cooling, and increased park closures or repairs as a result of an increase in extreme rainfall, wind, or winter events.

11.8 Financial Strategy

The Parks Building Facilities budget is guided by TRCA budget principles and involves the operation budget and capital budget.

The annual capital budget allocates funds each year for new assets, or rehabilitation and replacement of existing assets, and is funded primarily from municipal levy. The capital budget is used to plan and fund large expenditures including the construction of infrastructure assets with long life spans.

Primarily, the annual capital funds that are allocated for parks assets will include parks building facilities and parks linear infrastructure. Forecasted annual funds are identified in Table 11.5:

Table 11.5 – Parks Facilities - Forecasted annual capital funds

Regions and Municipalities	Forecasted funds
Peel	$ 1,649,000
Toronto	$ 371,000

The annual operating budget for Parks is approximately $780,000. These funds are used to support the day-to-day activities for operations and maintenance of Parks Facilities.

The annual operating and maintenance budget is funded primarily from multiple regions and municipalities to support the operation and maintenance for Parks Facilities assets. The breakdown of operating funds by municipality is in Table 11.6:

Table 11.6 – Parks Facilities - Forecasted annual operating funds

Regions and Municipalities	Estimated funds
Toronto	64%
York	22%
Peel	11%
Durham	3%

As of 2023, the backlog of deferred maintenance across Parks Building Facilities was approximately $11.7 million. Furthermore, the Average Annual Required Investment (AARI) for the next 10 years is estimated to be $4.4 million. In comparison, the expected average annual forecasted revenues are expected to remain between $2.0 million to $2.3 million over the next decade.

Not accounting for any ad-hoc grant funding and considering the quantum of deferred maintenance as well as the age of the buildings, it is expected that the future repair cost trajectory will climb significantly on a year-over-year basis. This will have a direct impact on the expected service levels.

Since expenditures are not uniform across all years, the portfolio would likely experience intermittent budgetary challenges, based on revenue, in at least four of the next ten years.

Assuming the AARI of $4.4 million against a revenue of $2.0 million, each year the backlog due to funding shortfall would be approximately $2.4 million. The deferred maintenance that currently stands at $11.7 million would increase to $35.7 million.

A generally accepted or best practice funding gap standard for Parks buildings remains largely unestablished. As outlined in Tables 11.5 and 11.6 above, TRCA does benefit from municipal funding, however, it is often not sufficient for the upkeep of an ageing portfolio and it is not received in all municipalities, which limits where it can be applied. Given the limitations around municipal funding, TRCA may need to explore alternate revenue streams that are supplemental and recurring to the current sources of user-generated revenues.

In the absence of periodic funding injections, a combination of the below mitigation measures can be used to ensure that the condition of the Parks Buildings portfolio remains within the target range of Fair.

- Prepone or package certain capital projects, based on criticality, to take advantage of the revenue surpluses.
- Utilize Corporate Capital Reserves to draw down the State of Good Repairs (SOGR) backlog which is currently at $11.7 million. This can be done using a phased approach to allow the replenishment of capital reserves.
- Alternatively, draw from the Corporate Capital Reserves for years where funding pressures are expected. This would assist in mitigating the ballooning of the SOGR backlog.

TRCA's Parks Facilities are overall in Fair to Good condition, indicating that assets are functional but showing signs of deterioration. Maintaining current investment will result in an infrastructure gap of approximately $35.7 million over the next decade. Failure to address the infrastructure gap could result in localized reductions to service, such as visual signs of deterioration, potential closure of amenities, high maintenance costs, etc.

Fleet - Vehicles and Equipment

SECTION 12: FLEET – VEHICLES AND EQUIPMENT

Introduction

TRCA Corporate Fleet (Fleet) provides a range of services across all divisions which rely on fleet assets to facilitate program operations and complete identified deliverables. The composition of Fleet varies across Divisions that have high demand for vehicles and equipment. Fleet is generally comprised of Licensed Motor Vehicles, Highway Trailers, Off-Highway Equipment, Marine Vessels, and General Equipment.

Table 12.9 - A high-level overview of TRCA's Fleet asset inventory included within the scope of the AMP (as of Q4, 2023).

Fleet Type	Quantity	% Of Total Fleet
Agricultural Equipment	91	18
Construction Equipment	74	15
On-Highway Vehicles (Owned)	135	27
Highway Trailers	34	7
Off-Highway Equipment	51	8
Marine	38	8
Off-Road Vehicle	39	8
Snow and Ice Removal	41	8
TOTAL	**503**	**100%**

Fleet has several key responsibilities. Primarily it is to manage corporately owned vehicles and equipment, in addition staff administer contracted fleet services and manage the acquisition and disposition of approximately 40 short-term rental vehicles annually. These vehicles cumulatively travel approximately 1.5 million kilometers annually. Staff also administer driver and equipment operator training and competency.

Fleet assets are spread widely across TRCA Divisions. Projects and programs with high equipment and administrative-related demands receive dedicated ongoing fleet vehicle and equipment resource allocations. Conversely, short-term projects and programs with intermittent demand cycles receive access to pooled resource vehicles through an internal reservation-based system that requires users to preschedule vehicle use.

State of TRCA's Fleet Assets

12.1 Asset Inventory

TRCA Corporate Fleet consists of approximately 503 assets divided into nine (9) primary categories.

Each category is maintained as per Original Equipment Manufacturers (OEM) specifications, tracked, and replaced as needed at the end of lifecycle by Property & Asset Management(PAM). The PAM group also maintains a detailed inventory of every asset, ongoing condition development and changes, projected maintenance, and lifecycle replacement costs. The table below provides a breakdown of TRCA's Fleet inventory by primary work location(s).

Table 110.2 - Provides a breakdown of TRCA's Fleet inventory and assignment Divisionally.

Division	Agricultural Equipment	Construction Equipment	Highway Trailers	Marine	Off-Highway Equipment	Off-Road Vehicle	On-Highway Vehicle	Snow and Ice Removal
Conservation Parks and Lands	21	2	3	0	36	23	16	20
Corporate Services	0	0	0	0	0	0	9	0
Development and Engineering Services	0	0	7	22	2	1	13	0
Education and Training	4	0	4	7	6	2	9	8
Policy Planning	0	0	2	0	0	2	9	0
Legislative and Property Services	0	0	0	0	0	0	18	0
CEO's Office	0	0	0	0	0	0	1	0
Restoration and Infrastructure	66	72	18	10	7	11	71	11
TOTAL	**91**	**74**	**34**	**38**	**51**	**39**	**135**	**41**

12.2 Asset Valuation

Proactive fleet management strategies are designed to realize lifecycle extensions of many TRCA assets over several years. Described further in the Financial Strategy section below, the purpose of the strategy is to build up reserves, in addition to maximizing return-on-investment. In general, the methodology utilized to calculate replacement values uses a standard 3.0% annual inflation rate over and above historic capital value. The following chart provides an overview of the dollar value of total current (Q4, 2023) fleet assets.

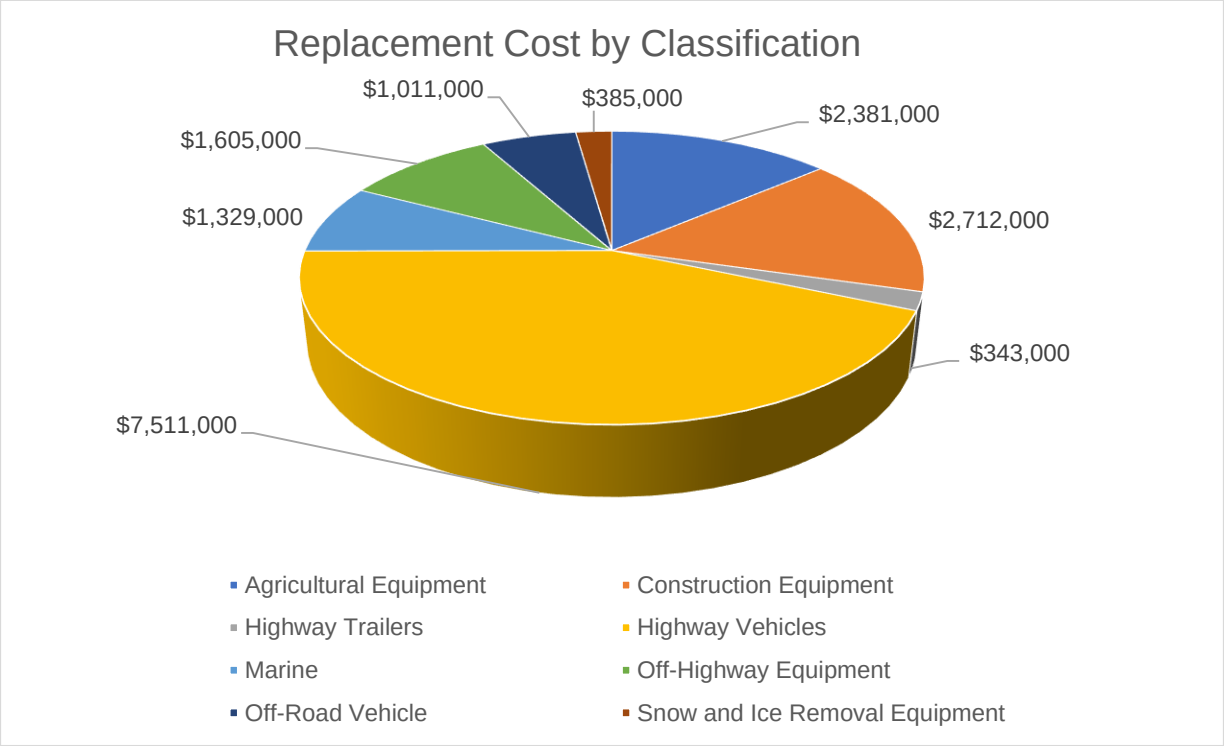


Figure 12.1 Provides a replacement value breakdown for the major fleet categories.

The replacement value of the existing Fleet is approximately $17,278,000 million. This value represents a realistic estimate of all TRCA fleet assets at the end of service life. Unless project or program deliverables change dramatically, lifecycle assets are replaced with similar vehicles and equipment.

The total replacement value of all primary asset categories within the corporate Fleet is shown in the table below.

Table 12.3 - Breaks down the replacement value of assets by Fleet type.

Fleet Type	Total
Agricultural Equipment	$ 2,381,000
Construction Equipment	$ 2,712,000
Highway Trailers	$ 343,000
Marine	$ 1,608,000
Off-Highway Equipment	$ 1,329,000
Off-Road Vehicle	$ 1,011,000
On-Highway Vehicle	$ 7,511,000
Snow and Ice Removal	$ 385,000
TOTAL	**$ 17,278,000**

Projected replacement costs are intended to establish the cost of future similar assets for budgeting purposes, replacement costs do not account for changes in asset type because of project and program growth, whereas changes to alternative fuel technologies i.e., Battery Electric Vehicle (BEV), and or adoption of Zero Emission Vehicle (ZEV) technology would be included in the projected replacement cost(s). Due to the recent increased costs of fleet assets seen across all manufacturing sectors which have outpaced inflation rates, replacement costs do not reflect current costs inclusive of current inflation, as its anticipated acquisition costs to return to near normal similar to that of historical inflation rates in future years.

To forecast capital funding requirements more accurately, where applicable, general aftermarket upfitting (vehicle customization for specific work-related requirements), such as truck bodies, lighting, van shelving etc., is included in the final purchase price to establish an overall replacement value for the asset. This replacement value is used to develop long-term funding needs.

12.3 Asset Useful Life

Optimal useful life of assets is established by vehicle and equipment manufacturers. Useful lifespan generally ranges between 8 – 15 years for On-Highway motor vehicles and between 10 – 50 years for assets in other primary categories.

However, several factors influence equipment and vehicle service life, such as work environment, terrain, vehicle load requirements, weather conditions, mileage accruals, and regular application of preventative maintenance. In general, TRCA regularly extends the service life of fleet assets beyond OEM expectations because they are used as intended and are well-maintained. The following table provides an overview of the expected service life for the five primary fleet categories.

Table 12.4 - Highlights the expected service life of Fleet assets by Fleet Type

Primary Fleet Type	Minimum (Years)	Maximum (Years)
Agricultural Equipment	12	15
Construction Equipment	15	50
Highway Trailers	10	15
Marine	10	25
Monitoring Equipment	10	15
Off-Highway Equipment	10	15
Off-Road Vehicle	10	15
On-Highway Vehicle	8	15
Snow and Ice Removal	10	15

While TRCA extends the useful service life of many assets, on average, lifecycle processes for most fleet assets are initiated with 25% residual service-life. That is, new vehicle and equipment acquisitions, and

eventual dispositions, begin at this stage to ensure new assets are operational when service life is exhausted. The overlapping period also provides enough time to train employees to use new equipment safely and to account for the fluctuating production and delivery schedules within the manufacturing sector. The entire process is effectively managed by utilizing OEM lifecycle consumption rates when forecasting failure rates and 10-year annualized budgets. Unexpected vehicle and equipment downtime is thus minimized.

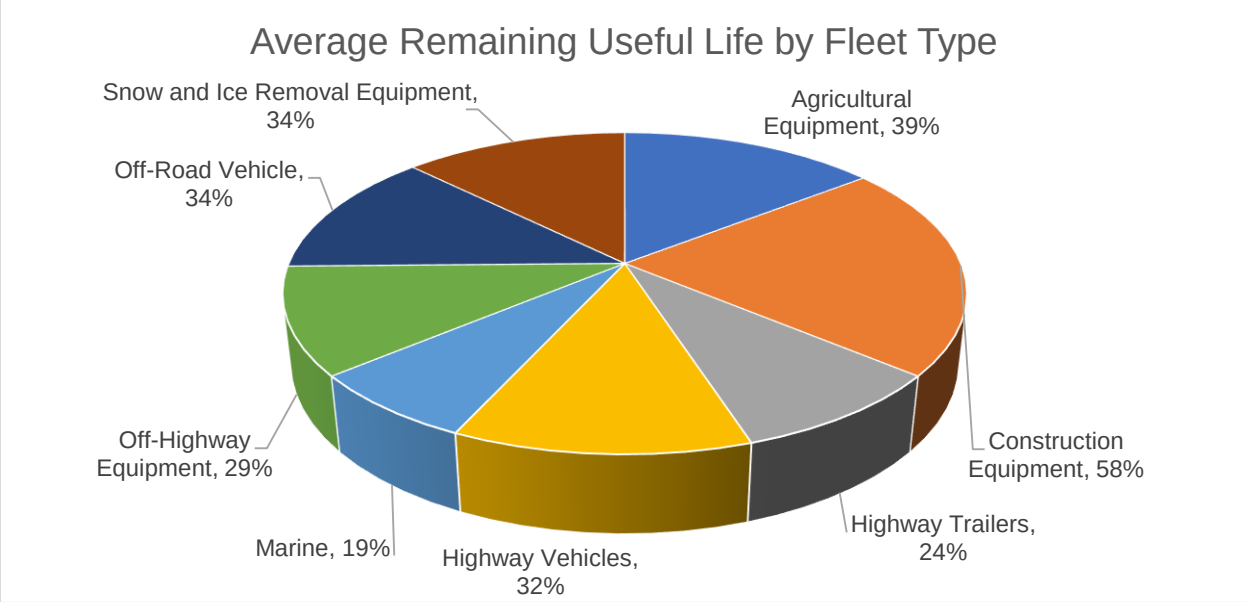


Figure 12.2 - Depicts the average remaining useful life by primary Fleet asset type (as of Q4, 2023).

Capital planning process requires the primary fleet categories in the above chart to be further categorized to apply OEM guidelines more easily, expected useful life, industry standards, preventative maintenance, annual inspections, and TRCA experience operating similar assets in comparable work environments were used to calculate the remaining useful life of the assets.

Consumption rate generally refers to the years of service of an asset compared to its projected service life**. With an average consumption rate of approximately 73 percent, TRCA's Fleet has reached or is near reaching the mid-point of service life.** Maintaining or even extending the average consumption rate will require adherence to regular preventative maintenance and inspections and periodic major maintenance activities to continue to provide the intended level of service through service life and or extend service life by preventing overall asset degradation.

In cases where fleet assets have surpassed expected useful life, a cost-benefit analysis is performed. An asset's condition is assessed for performance and reliability by existing maintenance records, wear and tear, and OEM specifications. A projected life expectancy beyond OEM specifications is identified, along with projected short-term maintenance costs. To try and maximize capital budgets, assets with extended service life may be transferred to projects or programs with less demanding requirements, provided the risk of full failure of the asset(s)is low. The condition or state of good repair is monitored closely to ensure these assets remain reliable while in active inventory. As risk profiles change and failure rates become more apparent, the state of good repair asset replacement is prioritized through annual capital budget planning.

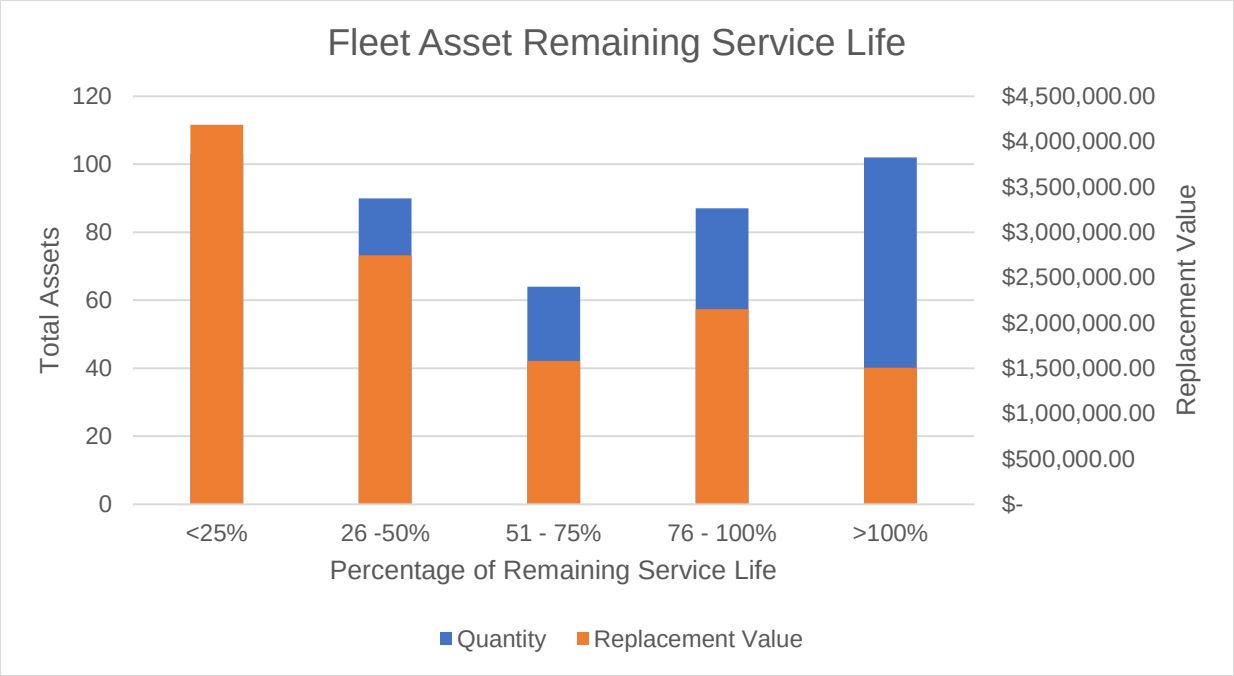


Figure 12.3 - Provides an overview of the quantity of fleet assets, remaining service life and replacement value (as of Q4, 2023).

In general, the quantity of assets which have remained in service beyond their projected service life has increased in recent years, however, this can be attributed to the delays and production lead times for various asset types as seen during the Covid-19 pandemic (2020 – 2022). Whereas some assets would have remained in service beyond expected service life upon receipt of the replacement asset with the intent of further supporting projects and programs with fleet resources while minimizing external costs related to additional vehicle rentals.

Further discussions with business units and analysis of risk occur to determine if the assets whose service life has been extended have a remaining serviceable life and value for the business units.

12.4 Asset Condition

Regular preventative maintenance on all fleet assets is conducted by third-party service providers. TRCA does not have the physical capacity or trained personnel to perform this work. Once the overall condition of each asset is evaluated by a trained professional, the results are compared to the Asset Condition Grade Summary chart below.

Note that the grade summary chart focuses on assessed asset condition and not necessarily on age of asset or OEM life expectancy alone. TRCA's approach to asset management is strategic in nature. Prior to deciding to dispose of an asset, staff, in consultation with third-party service providers (as required), use a four-pronged approach to evaluate asset usefulness and service-life extension:

- Condition assessment
- Project or program impact and relative intensity of work impact on asset
- OEM recommendations
- Employee experience using the same or similar assets

The byproduct of the evaluation informs service-life usefulness and probability of service life extension with an aim to maximize budgets.

Table 12.5 - Provides an overview and description of asset condition utilized in the AMP.

1	Very Good	The asset is generally in very good condition, typically new and or less than 25% expected useful life consumed. A few elements of the asset show general signs of deterioration that require attention
2	Good	The asset is generally in good condition ranging between 26-50% of useful life consumed. Some elements show general signs of deterioration that require attention. A few elements exhibit significant deficiencies.
3	Fair	The asset is generally in fair condition ranging between 51-75% of useful life consumed. The asset shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies.
4	Poor	The asset is generally in poor condition ranging between 76 - 100% of useful life consumed and near end of service life. Generally, many elements of the asset exhibit significant deterioration
5	Very Poor	The asset is generally in very poor condition and has exceeded useful life, showing widespread signs of advanced deterioration. Many components of the asset exhibit signs of imminent failure which can affect and or impair service, replacement parts are generally scarce, increasing risk of catastrophic failure.

In some cases, the percentage of remaining service life is not the most suitable condition indicator. In addition to the four elements above, service-life information should be augmented to include maintenance history, projected cost of preventative maintenance and major repairs during extended life. In a cost-benefit manner, these costs ought to be compared to the price of a new asset and life expectancy, along with expected reliability. These other factors could be incorporated in future updates to the asset management plan.

Shown in the following graph, approximately 38 percent of existing fleet assets are rated ‘Good’ or better. Conversely, approximately 44 percent of existing fleet assets are in ‘Poor’ or worse condition. This ratio suggests this will be a key business driver during budgetary processes as assets continue to age. Ensuring reliability and consistent performance requires a well-developed lifecycle plan in-place with judicious capital planning strategies.

Figure 12.4 – Overall fleet assets condition (as of Q4, 2023)

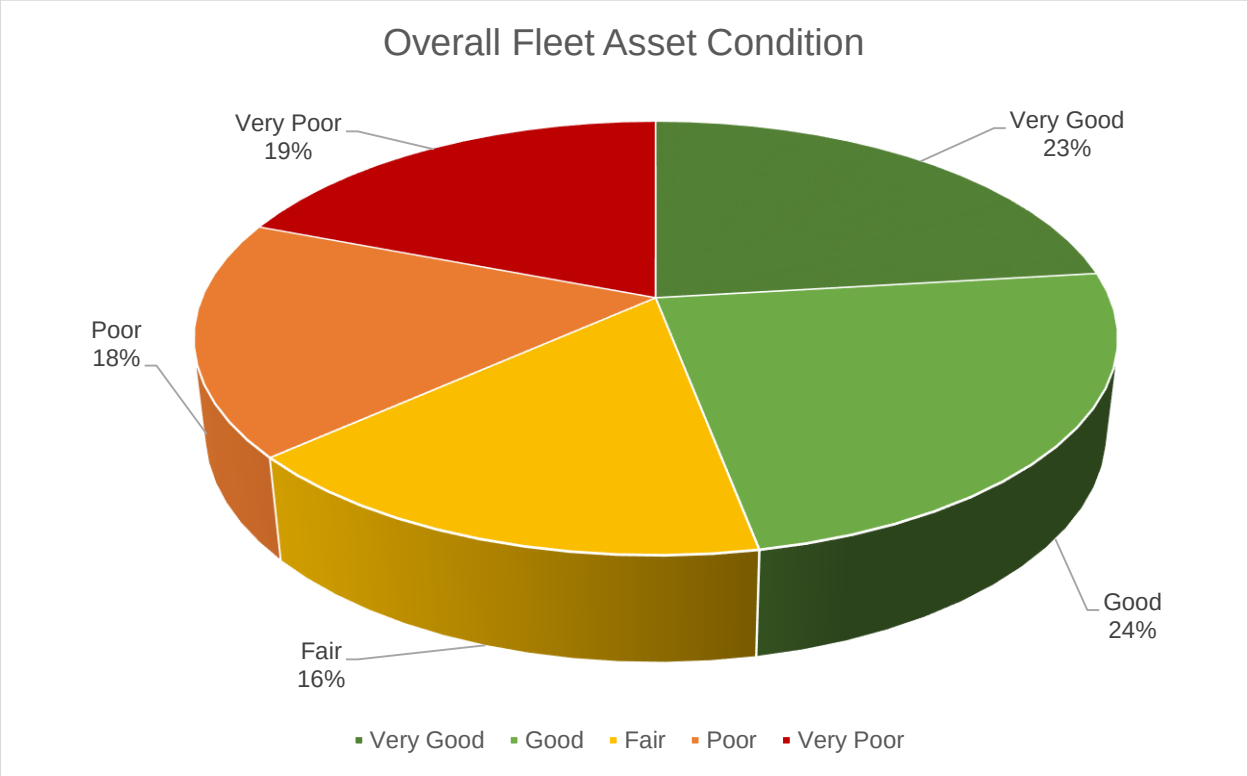


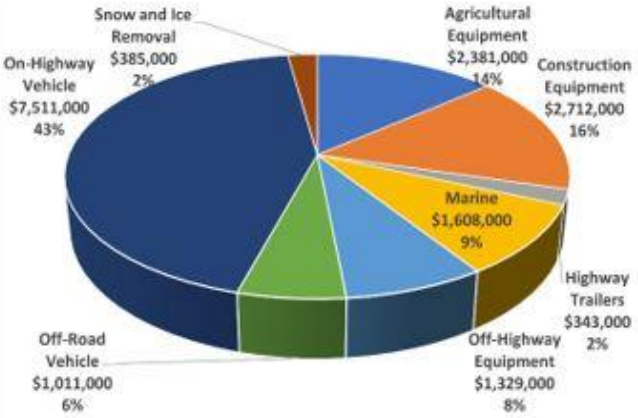
Table 12.6 - Provides an overview and description of asset condition utilized in the AMP

Service	Asset Condition	Inventory	Replacement Value
Fleet	Very Good	116	$4,815,000
	Good	120	$4,694,000
	Fair	83	$2,379,000
	Poor	88	$2,993,000
	Very Poor	96	$2,397,000
TOTAL		503	**$ 17,278,000**

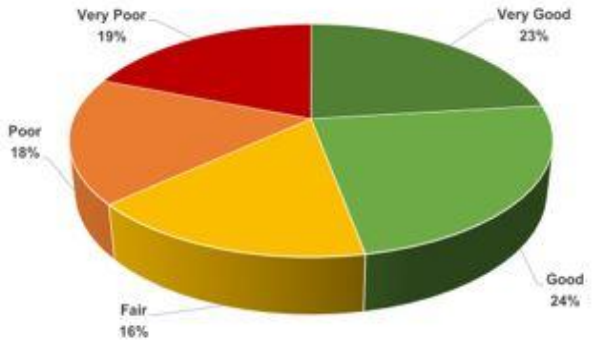
Total Asset Replacement Value:	**$17,278,000**
Current Condition:	Fair
Future Condition Trend (next 10 years):	Increasing
TRCA Strategic Plan:	Reduction or elimination of risk related to operations and improved operational efficiency.
Assets Included in this Category:	Agricultural, Off-highway, On-Highway Vehicle, Marine, Highway Trailers, Construction Equipment, Snow and Ice Removal, Off-Road Vehicle, Monitoring
Data Confidence and Reliability:	Condition Based Medium

The total replacement value of TRCA Fleet is **$17,278,000**. 47% of the assets are in Good to Very Good condition, and 14% are in Fair condition, with the remaining assets close to, or past, the end of Service Life. As the TRCAs Fleet assets having an overall average of Fair condition trending towards an averaged Good condition, these assets are meeting current needs but aging and may require attention in select asset types.

REPLACEMENT VALUE BY ASSET TYPES



CONDITION OF FLEET ASSETS



12.5 Level of Service (LOS)

Purpose

An objective of asset management planning is to ensure the performance and service provided by each asset meets the needs and expectations of end-users. Consistent levels of service also support the organization's strategic goals, corporate policies and procedures, legislative and regulatory requirements, and best practice standards. As noted, service levels are very much dependent upon capital budgets and TRCA's financial capacity to deliver the vehicles and equipment departments require.

12.5.1 Customer LOS

The Customer LOS defines the Divisional and or Project and Program requirements and the services that Corporate Fleet provide for the individual business units within the Projects and Programs through the assigned fleet resources tailored to their needs to meet operational requirements.

As the very objective of the Corporate Fleet is to provide safe, efficient, reliable, and effective fleet resources, the customer LOS is primarily qualitative because it has a high impact on Divisional and or Project and Program operations. Additionally, through the use and operation of fleet resources by business units, Corporate Fleet resources actively represent TRCA through operations pertaining to the business units and can have a direct impact on the perception of TRCA from all levels of customers, internally and externally.

The Customer LOS of Corporate Fleet as seen below, is somewhat challenging to quantify, due to the external factor requiring review of feedback including complaints and or inquiries related to fleet being received by TRCA. Whereas the Customer LOS pertaining to internal customers being the business units who rely on Fleet resources is relatively straightforward and relies on feedback from direct supervisors and review of historical operations of the asset. The economic impact or benefit is relatively broad in that select assets are directly related to fee for service projects and programs, and or have an impact on the service offerings available to guests at Conservation Parks or Educational Field Centers.

Table 12.7 – Customer LOS

Value	Objective	Measure	Performance	Target
Safe	Providing safe fleet resources for projects and programs	Percent (%) of legislated inspections met.	100%	
Effective	Providing vehicles and equipment at the appropriate quality	Percent (%) of fleet assets that meet the quality requirements for end users	>95%	
		Percent (%) of new vehicles which meet or exceed end user expectations	>95%	
Reliable	Providing reliable vehicles and equipment	Percent (%) of fleet assets that meet and or exceed the expected Serviceable Life	>95%	

Value	Objective	Measure	Performance	Target
	resources for end users.	Percent (%) of fleet assets that meet the expectations of the user groups.	>95%	⇧
		Percent (%) of time the appropriate number of vehicles are ready for use by a service group (i.e., uptime)	>85%	⇧
Efficient	Providing vehicles and equipment which have minimal Greenhouse Gas (GHG) emissions.	Annual Greenhouse Gas (GHG) emission (Tonnes)	829	⇩

12.5.2 Technical LOS

The Technical LOS as seen below, defines the technical standards, regulatory requirements and or industry guidelines required for select fleet resource types/categories to meet minimum requirements for operation on a regular basis. Additionally, Technical LOS includes quantitative and qualitative measures of fleet performance metrics, related to the operation of fleet resources. In alignment with the Corporate LOS, the Technical LOS includes measures related to Environmental Stewardship such as the efforts undertaken to decarbonize TRCA's Fleet resources.

Table 12.8 – Technical LOS

Value	Objective	Measure	Performance	Target
Safe	Providing safe fleet resources for projects and programs	Percent (%) of legislated inspections met	100%	100%
Effective	Providing vehicles and equipment at the appropriate quality	Percent (%) of fleet assets that meet the quality requirements for end users.	>95%	⇧
		Percent (%) of new vehicles which meet or exceed end user expectations	>95%	⇧
		Number of complaints related to appearance of vehicles (i.e., cleanliness, and or condition)	10	⇩
		Number of external complaints regarding fleet operations	5	⇩

Value	Objective	Measure	Performance	Target
Reliable	Providing vehicles and equipment at the appropriate quality.	Percent (%) of vehicles and equipment in operation beyond their optimum service life.	22.4[2]	
		Percent (%) of regular preventive maintenance activities completed on time.	>85%	
		Percent (%) of time the appropriate number of vehicles are ready for use by a service group (i.e., uptime)	>85%	
Efficient	Providing fleet services in an efficient manner	Operating budget of Corporate Fleet	$1.5M	
		On-Highway Vehicle Operating Cost per Kilometer ($/km)	$ 0.89	
		Reinvestment Rate -Annual average of projected 10-year fleet asset renewal budget as a % of current replacement value	9.2%	

 **Positive Upward**  **Positive Downward**  **No Change**

TRCA utilizes a technical LOS for prioritizing the regular inspection and maintenance requirements of Fleet resources to ensure safe operation. There are numerous legislative and/ or regulatory requirements which provide guidelines minimum requirements for select categories of fleet, for the operation, and maintenance, Fleet Resources.

Resources related to the safe operation of Fleet within TRCA include:

On-Highway Vehicles and Trailers:

- Ontario Highway Traffic Act
- Commercial Motor Vehicle Inspections

Off-Highway Equipment:

- O. Reg. 213/91 Construction Projects; Occupational Health and Safety Act

Off-Road Vehicles:

- Off-Road Vehicles Act
- Motorized Snow Vehicles Act
- Safety Helmets

[2] Approximately 50% are non-powered equipment and pose low risk of failure, whereas the balance is in various stages of lifecycle replacement

Marine Vessels:

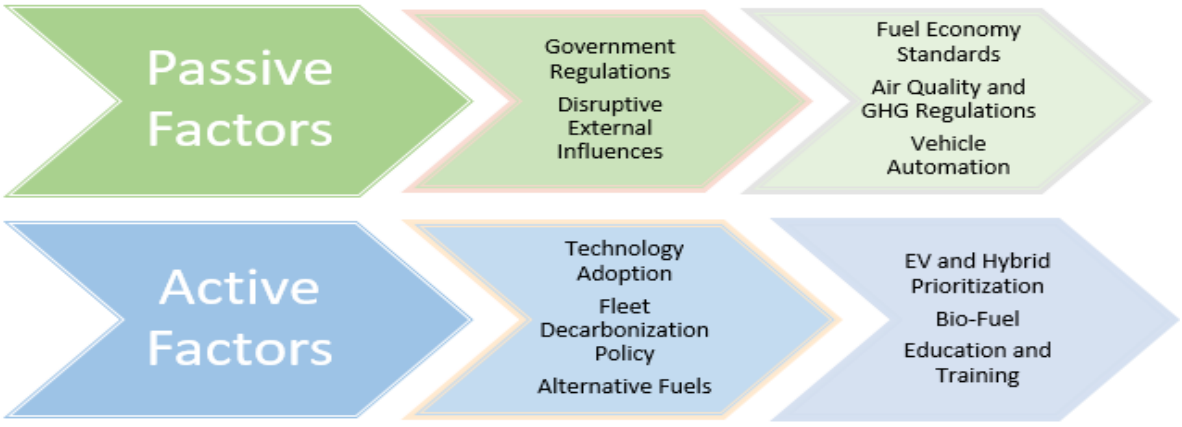
- Transport Canada, Small Commercial Vessel Safety Guide
- Transport Canada, Canada Shipping Act
- Transport Canada, Small Vessel Register (Commercial Vessel)
- Transport Canada, Small Vessel Compliance Program

In collaboration with TRCA business units who rely on Fleet resources, projects and programs communicate quantitative service requirements and qualitative needs and desires. Similarly, each business unit must develop and present a viable business case for ongoing year-over-year vehicle and equipment service increases. These requests are evaluated on a priority basis against various other internal capital project submissions and may or may not be approved.

While participation in the Transport Canada (TC) Small Vessel Compliance Program (SVCP) is voluntary, TRCA ensures all vessels, equipment and machinery meets necessary guidelines and regulations. In addition to the above, TRCA conforms to SVCP guidelines by ensuring safe work and operational practices are in place for all vessel crews and passengers. Maintaining consistent service levels requires a state of good repair but also operating practices that do not place unnecessary and undue stress on assets.

Utilizing a best practice approach, standardized through policies and procedures, TRCA actively manages service levels by promoting documentation of pre and post trip defects and operational abnormalities for corrective action that is consistent with OEM recommendations and specifications.

Two other factors form trends potentially impacting fleet's ability to deliver consistent service levels. While each of the passive and active factors identified in the chart below impact service delivery in varying degrees over the short and medium term, it is essential to monitor and adjust fleet business practices to minimize vehicle or equipment downtime. Monitoring developments in these areas is essential to ensuring projects and programs have access to vehicles and equipment they require to meet their service delivery requirements.



Passive governmental factors that influence TRCA fleet operations potentially stem from both federal and provincial levels of governments. Regulations affecting fuel standards and air quality, for instance, tend to have long-term implementation plans that have nominal short-term financial impact to fleet operations. While some of these factors in the medium to long-term will help TRCA to procure a more sustainable fleet, most of the costs associated with regulatory changes are indirectly absorbed by the divisions that operate project and programs through suggested retail prices.

Regulatory developments in the passive category therefore represent a business-as-usual scenario. Retail price increases, emission standards changes and automation advances, as they occur, are accommodated through short and medium-term capital budget planning process much like the adoption of hybrid or electric vehicles in the past.

Active factors present a proximate adoption scenario because immediate action is required. Although, as noted above, TRCA has well-established fleet business practices that facilitate the adoption of highly efficient vehicles, including hybrid, plug-in hybrid, and electric vehicle technology adoption. Active factor implementation requires research, analysis, internal stakeholder collaboration, and eventual business case development with probable capital budget implications. Furthermore, with the development of TRCA's Fleet Decarbonization Policy, replacement of existing on-highway vehicles specifically that of Light-Duty Trucks and Passenger Vehicles will prioritize Zero Emission Vehicles (ZEV), generally in the form of Battery Electric Vehicles (BEV) technology. Considerations are to be made due to the constraints of specific business units where electrification would be highly restrictive to their operations. Whereas decarbonization efforts for Equipment, and Medium and Heavy-Duty Trucks will occur over time as technology becomes available and where budget exists, in the short-term adoption of blended biodiesel will assist in the decarbonization of TRCA's Equipment fleet.

Achieving economic, environmental, and social benefits requires significant internal stakeholder collaboration, compared to the business-as-usual passive factor scenario. In addition, the above active factor implementation often requires development of new policies and procedures that govern, for instance, modified operation and OEM maintenance requirements. Working with internal peer review teams to complete these items in a timely manner ensures employees operate novel equipment safely and that lifecycle asset usability is maximized.

12.6 Asset Management Strategy

PAM provides fleet management services covering the Administration (asset management, analytics, budget), Fleet Planning (procurement and remarketing), Fleet Maintenance (service and repairs). As part of PAM's fleet asset management strategy, a comprenhensive condition assessment and lifecycle renewal program has been developed for all corporate vehicles and equipment. This straegy is based on a combination of historical operations and condition assessments.

12.7 Existing Operations and Maintenance Activities

Vehicle and equipment maintenance activities are an integral component in the lifecycle planning process. The following major maintenance activities are examples of regularly scheduled activities managed and directed by fleet administrators. A stringent preventative maintenance program is followed as per OEM guidelines to ensure preventative maintenance and repairs are completed in a timely manner.

The following are the major maintenance activities TRCA performs:

- Daily safety inspections are conducted by staff and in compliance with TRCA policy and procedures.
- Periodic major component overhaul, repair and rebuilding structural asset pieces per OEM specifications.
- All safety related equipment, for example brakes, is inspected at minimum annually. Other maintenance items are inspected and replaced or repaired as necessary in accordance with OEM service schedules and/or accelerated or irregular wear.

End of service life fleet assets are disposed of through public auction, once replacement assets are onboarded. Fleet assets are maximized to the extent possible during the disposal process through appropriate timing and or bundling of equipment. Revenues generated through the disposal process are deposited into fleet reserve fund.

12.8 Procurement Methodologies and Future Demand

Staff strategieze asset managmenet replacement via a projected 10-year capital budget with annualized budget maps, which guide procurement and disposition. The process, combined with the four guiding principles, and preventative maintenance program structure listed above, provide sufficient time to reevaluate purchases while simultaneously ensuring existing service levels are maintained. This well-estabilshed process works efficiently beause it is executed in coordinated effort with all TRCA divisional needs and the existing purchasing policy and procurement guidebook.

12.9 Financing Strategy

The financial strategy was developed alongside the asset management plan to effectively manage and sustain fleet operations over the course of the plan. Long-term financial planning ensures vehicles and equipment are managed in a fiscally responsible and sustainable manner. A key objective is to predictably ensure long-term costs are both manageable and that projections are accurate.

This section provides a summary of financial projections over the following 13 years, ending in 2034. The data is based on the current state of fleet inventory and remaining service life. Projections focus on optimal service life by factoring reliability, efficiency, and the following costs into the equations:

- Recoveries/Revenues
- Operating Expenditures
- Capital Expenditures
- Reserve Fund Balance (end of year)

Projections were calculated using a modest 0.25 percent annual increase over 14-years whereas operating expenditures were calculated using a 0.5 percent increase per annum.

With exception of capital costs required for fleet replacement in 2024-2025 which utilized current market costing and inflation, capital expenditures forecasts utilized historical asset costs with a 3.0 percent annual inflation rate. As in Asset Valuation above, these costs do not consider changes in asset type requirements due to project or program growth and or conversion to alternative fuels. However, practical considerations are evaluated to account for aftermarket equipment upfitting when necessary.

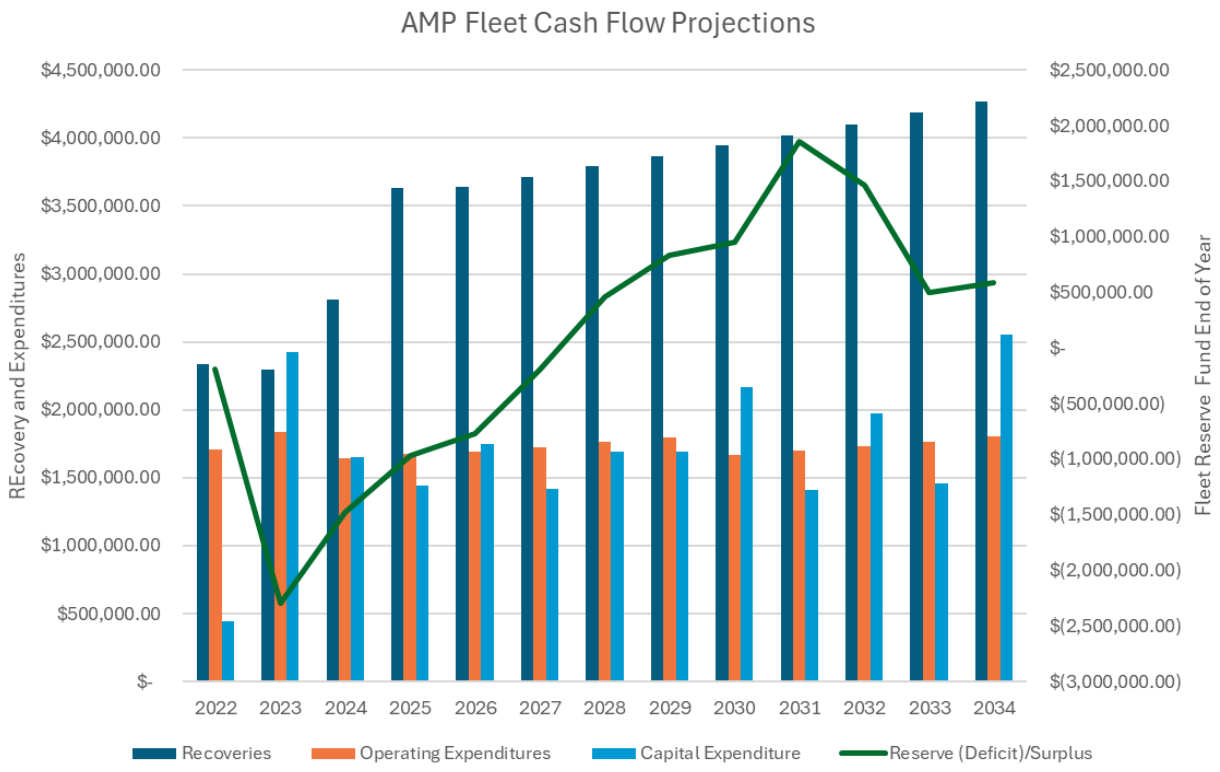


Figure 12.5 - Fleet Cash Flow Projections

The above graph projects capital expenditures (new fleet acquisitions), operating expenditures (fuel, maintenance, licensing, etc.), recoveries and projected fleet reserves during the period ending 2034. Most noteable is the continued growth of the reserve fund. The year 2023 reserve fund is approximately $1.6 million in deficit as a direct result of fleet order carry forward due to manufacturing supply chain and delivery challenges seen during the Covid-19 pandemic. Improvements in supply chain along with the recalculations to the intra-departmental fleet recovery rates is expected to assist in the return to a reserve surplus by 2026, at the earliest.

An active management strategy that will reduce risk of return to reserve deficits is recalculation of internal vehicle and equipment cost recoveries for some or all fleet asset categories. Historically, fleet recovery rates were static and not adjusted over time to account for inflation as it relates to purchase prices, fuel costs and maintenance and repairs. If deemed necessary, recalculation of usage rates for some or all fleet asset types can be completed to ensure sufficient reserve balance.

Maintaining a positive reserve balance provides PAM staff the flexibility and capacity to support projects and programs new assets when and where required due to new project and program requirements, pending business case approvals and or repalcement of an asset where full failure of an existing asset is observed.

Additionally, TRCA currently owns and operates four dual wand electric vehicle charging stations. While the revenue stream from electric vehicle chargers is currently relatively small, it is expected this revenue stream will increase over time as electric vehicle adoption increases. By 2024, TRCA estimates that between 15-20 electric vehicle charging stations will be active within TRCA and accessible at TRCA administrative offices for all electric vehicle drivers (public, staff, and fleet). These revenues, which

contribute to the fleet reserve are generated through user fees applied on a time used basis, and revenues are likely to increase in line with the proportion of electric vehicles in operation.

12.10 Environmental Stewardship

While environmental stewardship practices have been an informal part of asset management historically, through the procurement hybrid electric vehicles and the irregular procurement of battery electric vehicles. TRCA has historically tracked fuel consumption and the corresponding Greenhouse Gas (GHG) emissions generated through the operation of TRCA fleet.

Table 12.9 – Environmental Stewardship – Performance Matrix

Value	Objective	Measure	Performance	Target
Environmental Stewardship	Providing vehicles and equipment which have minimal greenhouse gas emissions	Annual Greenhouse Gas (GHG) emissions (tonnes)	829	
		Annual fuel consumption all On-highway vehicles (L/100kms)	16.45	
		Total fuel consumption Light Duty (LD) Vehicles per year (L/100kms)	13.2	
		Total fuel consumption Medium Duty (MD) Vehicles per year (L/100kms)	24.2	
		Total fuel consumption Heavy Duty (HD) Vehicles per year (L/100kms)	34.2	
	Fleet Decarbonization	Total number of Battery Electric Vehicles (BEV)	2	
		Total number of Hybrid Electric Vehicles (HEV)	30	
		Total number of Plug-In Hybrid Electric Vehicles (PHEV)	2	
		Total volume of blended biodiesel used in Fleet Equipment (Liters)	8000	
		Number of Fleet Equipment with Alternative Fuel Systems i.e., Propane, BEV, HEV, PHEV etc.	26	

 **Positive Upward**  **Positive Downward**  **No Change**

With the observation of an increase in passive factors related to regulatory requirements for a transition to Zero Emisison Vehicles (ZEV) and an increase in available ZEVs from automanufacturers in configurations which are similar to that required by TRCA currently available or scheduled for release in 3-5 years, staff have planned steps to actively decarbonize TRCA's on-highway vehicle fleet. These planned actions include the prioritization of BEV at end of lifecycle of existing fleet assets and or new acquisition, and these actions may require additional Electric Vehicle Supply Equipment (EVSE).

Replacement cost estimates for the existing fleet do not account for work location specific infrastructure improvements. For instance, the adoption of ZEV technologies i.e., Battery Electric Vehicles (BEV) or Plug-In Hybrid Electric Vehicle (PHEV) typically requires electrical infrastructure upgrades and Electric Vehicle Supply Equipment (EVSE), otherwise known as vehicle chargers to be installed to facilitate recharging. These infrastructure costs are distinct from EV vehicle purchase price and are critical equipment to ensure optimal usage and up-time and minimizing disruption to projects and programs. Ensuring adequate type and supply of EVSE at TRCA administrative and field offices will further assist in mitigating range anxiety among drivers and ensure optimal utilization of ZEV fleet. Additional capital budget considerations and planning occur when fleet at end of lifecycle are identified for ZEV adoption during replacement. Mid-to-long-term capital and strategic planning is necessary to ensure installations of EVSE occur as and when required during lifecycle of existing Fleet to align with Fleet Decarbonization efforts and strategies.

The decarbonization of TRCA's off-highway, agricultural, construction and marine fleet will be managed on a case-by-case basis currently due to the limited market technology available for ZEV and or alternative fuel systems for these fleet types at this time. It is plausible that increased ZEV or alternative fuel system technologies will be more present in these manufacturing sectors in the next five (5) years. While appetite for the adoption of these technologies is present within select business units, the limited technology and or available supplier inventory has been a challenge for those who desire to transition to ZEV and alternative fuel systems. Staff have identified areas of TRCA fleet which would be ideally suited to ZEV or alternative fuels and would facilitate a straightforward adoption of these technologies. It is foreseen the transition of ZEV and alternative fuel technologies in these fleet types can have a positive improvement in customer or guest experience at TRCA facilities, as well act as an example to industry peers and or customers and guests of TRCA that adoption of ZEV and alternative fuel technologies is feasible and has minimal impact to operations.

To assist in the decarbonization of off-highway, agricultural, construction and our marine fleet in the interim, staff have determined that an increase in usage of blended biodiesel for these fleet types is a suitable solution for decarbonization. The adoption of blended biodiesel will have minimal impact on the operations of TRCA's projects and programs due to current inventory of fuel storage at TRCA facilities. The initial phase of adoption of blended biodiesel primarily includes B20 blended biofuel, as upper tier manufacturers conducted sufficient testing of B20 fuel blend to determine impacts to performance and efficiency and suitable for warranty coverage. It is anticipated the blend ratio of biogenic to petroleum i.e., B20 biodiesel which contains 20% biogenic fuel base to 80% petroleum fuel base can be adjusted overtime due to powertrain compatibility and or seasonally as required for colder climate operations.

Section 13:

PLAN IMPROVEMENT AND MONITORING

SECTION 13: PLAN IMPROVEMENT AND MONITORING

13.1 Plan Review

This Asset Management Plan is intended to be a living document that is relevant and integral to TRCA's daily asset management activities. For the plan to remain useful and relevant, the following process of Asset Management Plan monitoring, and review activities will be undertaken:

- Formally adopt the plan.
- Review and formally adopt levels of service, as these become available.
- Revise the AMP every 5 years to incorporate and document changes to work programs, outcomes of service level reviews, and new knowledge resulting from the asset management improvement program. Some sections, such as Section 3.0 – State of the Infrastructure or Section 4.0 – Levels of Service, may require updating more frequently.
- Complete quality assurance audits of asset management information to confirm the integrity and cost-effectiveness of data collected (ongoing).

13.2 Plan Monitoring

In addition to benchmarking with comparable departments of other municipalities and/or Conservation Authorities, the following indicators can be monitored to measure the effectiveness of this AMP:

- Compliance with legislative requirements
- Quality of Service Delivery and compliance with service targets or targets exceeded
- Capital project delivery outputs delivered to schedule (or better) and on budget (or better)
- Operational and maintenance budgets met (or better)
- Quality of Risk Management—No events occurring outside the risk profile

13.3 Plan Improvement

Broader consideration should be given in areas such as:

- **Updated asset condition and lifecycle replacement studies**. It will be important to ensure alignment with the information requirements from the updated legislation and the forecasting outputs that will allow for less reliance for major asset categories.
- **Technology** – opportunity to leverage existing and emerging technological solutions for the purpose of planning, monitoring, and reporting on assets, as well as to pursue lifecycle cost savings and deferral opportunities in the delivery of services and rehabilitation of infrastructure.

  Once such initiative is the Enterprise asset management software (EAM) that TRCA acquired, the EAM includes the Maintenance Management System application that connects with the inventory management system and capital planning. Maintenance manager and Asset Manager Modules are used to maintain and report on TRCA facilities and infrastructure. These modules integrate with TRCA existing GIS ESRI Arc system.

- **Service level measurement** – refine and update service level measures, as well as develop KPI dashboards in order to incorporate the resulting information into TRCA's strategic decision-making processes.
- **Service Delivery** – continue to investigate opportunities to maximize efficiency, create value, manage risk, increase service level, and/or minimize overall cost (including infrastructure renewal cost) through service delivery models.
- **Growth-related infrastructure** – ensure any new framework provides for further integration of the planning for lifecycle costs of both existing and new growth-related infrastructure.
- **Resources** – the new planning and reporting requirements that are anticipated in the upcoming regulations will create an on-going demand that may need to be addressed through the allocation of new or re-purposed internal staff resources, and/or the allocation of additional funds for expanded third-party services.
- **Organizational alignment** – Standardize asset data-based capital project planning as well as routine O&M activities in order to better coordinate asset management processes across the organization.

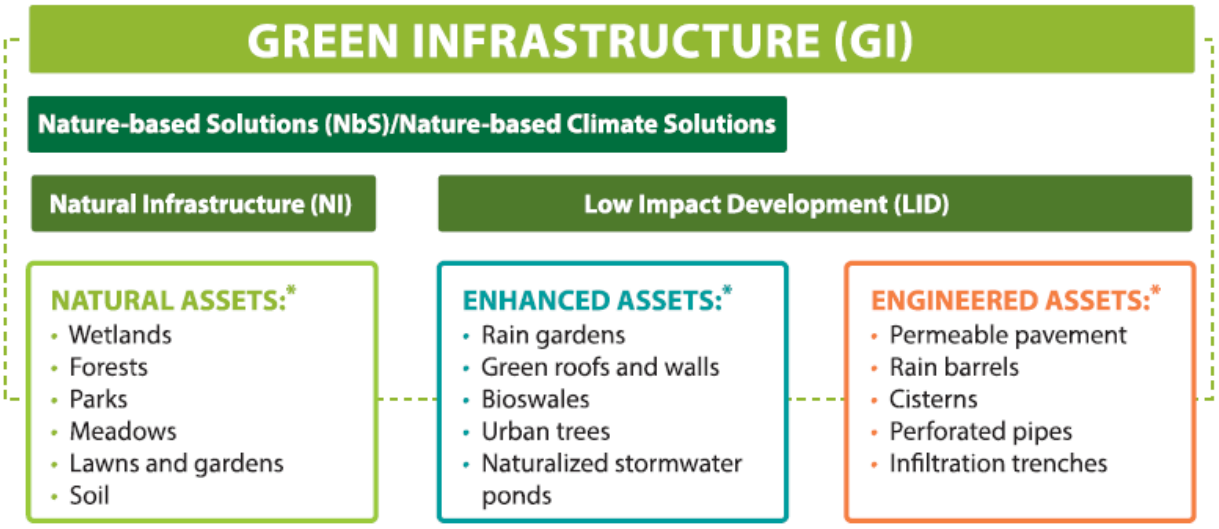
13.4 Next Steps – Integrate Green Infrastructure into TRCA's AMP

Green infrastructure supports the delivery of important Conservation Authority services through functions such as stormwater management, heat reduction, recreation, habitat provision, and pollination. By incorporating Green Infrastructure assets into asset management processes, organizations can help decrease capital, operations, and maintenance costs, maintain the delivery of important services, and enhance their ability to adapt to climate change, all while protecting or enhancing other environmental, economic, and social benefits that nature brings to communities. Many of our municipal partners are integrating Green Infrastructure into their AMPs in accordance with O. Reg. 588/17, therefore it is not only important for TRCA to align with these efforts but to lead by example.

Integration of Green Infrastructure in future AMPs is intended to help meet the following business objectives:

- Develop a state of infrastructure report for TRCA's green infrastructure assets that will create a foundational benchmark to understand the condition of our green infrastructure and the services it provides.
- Support TRCA in managing green infrastructure assets over their lifecycle to achieve desired levels of service.
- Directly support high quality facilities, user experiences and mitigated risks through effective asset management and a reduced state of good repair and improve understanding of current and future state of TRCA's watersheds and ecosystems and identify actions needed to achieve watershed health.
- Align TRCA's asset management with O. Reg. 588/17 with respect to the identification, condition rating and evaluation of levels of service of green infrastructure assets, focused on those that are owned and managed by TRCA.

For the purposes of this project, green infrastructure is defined as natural and human-made elements that provide ecological and hydrological functions and processes. Green infrastructure can be subdivided into three main categories: natural assets, enhanced assets, and engineered assets.



Because green infrastructure is a core component of TRCA's business, the integration project will involve significant coordination and collaboration between different TRCA divisions.

Some initial actions include consultation with various divisions to:

- Identify related TRCA strategies and management plans to ensure alignment and minimize overlap (e.g. Forest Management Plan).
- Meet with green infrastructure asset managers to introduce the process and benefits of asset management and decide on objectives for including specific green infrastructure assets in the process.

13.5 Next Steps – Integrate Information Technology Assets into TRCA's AMP

TRCA Divisions utilize a broad range of technological resources to deliver programs and services. These include corporately managed IT assets, as well as divisionally managed technologies that are directly incorporated into operational systems and assets such as flood management and monitoring systems, building security and management, and field monitoring and data collection services. IT assets encompass a broad range of technologies, but can be grouped into four major categories:

- **End User devices** – Laptops, Tablets and mobile devices; Field Data Collection devices; Surveillance equipment
- **Infrastructure** – Data Centre and Networking Equipment; Monitoring Equipment; Building Automation Control systems
- **Software** – Licensed software (perpetual contract); Developed software and database systems
- **Data Assets** – Acquired or developed data sets to support future decision-making and information products

The technology environment has seen a shift toward a subscription-based or technology-as-a-Service model, which is continuing to put pressure on operational budgets and away from capital investments for technologies.

Integration of IT Assets in future AMPs is intended to help meet the following business objectives:

- Develop a state of infrastructure report for TRCA's technology assets that will create a benchmark for lifecycle planning for the maintenance and replacement of technology solutions to support corporate and divisional services
- Better understand the service level requirements for technology used across TRCA business operations and to plan for future capacity needs
- Directly support TRCA Playbook term impacts: (4.2) asset management and state of good repair of technology assets, and supporting an agile and flexible organization

The shared responsibilities for IT asset management will require significant coordination and collaboration between different TRCA divisions.

Some initial actions include consultation with various divisions to:

- Develop ITAM policies to guide IT asset management plans for corporate and divisionally managed technologies.
- Develop service levels and capacity management targets to support different business operational requirements.
- Develop a financial plan for ongoing maintenance, upgrades and replacement of IT assets.

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