


TOWNSHIP OF ADJALA-TOSORONTIO

2022 ASSET MANAGEMENT PLAN

Core Infrastructure

Preface:

The Township of Adjala-Tosorontio is committed to operationalizing municipal Asset Management Planning best practices and meeting the requirements of Ontario Regulation (O. Reg.) 588/17: *Asset Management Planning for Municipal Infrastructure*. The Township's ongoing AMP efforts are guided by the Township's Strategic Asset Management Policy (2019).

The *2022 Asset Management Plan for Core Infrastructure* (2022 AMP) identifies the current levels of service for core infrastructure and cost of maintaining those levels of service. The 2022 AMP establishes a baseline for future AMP updates by assimilating the best current available information and analyzing the prescribed level of service measures.

Within the context of O. Reg. 588/17, the 2022 AMP is only one deliverable within a series of regulatory milestones. The milestone deliverables required under O. Reg. 588/17 are summarized below:

Strategic Asset Management Policy • Enshrines best practices and links AMP to other strategic plans and practices	**Due July 1, 2019**	✓
Asset Management Plan for Core Infrastructure • Establishes spending levels required to sustain current levels of service for municipal core infrastructure	**Due July 1, 2022**	✓
Asset Management Plan for All Infrastructure • Establishes spending levels required to sustain current levels of service for all other municipal infrastructure assets	**Due July 1, 2024**	
Financial Strategy • Determines appropriate and affordable proposed service levels, and associated spending requirements needed to undertake the lowest cost lifecycle activities in each asset category • Requires Council endorsement of lifecycle management and 10-year financial strategy to sustain the proposed levels of service	**Due July 1, 2025**	

Following publication of the 2025 AMP Financial Strategy, Council progress reviews will take place annually to review performance compared to the established Level of Service measures (O. Reg. 588/17, S.9). The Level of Service measures prescribed by O. Reg. 588/17 are summarized in **Appendix A** to facilitate the future performance reviews.

The Township of Adjala-Tosorontio's *2022 Asset Management Plan for Core Infrastructure* has been authored by Township Staff, based on the best available asset and financial information from a variety of sources from third-party professionals (these documents are listed in the **References** section). The AMP is also aligned with other corporate strategic plans and initiatives including the Official Plan, Community Based Strategic Plan, Water Financial Plans, Water and Wastewater Connection Charge Studies, Development Charges Background Studies, Master Servicing Plans, Recreation Master Plans, annual budgets, capital forecasts, operational policies, and other relevant approved documents.

It must be understood that fundamentally, Asset Management is an ongoing process requiring significant inputs of time and effort. It is not simply, in and of itself, a plan, software, or a database. Since AM is an ongoing process, a concerted effort and dedication to continuous improvement is necessary to achieve positive outcomes for the community and the Township. Accordingly, it is imperative that sufficient Staff resources are dedicated to bolstering the Township's analytic capabilities and continuing to implement data-driven processes to support informed decision-making.

The delivery of the Township's municipal services cannot continue without the use of its municipal infrastructure. Asset Management is the mechanism to deliver sustainable, affordable, and transparent levels of service to meet community expectations.

Adjala-Tosorontio

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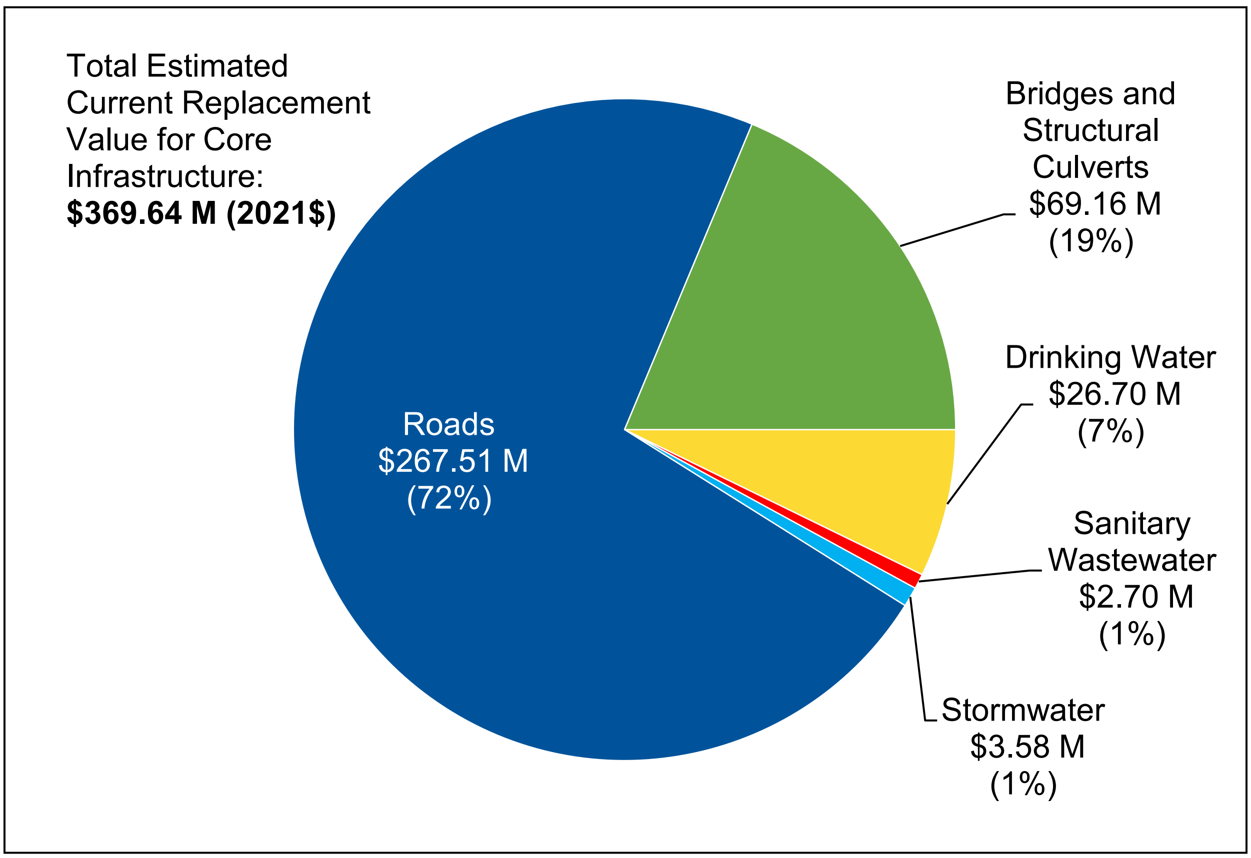
1. Executive Summary: Current State of Core Infrastructure

At a high level, the Township's municipal core infrastructure comprises:

- 613 lane-km road network, predominantly rural, 23% being gravel surfaced
- 48 Bridges and 25 Structural Culverts (with spans of 3 metres or greater)
- 6 independent Drinking Water Systems, with a total of 1,014 connections, and a distribution network comprising approximately 23.4 km of watermain
- 1 Sanitary Wastewater Treatment Plant serving 100 residential properties, with collection system comprising 1.5 km of gravity sewer and 2 pumping stations
- 10 Stormwater Management assets consisting of ponds, swales, sewers, and appurtenances servicing various residential and commercial subdivisions

Altogether, measured in 2021 dollars, the total current replacement value of the Township's core municipal infrastructure is estimated to be $369.64 M. **Figure 1-1** illustrates the distribution of these replacement costs between the core asset categories.

Figure 1-1: Current Estimated Replacement Value (2021$) by Core Asset Category



Based on a review of **Figure 1-1**, it should be noted that the core infrastructure assets required to deliver the Township's transportation services (613 lane kilometres of roadway, 48 bridges, and 25 structural culverts) account for 91% of the estimated current replacement value of all core infrastructure assets, at $336.67 M (2021 dollars).

Table 1-1 summarizes the overall average condition of each core infrastructure asset group.

Table 1-1: Average Condition of Core Infrastructure by Asset Group

Core Infrastructure Asset Category	Asset Group	Average Condition
Drinking Water	Facilities	*Good*
	Linear	*Fair*
Sanitary Wastewater	Facilities	*Poor*
	Linear	*Good*
Stormwater	Facilities	*Fair*
	Urban Linear	*Fair*
Roads	Paved Surface	*Poor*
	Unpaved Surface	*Good*
Bridges and Structural Culverts	Bridges	*Fair*
	Structural Culverts	*Fair*

Particularly, it should be noted that the majority of paved roads in the Township are in "*Poor*" condition. The current condition of paved roads can be attributed to insufficient funding levels and resultant deferred maintenance over a period of decades. It is also evident that the historical practice of "hard-topping" gravel roads with a single thin lift of hot mix asphalt has not produced lasting or desirable outcomes. Undertaking the necessary spot repairs to these failed pavements in a reactive manner is likely not the most cost-effective approach as compared to implementing proactive and alternative treatment strategies. For example, Surface Treatments (which are also capable of providing a hard, durable road surface) are an economically viable alternative for many of the Township's rural roads and are being explored as a more sustainable alternative to satisfy community expectations. It is noted that gravel roads, which comprise a significant portion (approximately 23%) of the Township's road network are, on average, in "*Good*" condition.

The overall average condition of Bridges and Structural Culverts which had previously been trending negatively, has stabilized in 2021 as a result of concerted rehabilitation efforts. Anecdotally, the Township of Adjala-Tosorontio is unique in having an extensive inventory of Bridges and Structural Culverts (73 in total), which is likely remarkably more than most other lower-tier municipalities. It is also noted that in 2020, several structural culverts that had previously eluded the asset inventory (located below deep fill and obscured by vegetation) were uncovered and added to the Township's AMP.

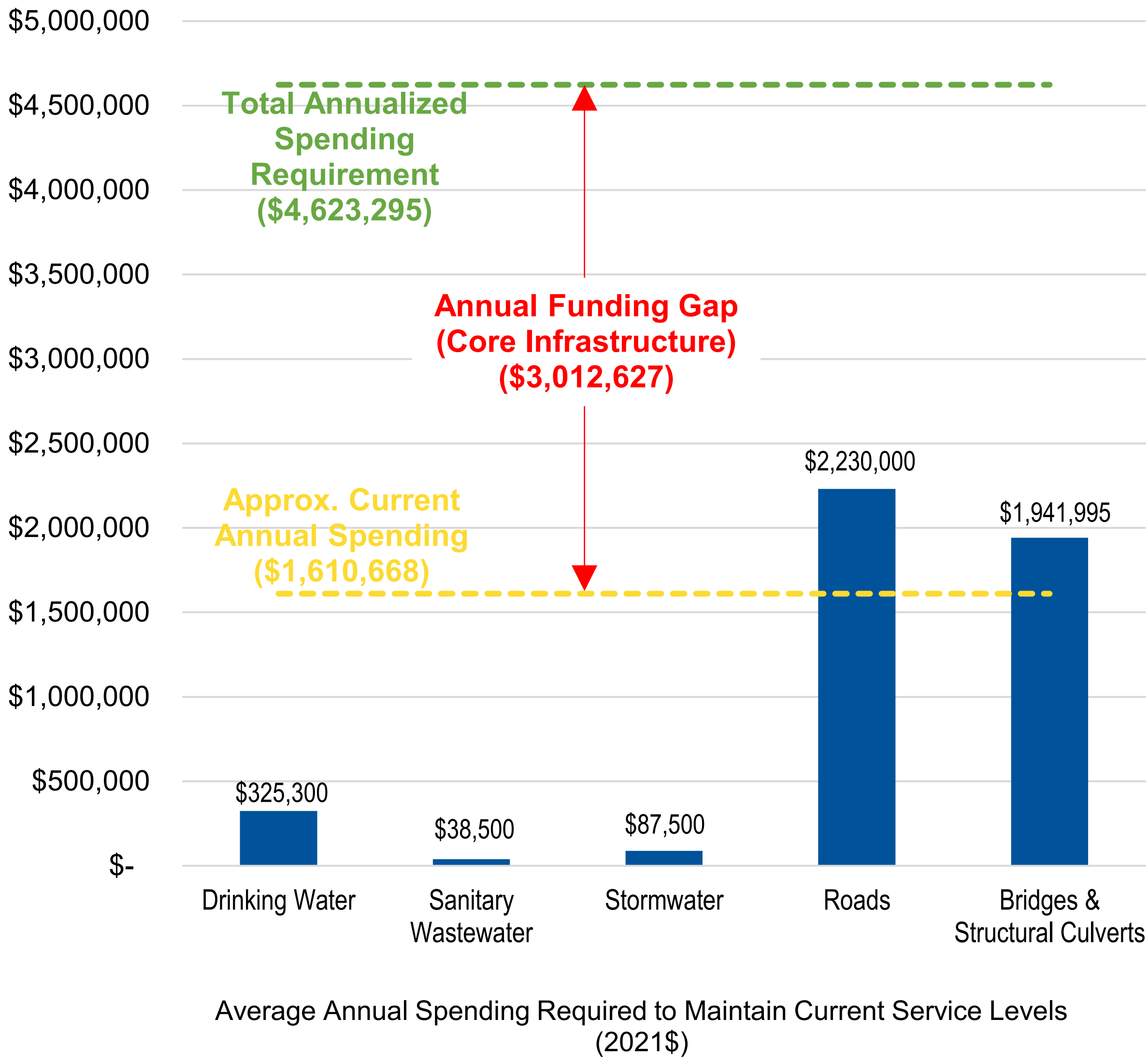
Based on their age, Stormwater Management Facilities (particularly Wet Ponds) may require capital investment in the short-term (or at the very least, detailed condition assessments). All Stormwater assets are noted to be in "*Fair*" condition, functioning as intended with only spot repairs and maintenance required.

Current service levels for Drinking Water and Sanitary Wastewater are maintained through annual Capital expenditure relating to scheduled major maintenance projects. When required, unscheduled repairs are undertaken on an emergency basis. In accordance with the *Safe Drinking Water Act, 2002*, the Township and its elected Council have special obligations to uphold the *Standard of Care*. The Township currently has a long-term plan to achieve sustainability for Water and Wastewater service delivery, which is detailed in the most recent approved 2021 Water and Wastewater Rate Study and Financial Plan, as required by O. Reg. 453/07. The Township currently contracts the Ontario Clean Water Agency (OCWA) as its Operating Authority.

In accordance with Ontario Regulation 588/17, the prescribed Level of Service Measures are detailed throughout this report and are summarized in **Appendix A**. Implications of projected growth are also discussed in accordance with the requirements for municipalities with populations less than 25,000.

As shown below in **Figure 1-2**, the annual level of spending required to sustain current service levels for core infrastructure over a 10-year planning horizon is, on average, about \$4.62 M. The Township's current annual spending is approximately \$1.61 M, meaning that about \$3.01 M worth of core infrastructure needs currently go unfunded every year.

Figure 1-2: Average Annual Spending Required to Sustain Current Levels of Service for Core Infrastructure over the next 10-year period (2021$)



The magnitude of the annual funding gap suggests that achieving sustainable Levels of Service may require both the re-evaluation of current funding levels, as well as a rationalization of existing service levels (in other words, this means making the yellow and green lines in **Figure 1-2** meet somewhere in the middle). The total annualized spending requirement could potentially be reduced by adopting a more widespread application of surface treatments (as opposed to hot mix asphalt) for appropriate roads, as well as divesting select bridges based on uniformly applied criteria.

Proactive lifecycle strategies that extend the life of an asset at an overall reduced annualized cost provide value and help to leverage the impact of limited funding. The physical condition of many core infrastructure assets is currently within the "*Fair*" state, which is generally the critical time to undertake cost-effective rehabilitation strategies. If the physical condition deteriorates beyond this point, rehabilitation may no longer be viable or economically feasible, and a more costly end-of-life replacement will likely be required in the short-to-mid term to sustain Levels of Service. Forgoing the opportunity to undertake viable rehabilitation and maintenance projects is contrary to the principals of AM, since this approach results in higher overall costs to deliver the same level of service. While the necessary funding for rehabilitation projects may not be available in reserves, a compelling argument could be made in favour of funding these types of projects through debt if the return-on-investment over the life of the asset is less than the interest rate of borrowing (which is most often the case).

It must be recognized that the Township is faced with a very significant challenge: our core infrastructure assets are nearing the end of their useful lifespans faster than we are covering the costs of replacing them. Most importantly, it must be recognized that the infrastructure funding gap is an inescapable issue that must be confronted. As more time passes without meaningfully addressing this issue, the difficulties will only continue to compound. In the year 2025, the Township is required under O. Reg. 588/17 to adopt a Financial Strategy capable of sustaining Proposed Levels of Service not only for the "core infrastructure" assets addressed in this 2022 AMP, but for all municipal assets, which will be covered in detail in the forthcoming 2024 AMP update.

2. Introduction

The *2022 Asset Management Plan for Core Infrastructure* (2022 AMP) has been prepared in accordance with Ontario Regulation (O. Reg.) 588/17: *Asset Management Planning for Municipal Infrastructure*. Accordingly, the 2022 AMP addresses all core infrastructure asset categories as defined by O. Reg. 588/17:

- ✓ Roads
- ✓ Bridges and Structural Culverts
- ✓ Drinking Water
- ✓ Sanitary Wastewater
- ✓ Stormwater Assets

The Township's delivery of municipal services is largely dependent upon the reliable and continuous use of its physical infrastructure assets by the community. Over time, all assets deteriorate due to a variety of factors and therefore require ongoing financial investment to sustain these services that municipal infrastructure provides. The goal of the AMP is to provide a framework for managing infrastructure assets in the most cost-effective manner from a lifecycle perspective. Asset Management (AM) provides a transparent and consistent process to prioritize the Township's infrastructure spending with the aim of delivering the greatest outcome from limited expenditures. The Township, like most other municipalities, operates within a financially constrained environment, therefore it is incumbent upon Staff and Council to foster continuous improvement in developing AM processes that will support the prioritization of infrastructure spending based on where it can deliver the greatest return on investment.

AM is based on value-driven prioritization, which is fundamentally at odds with the "worst-first" or "complaint-driven" approach to decision-making. Considering that the "worst" ("*Poor*" condition) assets demand the most extensive and expensive repairs, it should be recognized that addressing a poor condition asset would effectively take scarce funding away from a greater number of better value projects, thereby diminishing the net effect of the Township's overall funding allocation. Fundamentally, AM prioritizes projects based on their return-on-investment (ROI) from a lifecycle perspective.

Furthermore, based on the physical nature of deterioration, there is a limited timing window for undertaking different lifecycle activities, and once this has elapsed, the opportunity for leveraging asset lifecycle cost-savings is lost. The costs associated with the appropriate asset lifecycle strategies tend to increase as the condition of the asset decreases. Accordingly, the conventional AM wisdom is to "keep the good assets good". The extent of work (and therefore, the relative level of financial investment) required to address a "*Poor*" condition asset does not change considerably year over year, whereas assets in a "*Fair*" condition state will deteriorate in an accelerated manner if deficiencies are allowed propagate unaddressed.

O. Reg. 588/17 defines ***Lifecycle Activities*** as *"activities undertaken with respect to a municipal infrastructure asset over its service life, including constructing, maintaining, renewing, operating and decommissioning, and all engineering and design work associated with those activities"*. A lifecycle management strategy includes the identified set of lifecycle activities that need to be done throughout an asset's lifecycle, and the estimated costs of undertaking these activities. In accordance with O. Reg. 588/17, the lowest cost lifecycle activities necessary to meet the Proposed Levels of Service should be adopted, as part of the lifecycle strategies and financial strategy required to meet the 2025 milestone.

Proactive maintenance and appropriately timed rehabilitations are the most economic lifecycle treatments. To illustrate this, consider a scenario where the cost of replacing an asset is $750,000 and it has an expected useful life of 75 years. Dividing the replacement cost by the expected useful life derives an annualized lifecycle cost of $10,000. This is the annual cost of delivering the service which the asset provides; however, the annualized lifecycle cost can be reduced by implementing a series of appropriately timed and selected maintenance and rehabilitation strategies. For example, assume that the total costs of undertaking the lifecycle strategies equate to $250,000 and have the effect of extending the total expected life of the asset to 115 years. Now, the annualized lifecycle cost has been reduced to $8,695, resulting in considerable annual savings. The AM approach strives to leverage lifecycle cost savings for all assets by considering the different lifecycle cost scenarios unique to each asset and selecting the lifecycle interventions that will maximize return on investment.

Asset condition data plays a critical role in AM decision-making, as it generally serves as the trigger for undertaking time-sensitive lifecycle activities. Accordingly, to support value-driven decision-making regarding infrastructure spending, up-to-date asset condition and performance data is required; therefore, asset conditions are periodically re-inspected on a cyclical schedule, specific to each asset group as appropriate.

Insofar as practicable, the AMP measures the physical conditions of assets using established industry standards. To ensure that the AMP can be easily interpreted by a wide audience, all assets are assigned an indexed condition rating on a scale from 1 to 100, wherever possible (with a score of 100 being the best condition, and 1 being the worst). In cases where providing a numerical condition rating is not possible, the asset is assigned a qualitative descriptor (*Very Good*, *Good*, *Fair*, *Poor*) based on the best available information, which may include inspection reports, performance assessments and other relevant documentation. As defined in the International Organization for Standardization (ISO) 55000 Standard, ***Performance*** means *"the ability of an asset to fulfill the organization's objectives or requirements"*. Accordingly, an asset within the "*Very Good*" to "*Good*" performance category meets the Township's requirements and delivers the expected level of service, whereas an asset within the "*Poor*" performance category is failing to meet the Township's requirements and deliver the expected level of service.

An objective of the AMP is to ensure that the overall condition of an asset group will not decrease over time, which will require the development of a financial strategy to ensure that this objective can be realized. Additionally, each core infrastructure asset category should meet Proposed Level of Service objectives, which includes those prescribed by O. Reg. 588/17, and may include other Level of Service objectives established by Council.

The Township recognizes that for the AMP to be effective, it must support the development of the annual budgeting process. To fully implement sustainable service delivery, it is necessary to determine the funding shortfall between annual budget allocations and annualized infrastructure funding needs. By determining this "*Infrastructure Gap*", the Township can assess the most appropriate funding strategy to meet its projected needs and available resources for future asset investment. For the purposes of the AMP, competitive merit-based grant program funding is not considered; while highly beneficial, the availability of this funding is not guaranteed, and therefore should not be relied upon.

In alignment with the Township's Strategic Asset Management Policy (2019), the AMP strives to manage all assets in a coordinated, efficient, and strategic manner, cognizant of all other corporate strategic plans and initiatives including the Official Plan, Community Based Strategic Plan, Water Financial Plans, Water and Wastewater Connection Charge Studies, Development Charges Background Studies, Master Servicing Plans, Recreation Master Plans, annual budgets, capital forecasts, operational policies, and other relevant approved documents.

Furthermore, it is recognized that lifecycle planning must be interdependent, meaning that assets should not be managed in isolation from one another. The Township recognizes that value, efficiency, and cost-savings can potentially be realized through the coordination of capital plans between linear underground infrastructure and other core infrastructure situated within the road allowance; therefore, in some scenarios, the coordination of capital plans may influence the timing of linear asset replacement. While the core infrastructure asset categories are discussed separately for the sake of a complete and organized AMP format, all core infrastructure assets sharing the same road allowance should considered holistically at the project level.

The Township has a population of 10,989 as reported by Statistics Canada in the most recent official census data (2021); therefore, the requirements for including detailed costing associated with population and employment growth listed under Section 6(1), 6 (i-iii), O. Reg. 588/17, do not apply. Alternatively, growth-related assumptions pertaining to AM are discussed within the section of the AMP respective of each core infrastructure asset category, in accordance with Section 6(1), 5 of O. Reg. 588/17 (applicable to municipalities with populations less than 25,000).

3. Drinking Water Assets

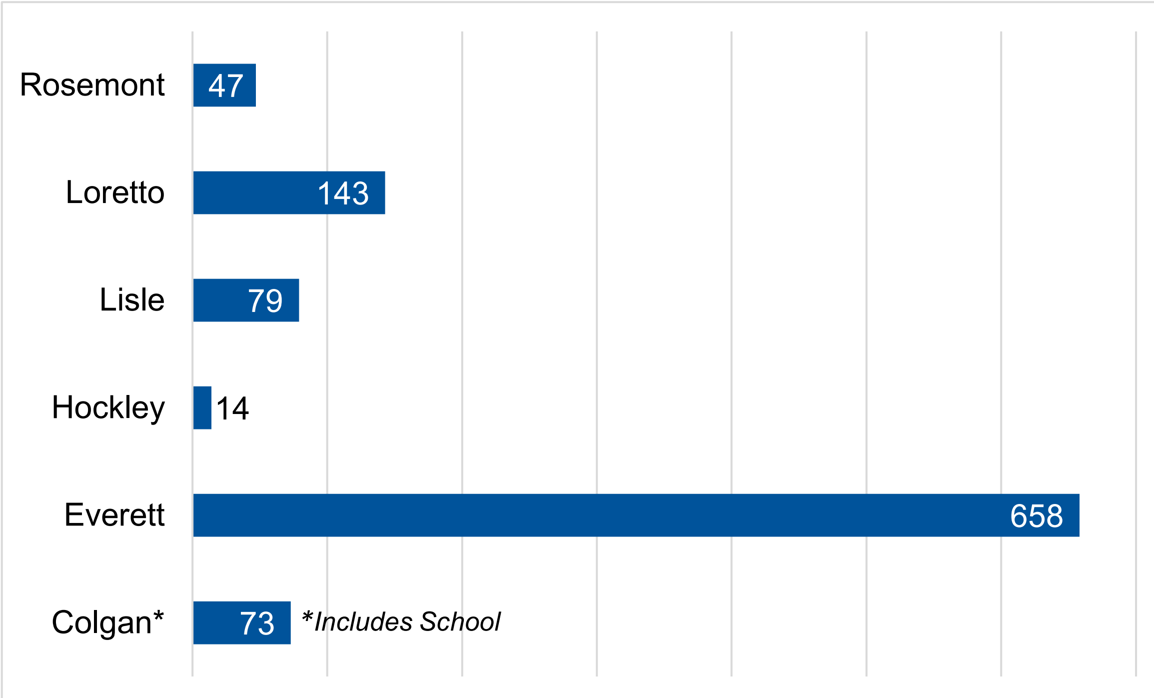
3.1. Service Delivery Overview

The Township owns six (6) independent municipal Drinking Water Systems (DWS), altogether supplying potable water to a total of 1014 properties within the settlement areas of Lisle, Everett, Rosemont, Loretto, Hockley, and Colgan. Although physically operated as separate systems due to geographic distribution and separate aquifer sources, they are managed administratively as one cohesive unit. Currently, the Township contracts the daily operations and maintenance activities to the Ontario Clean Water Agency (OCWA). All water assets are managed, operated, and maintained to meet provincially issued system and facility operating permits and licenses.

As defined by O. Reg. 170/03, Everett and Loretto are currently classified as Large Municipal Residential Systems (LMDWS), whereas Lisle, Rosemont, Hockley, and Colgan are classified as Small Municipal Residential Systems (SMDWS). Notwithstanding, the Township's DWS generally exemplify a small-scale rural character. As shown in **Figure 3-1**, the number of total service connections per DWS range from 14 in Hockley, up to 658 in Everett. The Township's DWS predominantly service residential properties. There are very few commercial, industrial, or institutional service connections.

Each DWS is unique, having been constructed with different design and construction procedures, consistent with the engineering practices of their age and subject to various maintenance activities and retrofits over time as required. Furthermore, each DWS requires unique operational considerations due to differences among aquifer characteristics, distribution networks, water demand, and water supply.

Figure 3-1: Count of Service Connections by Drinking Water System (to 2022)



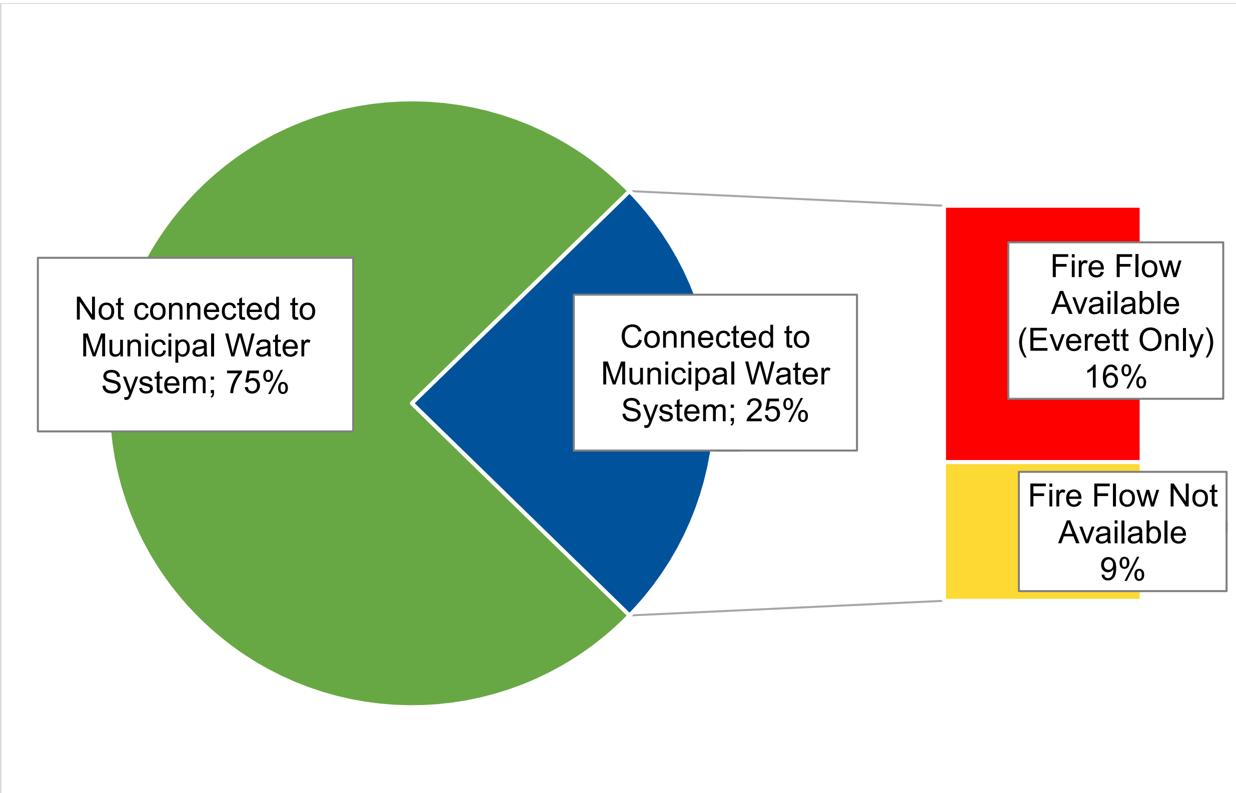
All Township DWS rely on groundwater resources. Raw groundwater is drawn from the underlying aquifer and treated at each wellhouse. It is further distributed and metered to all the water customers while meeting regulated pressure, flow and quality standards. Additionally, the Everett, Rosemont, and Colgan DWSs include below-ground reservoirs as a means of storing treated water to efficiently accommodate peak demand.

Each DWS is a fully integrated system, generally comprising multiple production wells and wellhouses which helps to provide a level of resilience to manage risks associated with unplanned service disruptions. Alternatively, when required the Township will haul potable water to augment supply as needed to maintain service delivery and compliance with Provincial regulations.

All DWS are operated to ensure sufficient quality, flow and pressure to satisfy drinking needs. In the Everett DWS, pressure and flow requirements for fire protection are met, whereas the hydrants in the other DWS are for maintenance purposes only.

A significant challenge in achieving financial sustainability of the Township's DWS is that the number of service connections is insufficient to generate the economies of scale, thus rates do not cover capital, operating, and maintenance costs. Currently, 25% of properties within the Township are connected to Municipal Water as shown in **Figure 3-2**. The Township's approved 2021 Water Financial Plan forecasts that financial sustainability of the Township's Water Assets will be achieved by 2031 based on growth projections. Also, the percentage of properties where fire flow is available will increase as a result of anticipated residential growth.

Figure 3-2: Total Municipal Water System Connections and Fire Flow Availability



3.2. Current Replacement Value

The Township's delivery of municipal drinking water services requires an extensive network of infrastructure valued at approximately $26.7 Million. Water assets are broadly categorized into two groups: *Linear* and *Facilities*; current replacement values are estimated at $17.0 Million and $9.7 Million respectively, as detailed in **Table 3-1**.

Table 3-1: Water Assets Estimated Current Replacement Value (2021$)

ASSET CATEGORY	QUANTITY	CURRENT REPLACEMENT VALUE (MILLIONS; 2021$)
Water Facilities	11 facilities	$9.7
Water Linear	24.3 km	$17.0
TOTAL		**$26.7**

The service of providing safe municipal drinking water is delivered by infrastructure assets related to production, storage, treatment, and distribution. The *Facilities* asset category is inclusive of municipal wells, pumps, treatment trains, storage reservoirs, standby generators, and building envelopes. The *Linear* asset category is inclusive of watermain, hydrants, system valves, and sampling points; the municipally-owned portion of private services and water meters are both currently not included in the AMP, and instead are managed on an as required basis.

3.3. Asset Age and Condition

The Township has determined that free swimming condition assessment tools and methodologies are cost-prohibitive and impractical for much of its watermain inventory which is characterized by small diameter pipes with frequent appurtenances. Alternatively, factors for determining watermain renewal needs are performance (i.e. break history, water loss), estimated remaining service life (as determined by material type and installation date), and coordination with other capital plans.

It is also noted that the Reliability Level of Service Measures prescribed by O. Reg. 588/17 pertaining to Water Assets (see **Appendix A**) are indicative of condition to an extent; these include:

- *The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.*
- *The number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system.*

O. Reg. 588/17 defines "connection-days" as *"the number of properties connected to a municipal system that are affected by a service issue, multiplied by the number of days on which those properties are affected by the service issue".* The Township and its Operating Authority routinely track and record the operational data needed to generate these reports.

Figure 3-3 shows the trending for the reliability measures over the last four years, from 2018 through 2021. The data reflects that relatively few watermain breaks have occurred during recent years, suggesting that watermains are generally in a fair physical condition, based on performance.

Figure 3-3: Reliability Level of Service Measures for Water Assets (2018-2021)

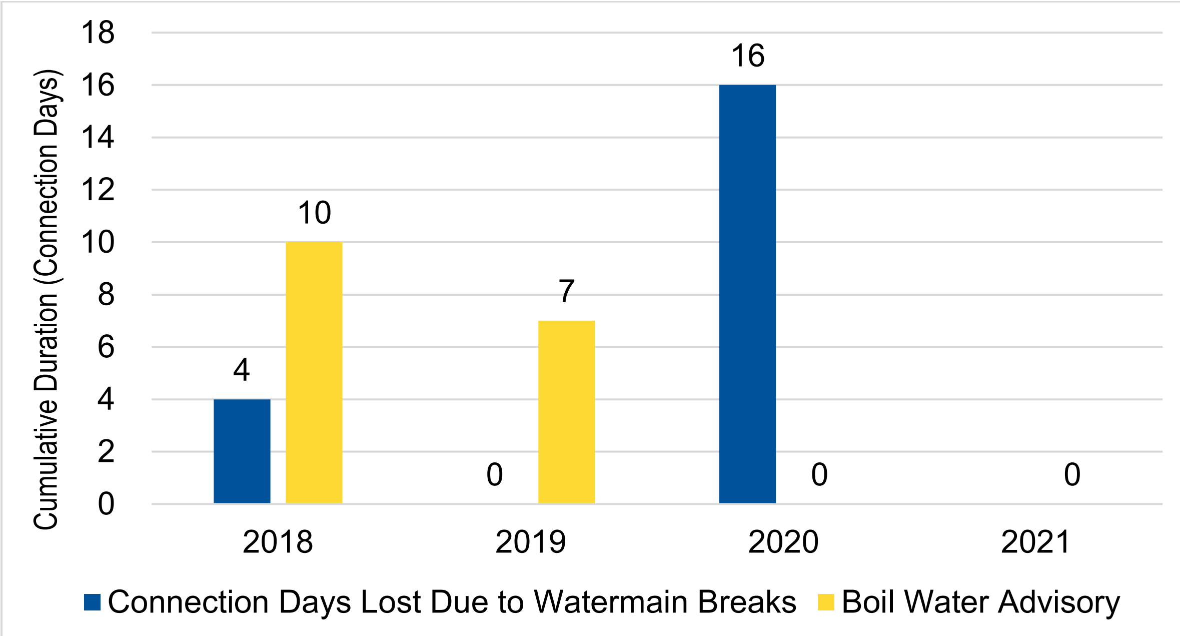
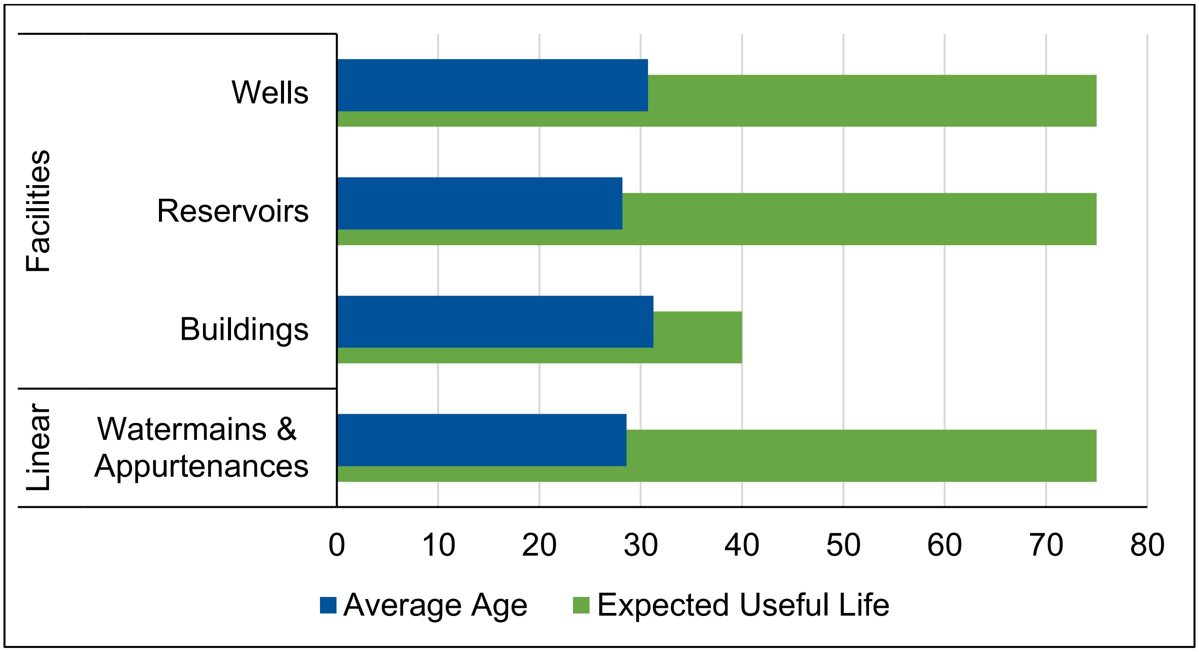


Figure 3-4 depicts the average ages for each water asset group relative to expected useful life. Asset ages have been established based on available historical records in alignment with the Township's Financial Tangible Capital Asset (TCA) database. As discussed, the installation date (asset age) is reflective of watermain condition, and would be a key deciding factor (among a variety of other factors, in determining when to schedule replacement or rehabilitation of *Linear* Drinking Water assets.

Figure 3-4: Average Age of Water Assets Relative to Expected Useful Life



All the Township's watermains comprise Polyvinyl Chloride (PVC) pipe, with the exception of a section in Lisle comprising Cast Iron pipe. An estimated service life of 75 years is assumed based on the PVC and Cast Iron pipe materials.

Downhole well inspections are completed periodically through a retained specialized third-party to video record the condition of the well casing; maintenance needs identified through the inspections are subsequently scheduled for the necessary improvements.

The Township's below-ground reservoirs are typically pumped out and cleaned on an approximately 7-year cycle as part of routine maintenance. During these activities, the chambers are visually inspected for potential structural defects.

The building envelopes, and the treatment trains which they house, are generally maintained in a "*Good*" condition by undertaking major maintenance projects as required through annual capital budget allocations.

On average, the Township's Water *Facility* assets are in a "*Good*" condition, reflective of the value derived from annual capital investments, while Water *Linear* assets are in a "*Fair*" condition meaning they are meeting current needs but are aging and will require budgeting to support the necessary projects to sustain current levels of service.

3.4. Lifecycle Management

The Level of Service delivered to the community is based on the propensity of these assets to continue fulfilling their purpose. Appropriate maintenance is therefore critical to sustain Level of Service.

Non-functioning, or under-performing components within the system can result in unplanned service disruptions; however, given the Township and Council's obligations to uphold the *Standard of Care* under the *Safe Drinking Water Act, 2002*, any such unbudgeted work is typically completed on an emergency basis.

The spending required to provide the lifecycle activities needed to maintain the current service levels for water assets is detailed in **Table 3-2** below. The Township's AMP is aligned with its Water Financial Plan under Regulation 453/07.

Table 3-2: Water Assets – 10-year Capital Needs Forecast

TIMEFRAME	PLANNING HORIZON	ESTIMATED SPENDING REQUIRED TO MAINTAIN CURRENT SERVICE LEVELS (2021$)	
		Facilities	Linear
Short-term	1 - 5 years	$ 950,000.00	$ 309,000.00
Medium-term	5 - 10 years	$ 1,160,000.00	$ 834,000.00
Total 10-year Cost Projection		$ 3,253,000.00	
Annualized Budget Estimate		**$ 325,300.00**	

Based on the capital needs forecasted over the 10-year planning horizon, the estimated spending required to maintain asset performance of the water systems is approximately $3.25 M, resulting in an annualized budget estimate of $325,300.

As this is an average annual budget estimate, minor year over year variations are to be expected in the actual annual funding requirements; however, the use of reserves may be a prudent strategy to soften these fluctuations.

Major maintenance upgrades to the Water Facilities are based on needs assessments and recommendations from the Operating Authority. These Major Maintenance and Capital projects are funded through the Township's Annual Capital Budgets.

Based on the best current available age and performance information, there are no capital needs projected for the linear distribution network within the 10-year planning horizon, however, provisions for linear assets are reflective of the Township's approved 2021 Water Financial Plan. Also, based on specific recommendations from the Ministry of Environment, Conservation and Parks (MECP), the Township should consider options to undertake detailed leak detection surveys for its watermain assets. Pinpointing and repairing leaking pipe sections would serve to reduce water losses and help to support holistic maintenance and capital planning.

4. Wastewater – Sanitary

4.1. Service Delivery Overview

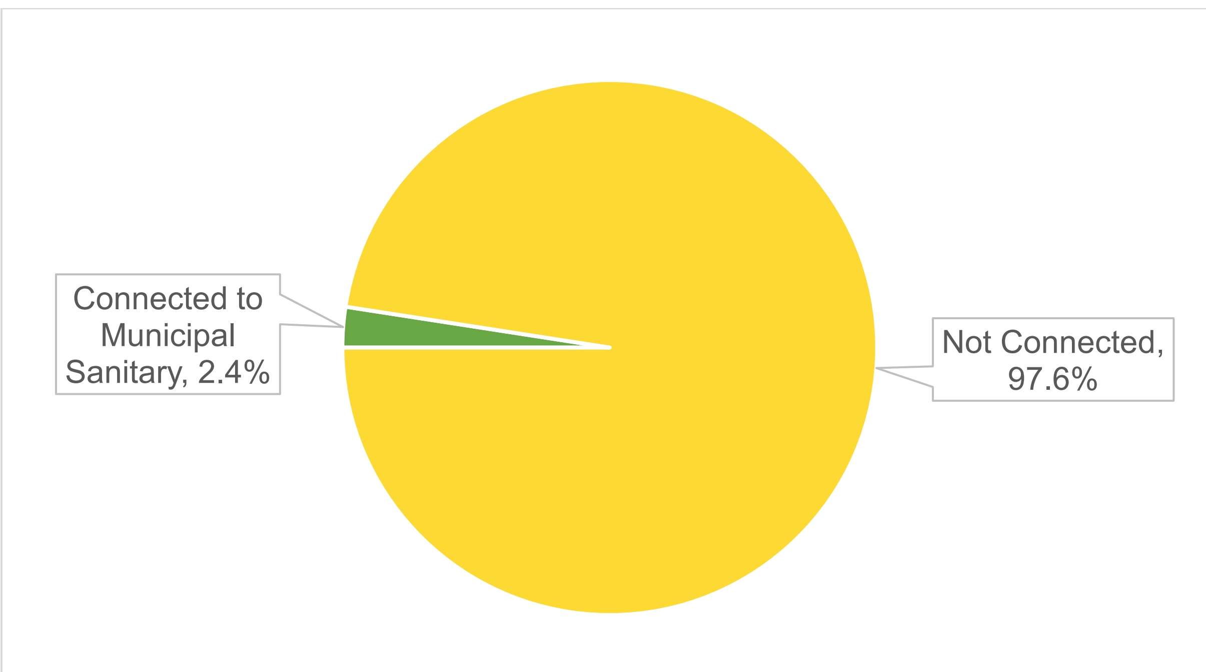
The Township's Sanitary Wastewater assets are contained within one system, known as the New Horizon sanitary system. This system comprises approximately 1.5 kilometres of gravity sewers and two (2) pumping stations that convey wastewater from 100 detached residential units to a Rotating Biological Contactor (RBC) package plant, where it is treated and ultimately discharged to the subsurface environment through three (3) leaching beds. The collection system consists of separate sanitary sewers that do not integrate with any municipal stormwater management systems.

OCWA is contracted by the Township as the Operating Authority for the Township's sanitary wastewater assets.

Flat rate billing is currently applied to users as sanitary wastewater is not metered at each connection.

Figure 4-1 shows the percentage of properties within the Township connected to the municipal wastewater system.

Figure 4-1: Percentage of properties connected to municipal wastewater system



The Reliability Level of Service Measures prescribed under O. Reg. 588/17 (see **Appendix A**) are not applicable. Since there are no combined sanitary/storm sewers in the Township, all sanitary wastewater is collected by a dedicated gravity sewer system. Furthermore, any effluent exceedances for this system are relative to objective limits and do not represent violations. The Township, through its Operating Authority, undertakes all reasonable efforts to operate the plant in accordance with the standards and conditions set out in the Environmental Compliance Approval (ECA). It is noted that despite the best efforts on the part of the Township and its Operating Authority, the effluent often exceeds the objective limits set out in the Environmental Compliance Approval (ECA) for Total Nitrogen.

4.2. Current Replacement Value

As shown in **Table 4-1**, The Township's current delivery of Wastewater services requires a network of infrastructure valued at approximately $2.7 Million. These Wastewater assets are categorized into two groups: *Linear* and *Facilities*. The *Linear* asset group is inclusive of the assets that convey sewage to a sewage treatment plant, including gravity sewers, maintenance holes, and pumping stations. The *Facilities* asset group is the sewage treatment plant, inclusive of the system components comprising the liquids and solids treatment trains, building envelope and sewage disposal components.

Table 4-1: Wastewater Assets Estimated Current Replacement Value (2021$)

ASSET CATEGORY	QUANTITY	CURRENT REPLACEMENT VALUE (MILLIONS)
Wastewater Facilities	1 facility	$1.4
Wastewater Linear	1.5 km	$1.3
TOTAL		**$2.7**

The New Horizon Sanitary Facility exhibits many critical performance issues to the extent that rehabilitation is not technically nor financially feasible. Accordingly, the future capital plan for this asset is divestment, not replacement. In this regard, it should be noted that the current replacement value reported above for Wastewater *Facilities* is not relevant to the Township's future service delivery plans.

Considering future development plans within the area, the Township has identified a prudent alternative to continue providing service for existing users while leveraging economies of scale. This option, which is supported through Class Environmental Assessment and detailed in the Everett Master Servicing Plan, involves decommissioning the existing RBC, undertaking necessary pumping station retrofit, and installing a new sanitary forcemain to convey flows to a state-of-the-art Membrane Biological Reactor (MBR) Wastewater Treatment Plant, which is anticipated to be constructed by a residential developer in the foreseeable future, and subsequently assumed by the Township.

This solution is consistent with the Township's Everett Master Servicing Plan (MSP) Class Environmental Assessment (EA) Addendum #2, and more specifically the preferred wastewater conveyance solution identified therein (Option WWC-F). Nine (9) other alternatives were also considered as part of the EA process.

It is envisaged that the new Wastewater Treatment Plant (WWTP) in Everett will be a state-of-the art Membrane Bioreactor (MBR) plant, capable of treating wastewater to the limits of technology.

4.3. Asset Age and Condition

The New Horizon sanitary system was commissioned in 2003 and assumed by the Township in through Provincial mandate in 2005. As such, the sanitary wastewater assets are approximately 19 years of age.

The condition of the *Sanitary Facility* is deemed to be "*Poor*", due to its irreparable performance deficiencies. In 2018, OCWA prepared a detailed Facility Optimization Report for the Township, which provides detailed discussions regarding the plant's technical challenges and recommends the best operating practices while considering the future plans to divest the *Facility* (i.e. low or no cost improvement options). While the Township does not have numerical condition rating data for the *Facility*, there is sufficient information available to justify assigning it a "*Poor*" condition.

Physical conditions of sanitary gravity sewers and maintenance holes are periodically inspected using Closed-circuit Television (CCTV) to ensure they are functioning properly and to identify any structural defects. The latest CCTV Inspection in 2020 revealed that there are no remedial works or capital improvements required at this time. The two Sanitary Pumping Stations are subject to annual cleaning, inspection, and pump servicing on an ongoing operational basis to ensure reliable service delivery. The overall condition of assets within the *Sanitary Linear* group is deemed to be "*Good*", based on inspection findings, estimated remaining service life, and asset performance.

4.4. Lifecycle Management

The estimated costs associated with sustaining the current service levels for sanitary wastewater assets are detailed in **Table 4-2** below.

The New Horizons *Facility* is not a suitable candidate for any long-term investment; however, routine operational and maintenance expenditures continue to be required in the interim to keep the plant functional and avoid any costly mechanical breakdowns. The feasibility of rehabilitating the *Facility* was considered but determined not to be a practical or financially viable solution, on the basis that the plant cannot be made capable of providing reliable and satisfactory performance.

As per the approved Everett MSP, the lifecycle strategy for the Wastewater *Facility* assets entails retrofitting the existing wastewater treatment facility into a pumping station and constructing a forcemain to convey the effluent from this system to a new WWTP that is anticipated to be constructed for a new residential development. The existing sanitary collection system assets, which are currently in "*Good*" condition would remain in service.

Conveying the existing New Horizons sewage flows using the proposed forcemain and pump station delivers significantly lower life-cycle costs compared to the extent of work required to sustain Levels of Service through the current *Facility* in the long-term. The envisaged new state-of-the-art MBR WWTP will also provide the wastewater treatment to the limit of technology. The cost of the new WWTP, which will service new residential development, as well as the existing sanitary wastewater users is estimated to be $2.82 M. The Township has, and continues to, actively explore partnership opportunities to improve the affordability of fully implementing the approved solution. To date, no specific financial arrangements have been determined. The costs of constructing new assets related to growth is not factored into **Table 4-2**.

The duration for which ongoing capital expenditure will be required for the existing *Facility* is dependent on the timing of the approved development plans in Everett.

Table 4-2: Wastewater Assets – 10-year Capital Needs Forecast

TIMEFRAME	PLANNING HORIZON	ESTIMATED COSTS TO MAINTAIN CURRENT SERVICE LEVELS	
		Facilities	Linear
Short-term	1 - 5 years	$ 75,000	$ 140,000.00
Medium-term	5 - 10 years	-	$ 170,000.00
Total 10-year Cost Projection		$ 310,000	
Annualized Budget Estimate		**$ 31,000.00**	

5. Wastewater – Storm

5.1. Service Delivery Overview

The Township's Stormwater Management (SWM) assets are categorized into two groups: *Facilities* and *Urban Linear*. *Facilities* include Wet Ponds, Dry Ponds, Enhanced Swales, and each of these asset's appurtenant structures. *Urban Linear* includes Storm Sewer systems which are an integral component of an urban roadway design, generally comprising a system of pipes, catch basins, maintenance holes, curb-and-gutter and other structures.

The function of SWM assets is to control the flow rate and quality of stormwater runoff, effectively serving to protect properties from flood risks and minimize environmental impacts to receiving water bodies. Altogether, the AMP identifies 10 stormwater assets situated within the Township's urban and semi-urban developments.

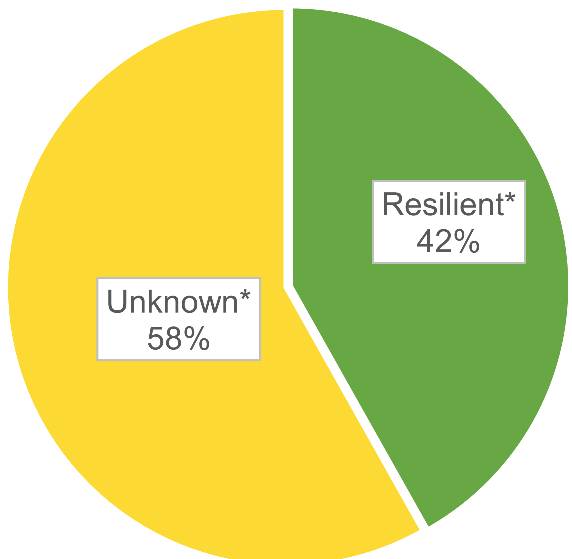
The AMP addresses existing SWM facility components that are subject to approval requirements under Section 53 of the Ontario Water Resources Act, R.S.O. 1990, c. O.40. (OWRA). Like many other municipalities in Ontario, the Township is currently working with the MECP towards a Consolidated Linear Infrastructure – Environmental Compliance Approval (CLI-ECA), which is a relatively new administrative framework that will foster efficiency and support holistic management of the Township's SWM assets. The current SWM asset inventory has been identified based on the available site-specific ECAs and available records.

For the purposes of the AMP, SWM assets are generally those which are approved by the MECP through an ECA; therefore, it is important to note that not all municipally-owned drainage features are considered SWM assets, or are necessarily within the scope of the 2022 AMP. For example, roadside ditches in rural and semi-urban environments are considered as an integral component of the adjacent road asset and are addressed through **Section 4** of the AMP. Also, while the Township has jurisdiction over Municipal Drains, they are excluded from the AMP since all aspects relating to Municipal Drains are managed in accordance with the legislative framework set out in the Drainage Act, R.S.O. 1990, c. D.17.

The prescribed Level of Service measures under O. Reg. 588/17 S.5(2), 1(i), Table 3 pertain to flood protection provided by municipal stormwater management systems (see **Appendix A**).

A prescribed Level of Service is the percentage of properties in the municipality resilient to a 100-year storm. The data available from the local Conservation Authorities is based on different return period events and assumptions; therefore, it is noted that the analysis could yield misleading results based on the data currently available. Alternatively, to determine this Level of Service measure it is assumed that all properties situated within a plan of subdivision are resilient to the 100-year storm. The results are illustrated in **Figure 5-1**. There is a high degree of unknown, as the Township does not have information for rural properties. Anecdotally, it is noted that many of these rural properties within the Township are larger rural parcels that include natural drainage features.

Figure 5-1: Percentage of Properties Assumed to be Resilient to a 100-year Storm



Another prescribed Level of Service is the percentage of the municipal stormwater management system resilient to a 5-year storm (see **Appendix A**). Based on the best current available information and records, 100% of the Township's stormwater management systems are resilient to the 5-year storm event.

5.2. Current Replacement Value

As shown in **Table 5-1**, the estimated current replacement value for the Township's 10 municipal SWM assets is $3.58 M.

Table 5-1: Stormwater Assets Estimated Current Replacement Value (2021$)

ASSET CATEGORY	ASSET COUNT	CURRENT REPLACEMENT VALUE
Wet Ponds & Appurtenances	2	$875,000
Dry Ponds & Appurtenances	3	$1,050,000
Swales & Appurtenances	2	$820,000
Storm Sewer Systems	3	$830,000
TOTAL	**10**	**$3,575,000**

It should be noted that while "*Current Replacement Value*" is the common terminology used throughout the AMP, in the particular case of *Facilities* (i.e. Ponds and Swales), the majority of the lifecycle costs pertain to periodic sediment removal required to maintain the functionality of the system; therefore, the activity itself does not necessarily entail "replacement" but rather "restoration".

5.3. Asset Age and Condition

The Township is aware of newly emergent standards such as CSA W211:21; however, there does not appear to be any generally accepted condition rating methodology for SWM ponds and swales. It is noted that a commonality throughout the relevant literature is that each asset should be inspected to determine whether remedial improvements are required. The inspections should have a particular focus on the extent of any apparent sediment build-up, and the physical condition of the inlet and outlet structures, as well as other site features and appurtenances.

In accordance with site-specific ECA requirements for SWM assets, the Township carries out routine inspections on an operational basis to determine maintenance and renewal requirements. While the inspection documentation is detailed, the findings are not set up in a format that can be translated to a numerical condition rating scale.

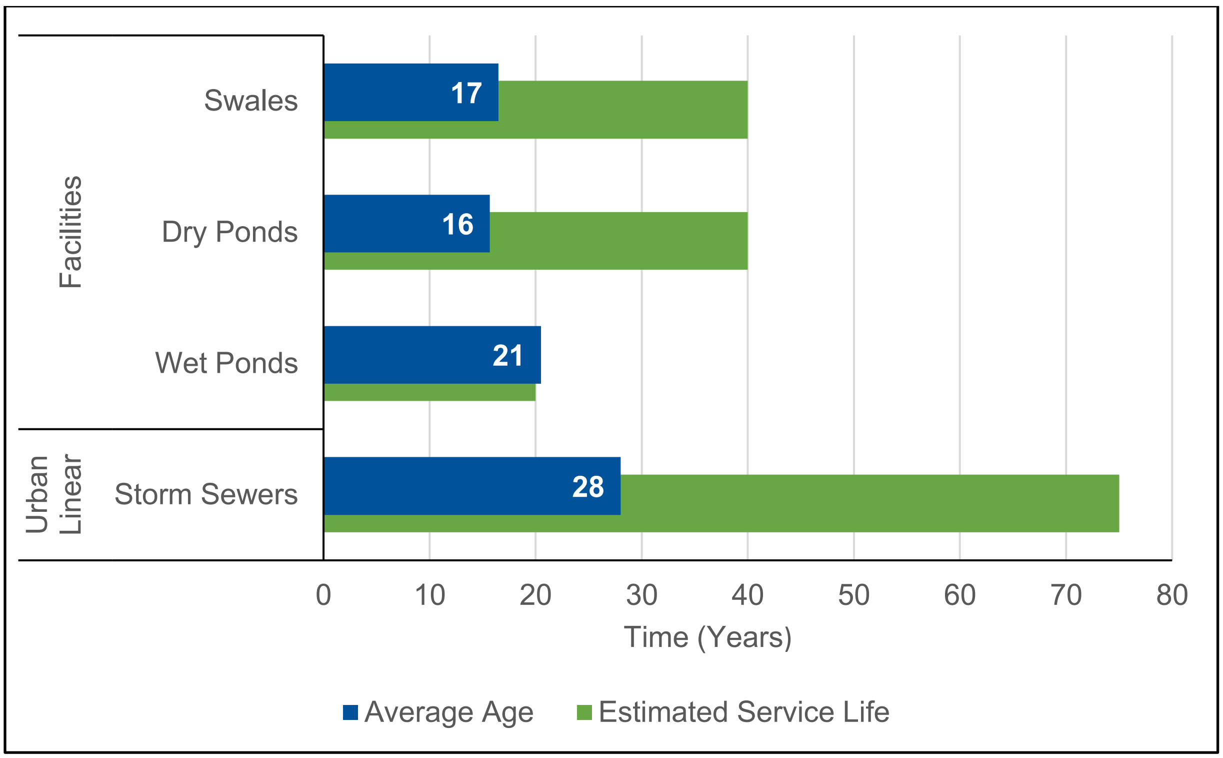
The average age of stormwater assets relative to service life, are presented in **Table 5-2**, which suggests that all SWM assets (except for Wet Ponds) are not expected to require any major works within the 10-year capital forecast. Based on the findings of routine operational inspections and past history, all SWM assets are noted to be functioning properly at this time.

It is also recognized that the remaining availability of sediment storage within a Wet Pond cannot be determined based solely on its age. Engineering investigations for Wet Ponds should be undertaken to determine the extent and timing of future sediment removal work required.

The physical condition of underground storm sewer systems are also inspected on a periodic basis to ensure they are functioning properly and in sound structural condition. To this end, specialized contractors carry out CCTV inspections and record all observed deficiencies in accordance with the PACP condition rating methodology. Structural defects identified through the CCTV inspections are used to determine the overall physical asset condition.

The Township's Storm Sewers have been assigned an estimated service life of 75 years, consistent with the construction materials which consist of PVC pipe, concrete pipe, and concrete structures. Sediment accumulation within Storm Sewers is removed on an operational basis and prior to CCTV inspections.

Figure 5-2: Average Age of Stormwater Assets relative to Estimated Service Life



Overall, the Stormwater Assets in the Township, including *Facilities and Urban Linear* are assigned a "*Fair*" condition rating, based on performance, inspections, and age.

5.4. Lifecycle Management

Contaminants such as metals, bacteria, and nutrients bind to sediment, and accumulate within the assets over their service life; therefore, over time as sediment accumulates within a SWM asset, the storage volume available for Total Suspended Solids (TSS) decreases until a threshold is reached where removal is required to restore the full functionality of the asset.

Maintenance is critical to ensure the optimal and long term continued functionality of urban and semi-urban SWM facilities. A lack of maintenance could result in premature SWM asset failures and/or poor performance, translating to increased risk of flood impact or undue environmental impact to the receiving waterbody.

The costs of sediment disposal could vary between assets depending on the presence and configuration of on-site sediment drying areas, as well as the degree of contamination found in the sediment (the parameters found in the sediment are dependent on land usage within the drainage area).

It is estimated that the required frequency of sediment removal is 20 years for Wet Ponds, and 40 years for Dry Ponds and Swales; however, it is also recognized that the timing of maintenance work will ultimately be governed by the actual sediment accumulation and loading rates at each the facility.

From a lifecycle perspective, to sustain the Township's SWM assets over the long-term, the annualized costs are $92,000, calculated by dividing the estimated Current Replacement Values by the estimated service lives of each asset. Historically, the Township currently has maintained a reserve account for the specific purpose of SWM pond maintenance. Future annual reserve contributions should be reflective of the needs identified within the AMP.

Table 5-2: Stormwater Assets – 10-year Capital Needs Forecast

TIMEFRAME	PLANNING HORIZON	ESTIMATED SPENDING REQUIRED TO MAINTAIN CURRENT SERVICE LEVELS (2021$)			
		Facilities			*Urban Linear*
		Wet Ponds	Dry Ponds	Swales	Storm Sewers
Short-term	1 - 5 years	$800,000	-	-	$75,000
Medium-term	6 - 10 years	-	-	-	-
Total 10-year Cost Projection		$875,000.00			
Annualized Budget Estimate		**$87,500.00**			

It should be reiterated that these forecasted capital needs for Wet Ponds are assumed solely based on the age of the assets relative to their estimated service life. To validate the extent and timing of any sediment removal work required, engineering investigations should be carried out as soon as practicable. While the Township does conduct routine visual reviews of its facilities, it is noted that these inspections are generally limited in their ability to assess underwater sediment accumulation. Bathymetric surveys are commonly undertaken by municipalities through a specialized contractor to assess subaqueous conditions of Wet Ponds.

Moving forward, as a potential option for minimizing lifecycle costs of Wet Ponds, the Township may consider whether proactive and more frequent sediment removal from forebays would have the effect of extending the overall service life and reducing the frequency of more costly main cell cleanouts.

6. Transportation – Roads

6.1. Service Delivery Overview

The Township is responsible for 613.646 lane kilometres of roadway, equating to 306.823 centreline-kilometres. All roads within the Township are bidirectional routes; therefore, it should be noted that total centreline-kilometres are equivalent to half of the total lane-kilometres.

The Township's municipal roads provide transportation services for passenger vehicles, commercial vehicles, heavy trucks, and over-dimensional farm vehicles. The Township's roadways are predominantly rural, and generally lack sufficient width or separate facilities to support pedestrians, cyclists and other forms of multi-modal transportation.

Roadside drainage, such as ditches, convey flows to an outlet and their function is essential for long-term road durability, due to the fact that granular road bases in a saturated condition are generally unstable and cannot support loading imposed by vehicular traffic without deforming. Roadside drainage ditches in rural and semi-urban cross-sections are considered to be integral road asset components and are generally distinct from SWM assets which are addressed in **Section 3** of the AMP.

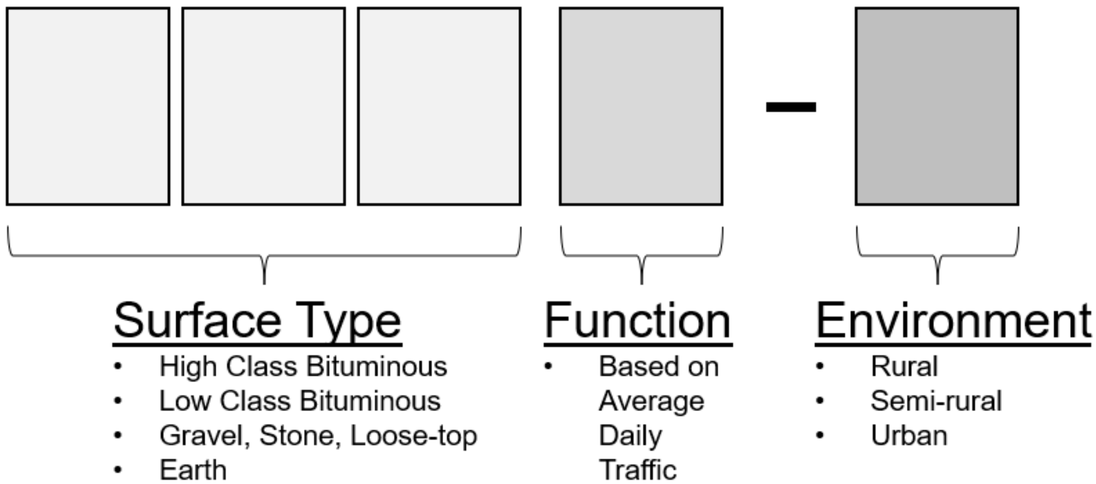
The information presented in the Roads Section of the AMP is reflective of the comprehensive needs assessment of the Township's road network prepared by 4 Roads Management Services Inc. entitled, *"2020 State of the Infrastructure and Asset Management Plan for Roads"*, the findings of which were presented at the Special Meeting of Council on September 2, 2020.

6.1.1. Road Asset Profiles

All road assets are categorized based on key identifiable characteristics, with each possible combination of unique variables forming what is referred to as a "*Road Asset Profile*".

As illustrated in **Figure 6-1**, *Road Asset Profiles* are determined based on the unique string created by the applicable combination of variables within each of the following three categories: (1.) *Surface Type*, (2.) *Function*, and (3.) *Environment*.

Figure 6-1: Naming Convention for Road Asset Profiles



The three characterizations making up the *Road Asset Profile* each entail unique implications: *Surface Type* provides the basis for the lifecycle activities which may be appropriate; *Function,* which is predominantly governed by traffic characteristics, further predicts the rate of deterioration and timing of lifecycle activities; and, *Environment* is assigned to inform the road asset's replacement cost. Additionally, it is noted that the quality of the design and construction of a road asset also inherently governs the viability and recommended timing of various lifecycle activities; however, considerations of this nature must be subject to project-level assessment.

These *Road Asset Profiles* could be incorporated into the framework for determining proposed levels of service, which must be established in the 2024 AMP in accordance with O. Reg. 588/17, S. 6 (1). Setting distinct Levels of Service specific to characteristics making up each *Road Asset Profile* (i.e. *Surface Type*, *Function*, and *Environment*), would support a pragmatic and transparent approach to deliver achievable and affordable service delivery, while managing the Township's inherent risks associated with having jurisdiction over a public transportation network.

Surface Type, *Function*, and *Environment* are described in more detail in the following sections.

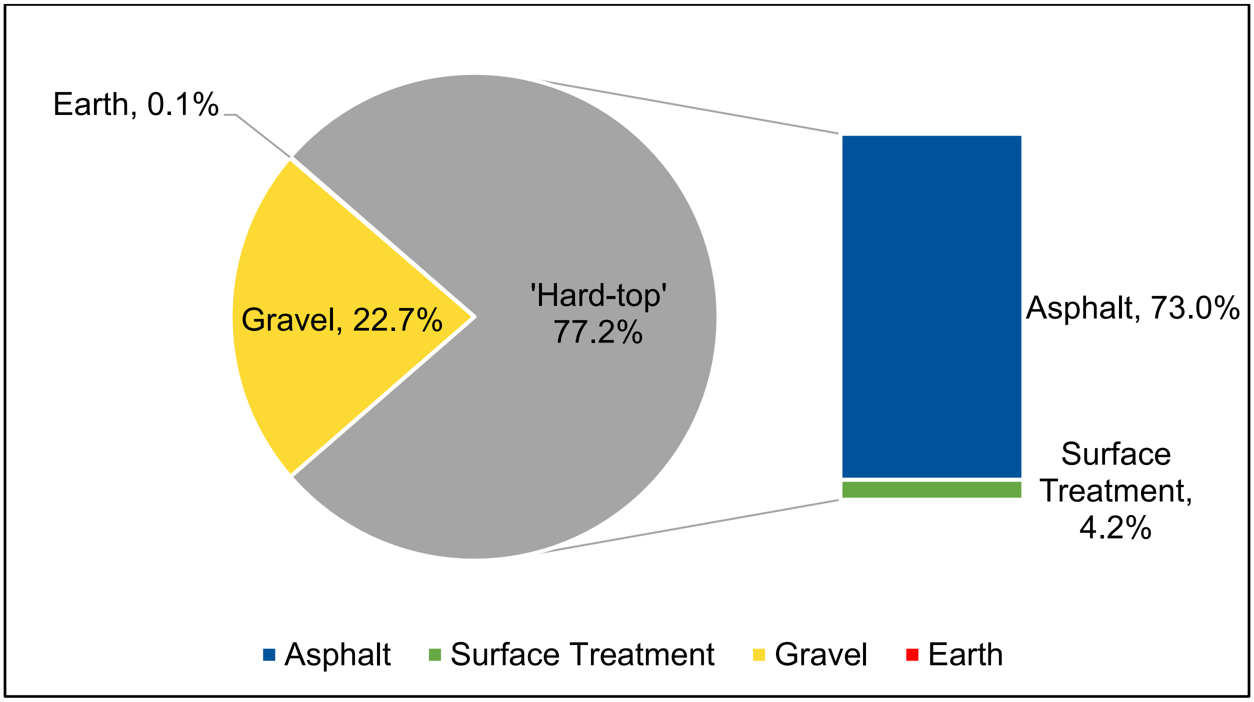
6.1.1.1. Surface Type

“High Class Bituminous” road surfaces (commonly referred to as “asphalt”) are represented within a *Road Asset Profile* using the acronym “HCB”. “Low Class Bituminous” road surfaces (commonly referred to as “surface treatment”, or “chip-and-tar”) comprise a matrix of stone chips bonded in asphalt emulsion, and are represented within a *Road Asset Profile* using the acronym “LCB”. Both HCB and LCB are considered “hard-top” bituminous paving mixtures. Altogether, the Township’s network inventory includes 236.948 centreline kilometres of “hard-top” roads comprising 77.2% of the network, as shown in **Figure 6-2**.

“Gravel, Stone, and Loose-top” road surfaces (commonly referred to as gravel) are represented within a *Road Asset Profile* using the acronym “GST”. Since 2020, the Township has been specifying the “Granular M” aggregate specification (OPSS.MUNI 1010) for gravel road resurfacing maintenance to improve asset performance and user experience. Granular M comprises a tight gradation of crushed particles, aggregates, and fines to hold the shape of the road and minimize airborne dust during periods of dry weather. The Township’s road inventory currently includes 69.633 centreline kilometres of gravel roads, comprising 22.7% of the network, as shown in **Figure 6-2**.. In recent years, this proportion has seen a decrease as hard-top conversions are carried out. Specifically, during the period from year 2020 to 2022, a total of about 9.6 centreline kilometres of gravel roads have been, or are scheduled to be, subject to hard-top conversion resulting in an average of 3.2 centreline kilometres annually.

“Earth” road surfaces comprise compacted fill or subsoils and are represented within a Road Asset Profile using the acronym “ETH”. The Township’s road inventory includes only one asset with an earth surface, which is a no-exit stub road, 0.242 km in length, used for private access, as shown in **Figure 6-2**.

Figure 6-2: Road Inventory Composition by Surface Type



6.1.1.2. Environment Class

The three (3) unique *Environment* characterizations used in part to determine the *Road Asset Profile* are described below. *Surface Type* by centreline-kilometre relative to each *Environment* are summarized in **Figure 6-3** below.

Rural:

Within the Township, Rural roads are generally the early Concession Roads and Sideroads established by Crown Surveyors. These routes would have been established prior to the invention of the motor vehicle. Over time, in response to changing transportation demands, these original paths would been built up, widened, and in some cases, paved. Many of these road assets in service today would not have been subject to modern engineering design; instead, they were likely constructed using the best judgement, materials, and methods available at the time. Rural roads comprise 86.12% of the Township's network.

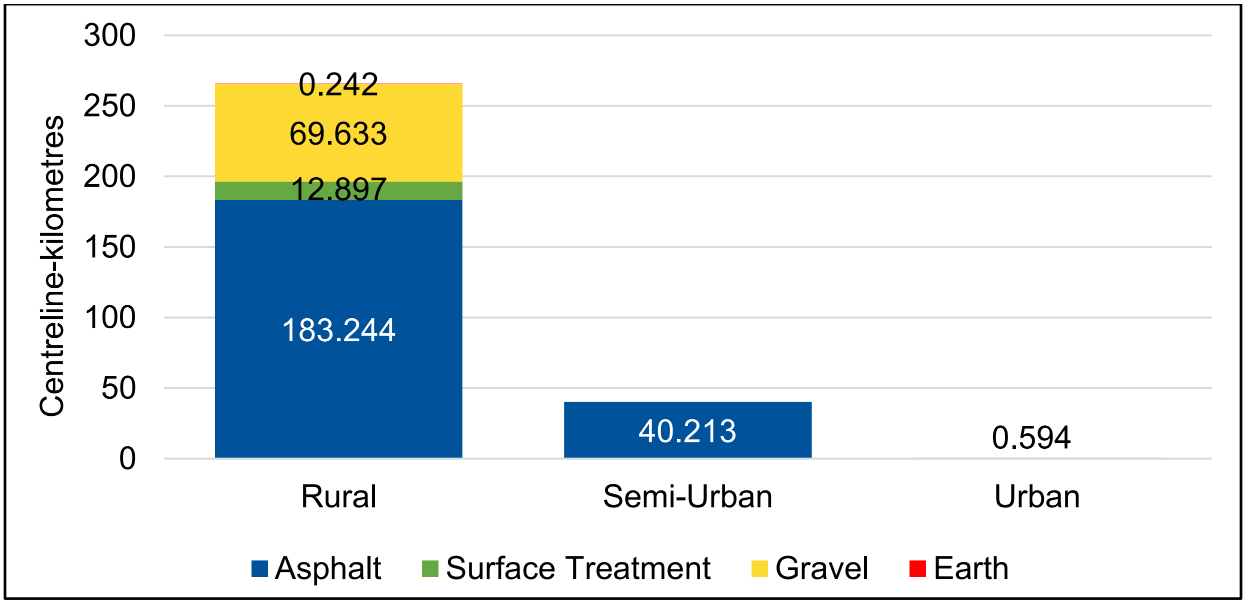
Semi-urban:

Semi-urban roads are generally the roads located within a Plan of Subdivision possessing a "rural cross-section", which is characterized by the presence of roadside ditches. All semi-urban roads within the Township possess a "Local" functional characterization and an HCB surface. In total, the semi-urban classification comprises 13.69% of the road network.

Urban:

Urban roads are defined as the roads located within a Plan of Subdivision possessing an "urban cross-section", which is generally characterized by the presence of a storm sewer system, and roadside curb-and-gutter. Currently, the Urban characterization applies to only 0.594 centreline kilometres situated within one residential subdivision, comprising 0.19% of the network. It is noted however that the percentage of Urban roads is expected to increase based on anticipated residential development.

Figure 6-3: Centreline-kilometres of Road Surface Type by Environment



6.1.1.3. Function

The *Function* of a roadway is assigned as either *"Local"*, *"Collector"*, or *"Arterial"*. This characterization is determined based on the Average Daily Traffic (ADT) recorded for each road asset. Traffic counting instrumentation is routinely deployed by Township Public Works staff to determine ADT, as well as a variety of other traffic-related parameters.

O. Reg. 239/02: *Maintenance Standards for Municipal Highways*, Table to Section 1 determines the applicable Maintenance Class based on the traffic volume and speed limit of each road. As defined in O. Reg. 588/17, Classes 1 and 2 correspond with *Arterial*, Classes 3 and 4 correspond with *Collector*, and Classes 5 and 6 correspond with *Local*. The AMP, being primarily concerned with asset deterioration, determines *Function* without distinguishing based on posted speed. Instead, Function is based exclusively on "Column 4" of the aforementioned Table to Section 1, which is reflective of the 80 km/h regulatory speed for Rural roadways and represents a conservative assumption. Furthermore, all road assets with a surface type of either Earth, Gravel, or Surface Treatment are reported as possessing a *Local Function*.

Table 6-1 summarizes the ADT ranges applicable to each *Function Code* represented within the *Road Asset Profile*. The Function Code is used for deterioration modelling to support forecasting of capital needs. **Table 6-1** only describes the Functions which are applicable to the Township's road network based on the most current traffic data.

Table 6-1: ADT in relation to Assigned Road Function

ADT Range	Function Code
*Any**	1
1,000 - 4,999	3
50 - 999	4

**Classification Code 1 is assigned to all surface types which are not HCB.*

A high-level characterization of the road network can be provided by comparing total land area within the Township's municipal boundary relative to the total lane-km for each Function; these proportions are illustrated in **Table 6-2**. This is a prescribed Level of Service Measure in accordance with O. Reg. 588/17, S.5(2), 1(i), and represents, on average for each road Function, the linear lane-km situated within a square-kilometre of municipal land area. This measure is effectively an indicator of how rural or urban a municipality is.

Table 6-2: Land area relative to total lane-km by Road Function

Road Function	(A) Total lane kilometres	(B) Total land area (km^2)	(A / B) Level of Service Performance Measure
Arterial	0	371.53	*N/A*
Collector	453.048		1.219
Local	160.598		0.432
TOTAL	613.646		1.651

6.2. Current Replacement Value

Replacement costs reflect the amount of funding required to reconstruct a road asset when its physical condition dictates that it is no longer feasible to rehabilitate. It is important to note that replacement costs assume that the features of a new, replaced road asset will be identical to those of the existing asset, meaning that upgrades to surface type, width, or other attributes are not accounted for. Recognizing that major capital works like road reconstruction must be carried out in accordance with current design standards, it is noted that the reported replacement costs may undervalue the true expense of asset replacement in some cases (although Development Charges may be applicable to offset incremental costs associated with design upgrades). Conversely, in some situations, actual replacement costs may be lower than reported for road reconstruction projects where underground infrastructure is replaced concurrently, as this manner of bundling construction work is more efficient and potentially enables the Township to receive lower unit rate pricing from contractors.

Replacement costs are informed by bid prices submitted by construction contractors. Bid prices are generally influenced by market competition, the market value of goods and materials, and any pertinent changes within the regulatory sphere, such as new requirements for excess soil management; therefore, construction unit rates are consistently updated to produce meaningful capital projections in the AMP. While there is a degree of uncertainty with respect to bid pricing, the replacement costs assumed in the AMP are based on the best current available information and are uniformly applied to allow for a comparative analysis. Unfortunately, it is noted that the inflation of typical commodities required for road construction and maintenance, such as fuel, asphalt, and salt, tends to far exceed that of the Consumer Price Index (CPI). Any changes to the market unit rates will have a dramatic effect on the funding need requirements.

Altogether, the estimated replacement costs of the Township's road system is $267,505,700, assuming like-for-like replacement to the current standards. **Table 6-3** breaks down replacement costs by Road *Function*.

Table 6-3: Road Assets Estimated Current Replacement Value (2021$)

Road Function	Quantity (Centreline-km)	Replacement Cost
Arterial	*N/A*	$ -
Collector	226.524	$ 206,161,400
Local	80.299	$ 61,344,300
TOTAL	**306.823**	**$ 267,505,700**

6.3. Asset Age

Each road asset consists of many different components such as the wearing surface, shoulders, underlying granular structure, roadside drainage and roadside grading. Assigning an age to a road asset can be difficult because components are often subject to repair, rehabilitation, and retrofit activities at different times, except for when a road is fully reconstructed. Determining the most recent date of full road construction is very challenging, particularly for older Rural road assets, for which available records are often limited, imperfect and difficult to ascertain.

Where records are not available, the ages of road assets have been estimated, while recognizing that improvements to the visible components of a road make estimating ages very difficult, if not impossible. The road asset age data, which is reflective of the Township's Public Sector Accounting Board (PSAB) reporting documents for Tangible Capital Assets (TCA), suggests that the current average age of the Township's Roads is 33 years. Regardless, it is noted that the physical condition of a road, rather than its estimated age, is what drives AM decision-making.

6.4. Asset Condition

To meet it's AM objectives for roads, the Township has implemented the assessment methodologies and related guidelines of the Ministry of Transportation Ontario Inventory Manual for Municipal Roads, 1991 (MTO Inventory Manual). Although its use was widely discontinued in the mid-1990's due to changes in the political sphere, use of the MTO Inventory Manual has been re-adopted by the Township as of the year 2020, as it is believed to provide the best available AM framework for managing Road Assets. The Inventory Manual provides a holistic perspective based on six fields of interest: *Geometrics*, *Surface Type*, *Surface Width*, *Capacity*, *Structural Adequacy*, and *Drainage*.

O. Reg. 588/17 requires that the physical condition of hard-topped road surfaces are reported using a numerical rating based on a scale of 0-100, known as a Pavement Condition Index (PCI). It is noted that there are a variety of industry-accepted methodologies which can be used in determining PCI, each with the potential to provide variation in the scoring results.

The Township's road assets were most recently evaluated through field inspections undertaken by a qualified consultant in 2020. The data collection and analyses were completed in accordance with the MTO Inventory Manual.

The PCI adopted by the Township is based on the Structural Adequacy parameter, implicitly scored on a 0-20 scale as part of the MTO Inventory Manual methodology. Structural Adequacy is determined based on the presence of visible distress manifestations on the pavement surface, often symptomatic of problems beneath the wearing surface. The Township's AMP derives PCI by multiplying the Structural Adequacy parameter for each road asset by five, effectively converting the physical condition rating to a 0-100 scale. The PCI for each asset is weighted by centreline-kilometre to correct for the inherent variability of road asset lengths.

Table 6-4 illustrates how the Township's PCI scores translate to qualitative condition, and corresponding high-level, general recommendations pertaining to the timing and selection of lifecycle treatments. The concept of *Time of Need* is detailed in **6.5 Lifecycle Management**.

Table 6-4: Summarized Implications of PCI Ranges

PCI Range	Time of Need	Qualitative Description	Lifecycle Treatment Implication
80 - 100	ADEQ	Very Good	No reconstruction or resurfacing needs, although maintenance such as crack sealing is recommended to extend service life.
60 - 79	6 - 10 year	Good	Reconstruction is anticipated in the next 6 to 10 years, absent intervention. Potential resurfacing candidate to defer reconstruction need. Distress covering 10% to 15% of the surface area.
40 - 59	1 - 5 year	Fair	Reconstruction is anticipated in the next 5 years, absent intervention. Potential resurfacing candidate to defer reconstruction need. Distress covering 15% to 20% of the surface area.
<40	NOW	Poor	Requires reconstruction or major rehabilitation. Represents the backlog of work required on the road system. Distress covering greater than 20% of the surface area.

In addition to the information summarized in **Table 6-4**, it should be noted that as per the MTO Inventory Manual methodology, roads with ADT less than 50 are automatically deemed to be *Adequate (ADEQ)*, no matter the deficiencies.

In accordance with prescribed Level of Service measures outlined O. Reg. 588/17, S.5(2), 1(i), the weighted average PCI of Paved Roads is 28.1, and the weighted average PCI of Unpaved Roads is 70.6, as presented below in **Figure 6-4** and **Figure 6-5**, respectively.

A unique feature of the MTO Inventory Manual methodology is that it enables a numerical 0-100 condition rating scale to be applied to unpaved roads. Unpaved roads are inspected during the spring breakup in accordance with the MTO Inventory Manual methodology. Soft spots and frost boils identified during this time detract from the Structural Adequacy score used to generate the PCI.

Figure 6-4: Weighted Average PCI of Unpaved Roads (to 2020)

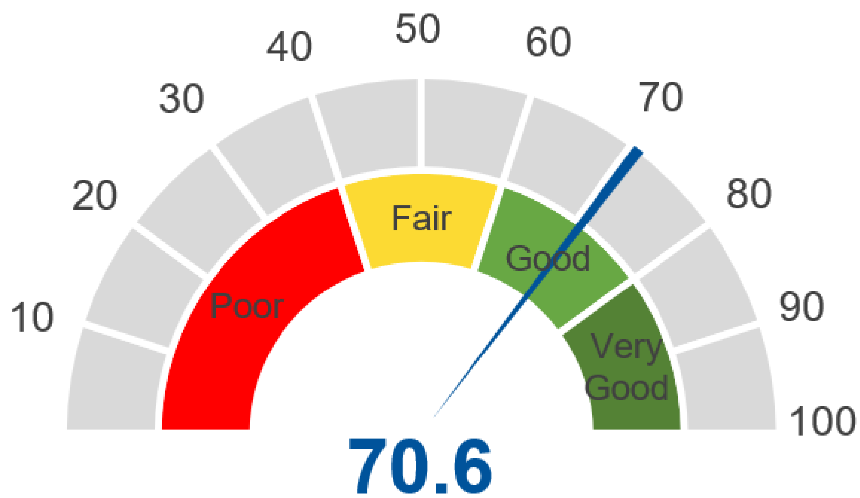
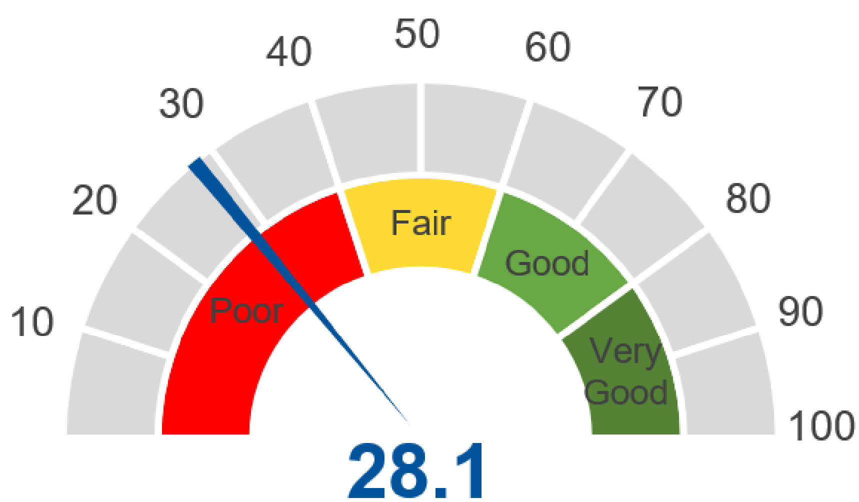
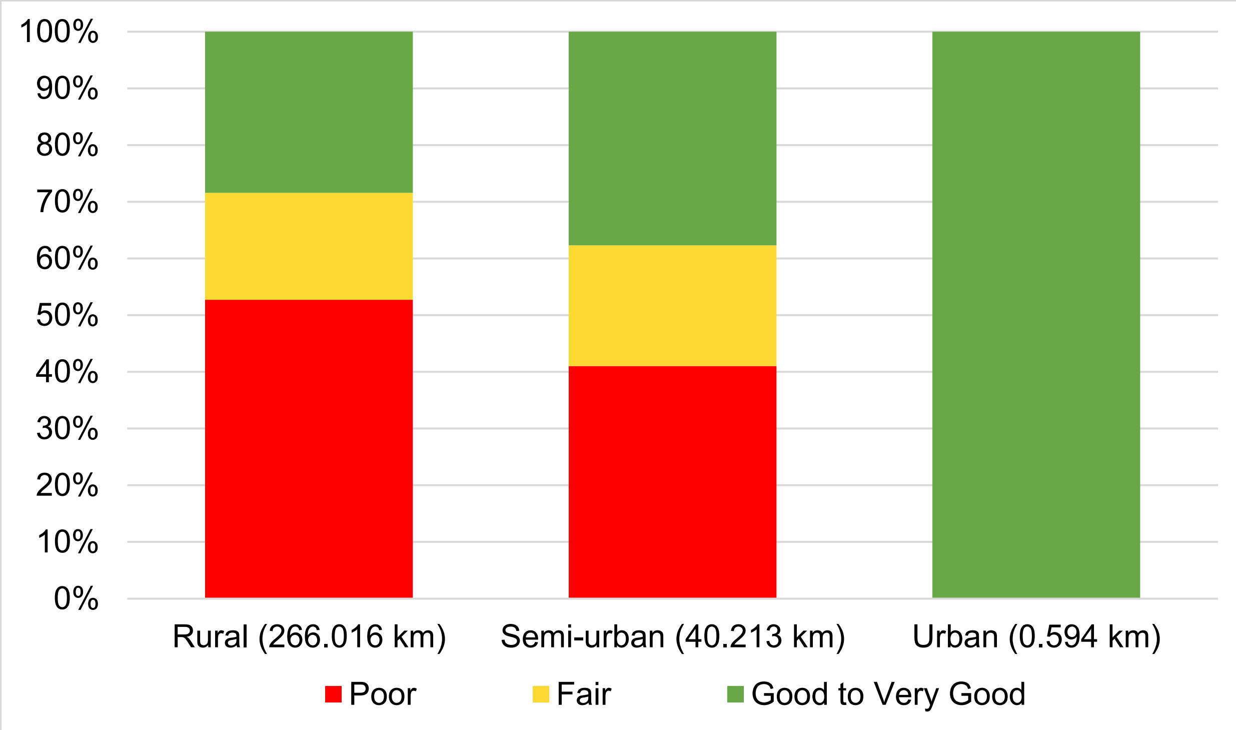


Figure 6-5: Weighted Average PCI of Paved Roads (to 2020)



To provide additional insight, **Figure 6-6** draws a comparison between rural roads and subdivision roads (semi-urban and urban environments) by showing as a percentage, the total kilometres within each physical condition category by *Environment*.

Figure 6-6: Physical Condition in centreline-kilometres by Roadside Environment

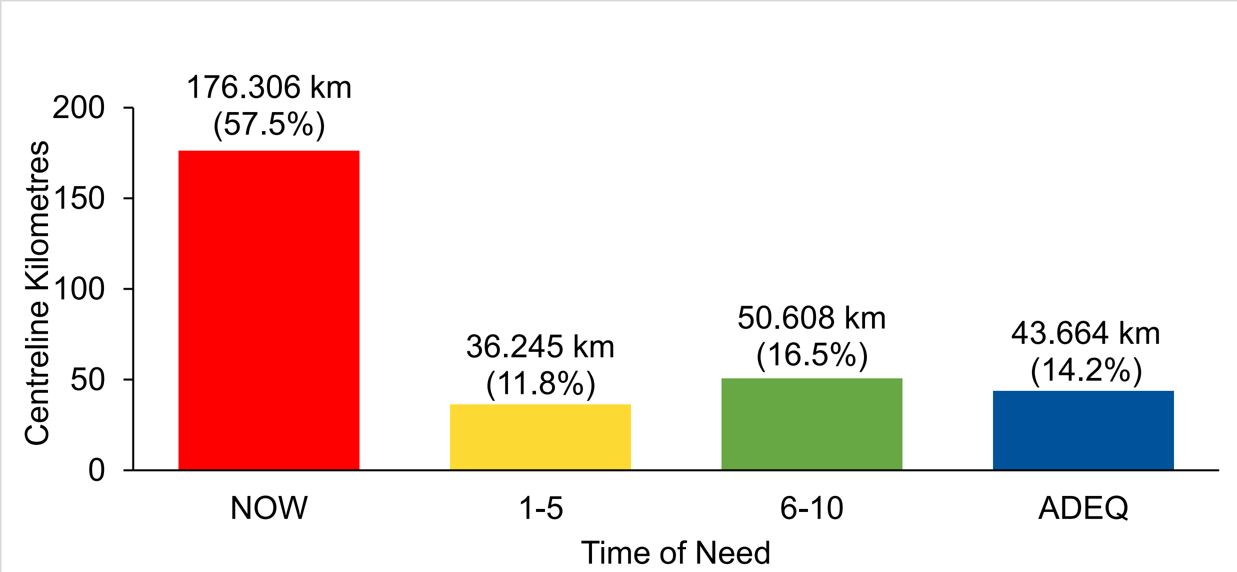


It should be noted that as part of the 2025 AMP, the Township will need to establish Proposed Levels of Service regarding the PCI of Paved and Unpaved Roads, supported by applicable lifecycle strategies and a financial strategy.

6.5. Lifecycle Management

Based on assessment data, the MTO Inventory Manual methodology assigns a *Time of Need* (TON) to each road asset. TON is a prediction of the time until the pavement has deteriorated to the point where reconstruction or structural rehabilitation is required, expressed as either *NOW*, *1 – 5 years*, *6 – 10 years*, or *ADEQ*. TON must not be conflated with the timing until any action is required. As highlighted in **Table 6-4**, road assets with a TON of 1 – 5 years, or 6 – 10 years are often suitable candidates for resurfacing to defer the timing of a NOW need, while extending the life of the pavement at an overall reduced lifecycle cost. As presented in **Figure 6-7**, a total of 176.3 centreline-km, comprising 57.5% of the road network, are 'NOW' needs, as they are in a *"Poor"* condition state with a reconstruction (or structural rehabilitation) recommendation.

Figure 6-7: Road Assets in centreline-kilometres by Time of Need



Within the MTO Inventory Manual methodology, the overall performance of a road network is measured by a metric known as "*System Adequacy*". *System Adequacy* represents the proportion of road assets that are not "NOW" needs, as derived through the following equation:

$$System\ Adequacy = \frac{(Total\ System\ km - NOW\ Needs\ km)}{Total\ System\ km} \times 100$$

The *System Adequacy* measure for the Township's road network is 42.3% (excluding roads with ADT less than 50).

Decades ago, when the MTO Inventory Manual was used as part of a system to allocate conditional road funding to municipalities, the *System Adequacy* target was 60%. It is understood that underperforming municipalities had increased difficulty in acquiring external funding. Based on the current *System Adequacy* of 42.3%, significant increases in the Township's funding levels and a commitment to ROI-driven project selection will be required to restore the performance of the road network to meet the 60% target.

By tracking the physical condition of road assets and their corresponding TON, the Township is able to identify and undertake the appropriate and time-sensitive pavement preservation and rehabilitation treatments, capable of providing the greatest ROI.

6.5.1. Current State

As exemplified in **Figure 6-5**, paved roads are generally in an undesirable physical condition, representing an AM challenge that should be prioritized. It is known that the majority of the Township's paved rural roads historically were converted from gravel roads by surfacing with a thin lift of hot mix asphalt (i.e. 30 mm to 45 mm thick). Most of these pavements are now aged, brittle, cracked, and in generally poor condition. Thicker pavement may be present in some locations where overlay treatments have been applied.

Generally, the overall physical condition of the Township road network is resultant of a reactive ad-hoc strategy characterized by addressing deficiencies on a "worst-first" basis. It is understood that historically, due to insufficient funding, the objective of addressing poor conditions was prioritized above proactive maintenance strategies aimed at extending the life of the road assets. Specifically, a common approach for maintaining asphalt surfaced roads has been to sawcut and remove problematic areas experiencing severe potholing and apply localized hot mix asphalt patches to improve ride quality. This approach may be necessary in certain cases; however, these patches are not permanent solutions and should be regarded only as "holding treatments". Limited funding is the Township's major obstacle in addressing road needs of any considerable length.

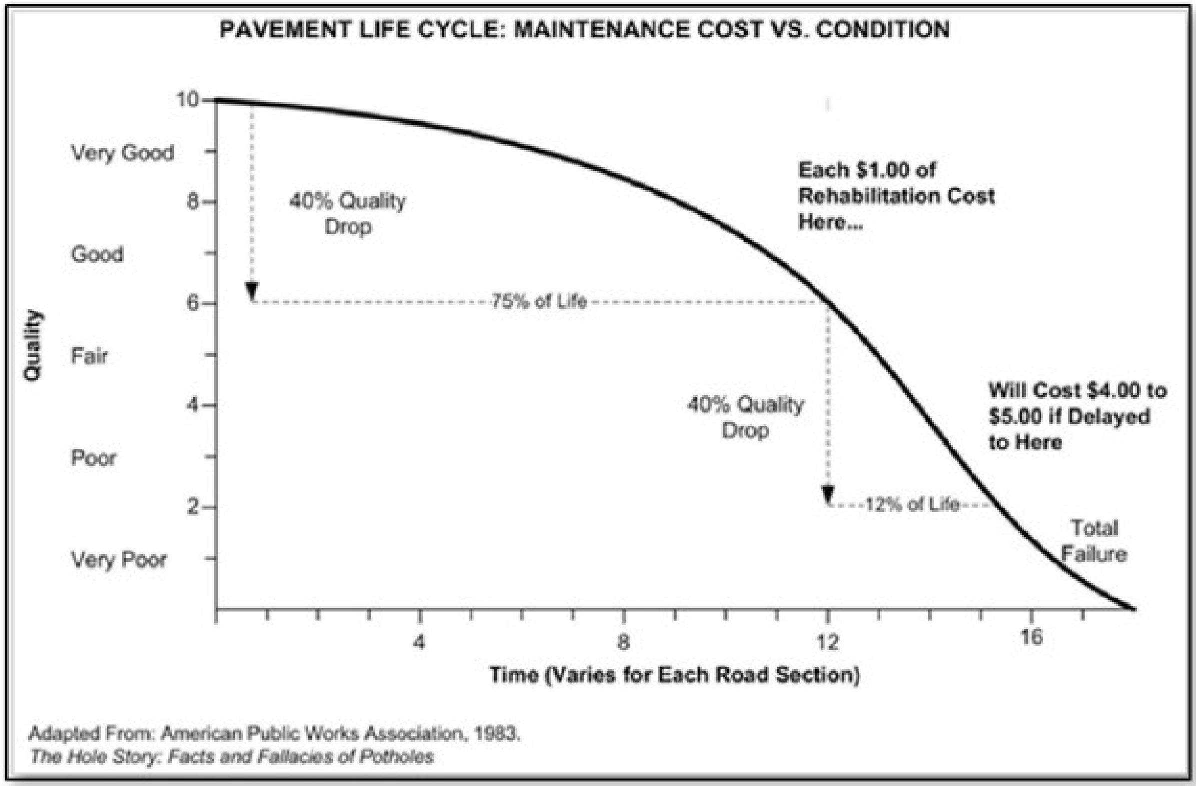
Given the service delivery objectives of O. Reg. 588/17, it is not viable to continue with these historical practices. Additionally, the risks of continuing the "worst-first" approach (rather than undertaking the treatments capable of offering the greatest ROI) include: suboptimal budget utilization, overall reduced PCI per dollar spent, impact on municipal reputation, undesirable user experience, and potentially increased risk exposure.

Figure 6-8 depicts a generalized road asset deterioration curve, illustrating how the rate of deterioration increases over time. Physically, as cracking propagates and potholes form (primarily due to structural fatigue and frost action), the pavement becomes progressively weaker while also becoming more susceptible to damaging climatic distress, thus resulting in accelerated deterioration. As shown in **Figure 6-8**, lifecycle treatments which are closer to the top of the deterioration curve offer the best value in terms of ROI. Each type of treatment is typically only applicable to a certain PCI range and the relative costs of treatment strategies tend to increase as PCI decreases. To meet the requirements of O. Reg. 588/17, it is incumbent upon the Township to prioritize road asset treatments based on the ROI. The ROI calculation used by the Township is as follows:

$$ROI = \frac{\left(\frac{Total\ Cost\ of\ Rehabilitation}{Estimated\ Service\ Life\ Rehabilitation} - \frac{Total\ Cost\ of\ Replacement}{Estimated\ Service\ Life\ Replacement}\right)}{Total\ Cost\ of\ Rehabilitation} \times 100$$

Given funding limitations, it is even more critical to "keep the good roads good" through ROI-driven project selection that prioritizes life-extending treatments undertaken at the optimal timing. This means that resurfacing, rehabilitation, and preservation should be prioritized over reconstruction.

Figure 6-8: Road Asset Deterioration and Lifecycle Activity Cost Implications



Excerpt taken from "2020 State of the Infrastructure and Asset Management Plan for Roads", by 4Roads Management Services Inc.

More recently, through the Township's dedication to continuous improvement in AM planning, lifecycle programs for roads are evolving in a more sustainable direction. The *2020 State of the Infrastructure and Asset Management Plan for Roads* identified candidates for crack sealing, and in 2021, the Township introduced a crack sealing program to support pavement preservation efforts. Within the available budget, the Township has also been successful in introducing other recommended preservation treatments that were not previously used, such as Surface Treatments as an alternative to Hot Mix Asphalt for resurfacing low volume roads (both paved and gravel).

To work towards achieving sustainable Levels of Service in the short-term, the highest ROI projects must continue to be prioritized (activities such as crack sealing and resurfacing, as detailed in **Section 6.5.3.**).

6.5.2. Funding Requirements to Sustain Levels of Service

In the long term, over the full road asset lifecycle, the costs associated with end-of-life reconstruction need to be accounted for; however, in the short-to-mid-term, physical asset condition can be sustained by implementing ROI-driven, optimized lifecycle treatments. Effectively, the difference is that the short to mid-term lifecycle programming does not consider deterioration of the granular road base over time. The service life of the underlying granular structure is assumed to be at minimum 50 years before reconstruction is required. Deficiencies indicative of base failure (i.e. rutting, deformation) are identified in routine condition assessments, and are assigned the appropriate lifecycle recommendation and are prioritized according to ROI.

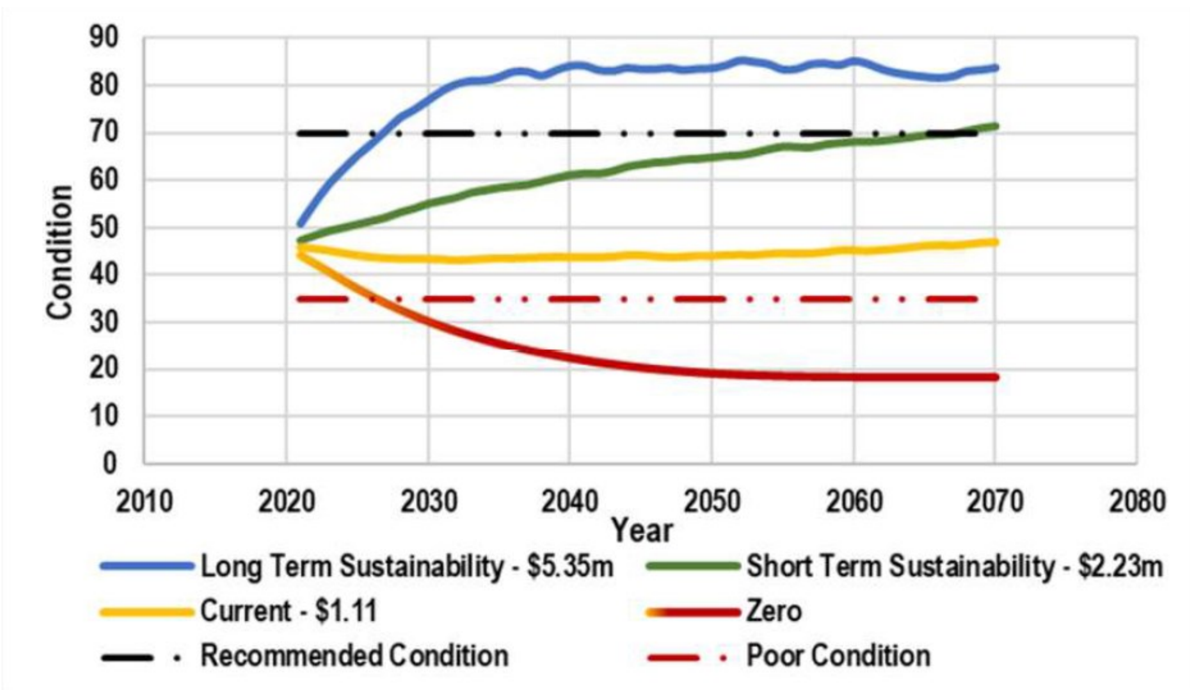
The difference in funding level requirements between *Short-Term Sustainability* and *Long-Term Sustainability* establishes the "*Funding Window*" (a key concept detailed in the *2020 State of the Infrastructure and Asset Management Plan for Roads*). To sustain the physical condition of the road network, the annual funding allocation should be within the range of the *Funding Window*. Assuming ROI-optimized treatment selection, a minimum annual investment of $2.23 M is projected (2020$); however, it should be recognized that this projection is theoretical and reliant on all assumptions being absolutely perfect (including cost estimates), as well as explicit adherence to the program without any deviations. In practice, the annual funding level should be higher than the minimum to account for the realities of maintaining a road network.

To facilitate the *Short-Term Sustainability* approach, it is recommended that an annual reinvestment level be established, which would serve as a gross budget for both capital and maintenance road improvements, with allocations being distributed between improvement programs between years. In-year variance between programs would be driven by the demands of the road system based on condition and ROI-driven project selection. *Short-Term Sustainability* prioritizes funding for the highest ROI projects, which generally include preservation and resurfacing (the nature of these projects may be considered major maintenance or small-scale capital).

Figure 6-9, taken from the *2020 State of the Infrastructure and Asset Management Plan for Roads*, models the effect that funding levels will have on the overall performance (physical condition) of the road network over time, assuming optimized lifecycle treatment. Various trajectories are provided to illustrate different funding level scenarios. The starting point in this model represents the weighted average PCI of the entire road network including paved and unpaved surfaces (PCI 45.3). The recommended PCI target is 70.

The Township's current funding for transportation assets is based on an annual budget of approximately $1.4 M, (which is reflected in **Table 6-5**) comprising the sum of the 2020 operating budget for physical road improvements and non-competitive conditional grant funding (while this analysis was completed in 2020 using the best current data available, this model is still conceptually applicable in 2022, despite incremental changes in funding levels and construction costs).

Figure 6-9: Road Asset Performance Modelling at Various Funding Levels (2020$)



Excerpt taken from "2020 State of the Infrastructure and Asset Management Plan for Roads", by 4 Roads Management Services Inc.

By actioning the optimized road treatment recommendations, the average PCI will inherently increase (in practice, it would be difficult to implement lifecycle strategies to sustain the paved road network in its current average physical condition).

Over the next 10-year period, the minimum annual funding requirement is $2.23 M (2020$). As compared to the approximate 2022 baseline funding level of $1.40 M (2022$), which inclusive of funding needed for bridges and structural culverts, the minimum *Funding Gap* is **$0.83 M** (2021$) annually, and the long-term annual Funding Gap reflective of capital depreciation is **$3.95 M** (2021$), as summarized in **Table 6-5**. The annual funding gap for road assets is an inescapable issue that must be confronted. As more time passes without meaningfully addressing this issue, the challenges will only continue to compound.

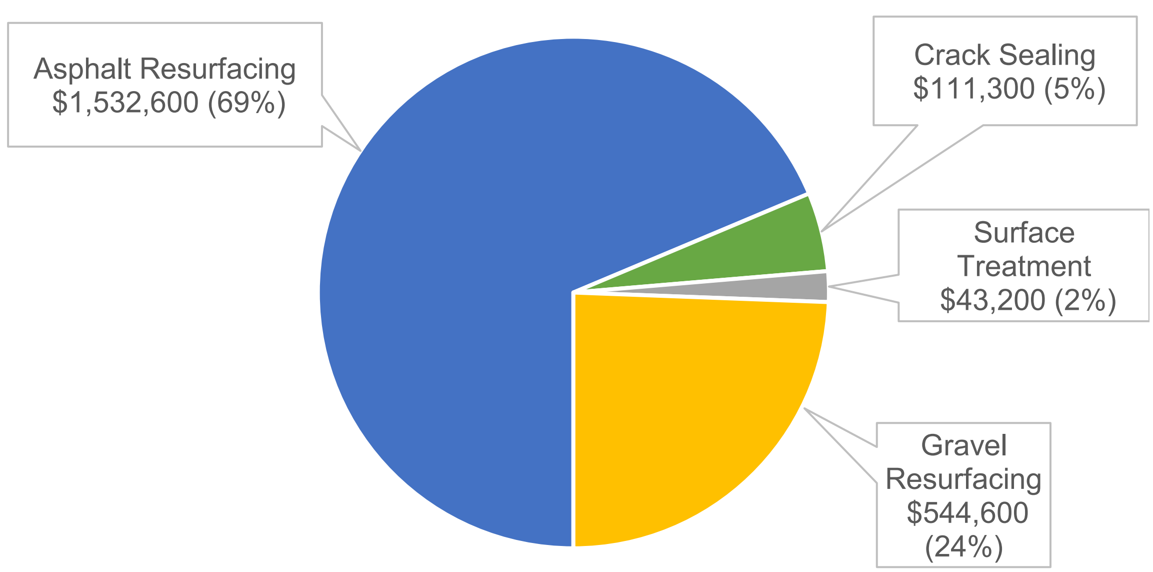
Table 6-5: Funding Scenarios to Sustain Levels of Service for Road Assets

FUNDING LEVEL SCENARIO (2020$)		APPROX. ANNUAL FUNDING LEVEL (2022$)	APPROX. ANNUAL FUNDING GAP
Short-term Sustainability	$2.23 M	$1.40 M *(inclusive of bridges & structural culverts)*	**($0.83 M)**
Long-term Sustainability	$5.35 M		**($3.95 M)**

6.5.3. Recommended Lifecycle Strategies

Notwithstanding current funding limitations, **Table 6-6** illustrates how road asset funding should be distributed, based on the optimized plan to achieve *Short-term Sustainability* over the next 10-year period. Each of these recommended treatment strategies are discussed in further detail in the following sections.

Table 6-6: Lifecycle Treatment Composition for Short-term Sustainability



6.5.3.1. Crack Sealing

Pavement Routing and Crack Sealing

Pavement routing and crack sealing is a preservation activity that extends the life of an HCB (asphalt) surface. Crack sealing should occur when the condition state of the road asset is still '*Adequate*' (ADEQ). It is typically the first recommended treatment in the lifecycle of paved roads. The AMP assumes that crack sealing extends the lifecycle of paved roads by holding the PCI constant for 2 years after the activity is completed. For thin single lifts of hot mix asphalt, pavement routing is not recommended; alternatively, in these circumstances cracks of sufficient width could be only cleaned and sealed (without routing).

Continuous Sealing

There are also other sealing technologies, such as *Fog Sealing* and *Slurry Sealing*, which are uniformly applied to the entire surface. These types of preservation treatments are intended to seal cracks early in the lifecycle and could be applicable to both HCB and LCB road surfaces.

6.5.3.2. Asphalt Resurfacing

The timing of hot mix resurfacing is required at an appropriate interval based on deterioration modelling specific to each *Road Asset Profile*. Based on the *Road Asset Profiles* currently assigned within the Township's inventory, it is assumed that resurfacing will be required on a cycle of 15 to 19 years, from the date of pavement renewal. The resurfacing timing interval is ultimately dependent on each road's unique traffic characteristics and its quality of design and construction (higher volumes of traffic, particularly heavy truck traffic, shorten the timing interval). Based on the current physical asset conditions, and optimized *Short-term Sustainability* recommendations, there are no paved road assets which are recommended for a simple asphalt resurfacing over the next 10-year period.

Pulverize and Resurface (PR-2):

A unique characteristic of the Township's rural road network is that there are many paved surfaces which are cracked beyond repair, but do not appear to exhibit any significant rutting or deformation. This may indicate that while the existing thin and brittle asphalt mat has failed, the underlying granular base and subbase remain in serviceable condition. This potentially creates an opportunity to restore the condition of these roads by pulverizing in-place the existing failed asphalt and upper portion of the granular base, installing a new granular levelling course, and resurfacing with two lifts of hot mix asphalt for a total thickness of 100 mm. This approach would be subject to engineering considerations regarding subsurface conditions and feasibility of marginally increasing the road elevation. The AMP treatment refers to this treatment as a *PR-2* (pulverize and resurface with two lifts of hot mix asphalt).

PR-2 candidates must be carefully vetted. In some cases, it is noted that visible pavement distress manifestations may be indicative of historical road widening retrofits where dissimilar subsurface materials were used to widen the road embankment, resulting in differential frost movement. Resurfacing a road with any obvious and extensive underlying subgrade deficiencies is not recommended. Resurfacing treatments cannot adequately address these types of issues. Subgrade movement and its resulting damage to the road surface will continue and worsen until such time that road subgrade can be reconstructed. Accordingly, a detailed, project-level review (and possible geotechnical investigation) of a road is always required before a major resurfacing treatment can be recommended.

The Township also recognizes that candidates for the *PR-2* treatment may be suitable for various other asphalt recycling technologies capable of delivering similar outcomes with a relatively lower carbon footprint, such as *Cold In-Place Recycling* (CIR) or *Cold In-Place Recycling with Expanded Asphalt Mixture* (CIREAM), subject to appropriate structural pavement investigation.

6.5.3.3. Surface Treatment Resurfacing

Surface Treatment (LCB) is applied by spraying a prepared road base with asphalt emulsion, which is immediately followed by the application of graded stone, compacted into a dense arrangement using a large smooth drum roller. A “Double Surface Treatment” (DST) involves carrying out this process twice in succession.

Surface treatments provide a hard top surface, hold the shape of the road, and keep dust down (although there will be some dust until such time the surface has fully stabilized).

By square metre, the Township finds that the cost of DST is generally between one-third to one-half that of a single lift of hot mix asphalt (note that single lifts of hot mix asphalt are the historical practice no longer being recommended). Surface Treatment is appropriate for local rural roads with lower volumes of traffic and fewer heavy vehicles.

Pulverize and Resurfacing (DSTrehab)

Existing paved rural roads with ADT less than 1,000 and not subject to significant heavy truck traffic are candidates for a treatment referred to as a *DSTRehab*. A *DSTRehab* follows the same process as the *PR-2* described above, except rather than two lifts of hot mix asphalt, a DST is applied.

Where warranted, this treatment can be further expanded to a *DSTrehab2* improvement which includes additional thickness of the compacted granular base course as well as spot drainage repairs to the roadside ditches.

Single Surface Treatment (SST)

DST is assumed to remain viable for about 7 years before needing to be resurfaced. At such time, a *Single Surface Treatment* (SST) overlay can be applied to extend the life of the road by approximately another 7 years. SST remains a viable option for continually maintaining the road, until such time that a *DSTRehab* is required to restore the shape and structure of the road.

The average annual cost estimate of $43,200 for Surface Treatment shown in **Table 6-6**, is exclusive of preparatory road base work usually completed using the Township’s own forces. The cost estimate is based on the current surface treated inventory of 11.48 centreline kilometres, however it is noted that many existing paved rural roads may be candidates for this treatment in the future.

At a considerably lower initial cost and reduced overall lifecycle costs compared to hot mix asphalt, surface treatments are an economically favourable solution for many lower volume rural roads.

6.5.3.4. Gravel Resurfacing

Gravel road resurfacing is a maintenance activity which is required periodically to restore the wearing surface of a gravel road and meet community demands. Gravel wearing surfaces are subject to degradation from winter maintenance, weather, and traffic.

The ideal gravel road surface derives its strength and stability from the tight-knit interaction between crushed, angular rock particles locked together with the optimum proportion of smaller particles such as sand and fines. The finished surface should be impervious and able shed water to the roadside ditches, provided it is properly graded and compacted.

The quality of the wearing surface aggregate is of the utmost importance in servicing gravel roads. Gravel installed on the road surface is required to meet engineering specifications, including distribution of particle sizes and percentage of crushed aggregate. In delivering transportation services on its gravel roads, the Township specifies *Granular M* (OPSS.MUNI 1010), which is installed at an average thickness of 75 mm. Laboratory testing of the material is always undertaken to confirm that the gravel road surface material meets the engineering specifications, which directly supports AM objectives by ensuring that the gravel installation provides a lasting benefit. The installation of quality aggregate material also eliminates undue maintenance demands, such as additional grading or dust-suppressant application.

Current operating budgets theoretically enable gravel resurfacing on all gravel roads over an 8-year cycle. In contrast, the *2020 State of the Infrastructure and Asset Management Plan for Roads* recommends a 75 mm thick resurfacing treatment scheduled for every 3 years. The frequency of routine resurfacing of gravel roads could be an area to examine more closely from a service delivery perspective. Furthermore, as part of the Township’s service delivery for gravel roads, liquid calcium is applied to all gravel roads on an annual basis. The effect of this treatment is to suppress dust, thereby improving the level of service to the community.

6.5.4. Other Strategic Priorities

6.5.4.1. Gravel Road Hard-top Conversion

The MTO Inventory Manual (1991), deems that gravel-surfaced roads with ADT greater than 400 are 'NOW' needs for a hard-topped surface. There are currently no gravel roads in the Township meeting this criterion. Accordingly, the optimized plan did not include *Gravel Road Hard-Topping*, and instead prioritized other necessary road treatments. It is noted however, that there are some other Engineering and Public Works literature resources advising that *Gravel Road Hard-Topping* is beneficial at traffic thresholds lower than 400 ADT.

An identified priority has been to undertake gravel road hard-top conversions. The perceived benefits of hard-topping a gravel road include: improved user experience due to more reliable smoothness, dust suppression, and a potential reduction in maintenance costs (subject to a variety of factors). Conversely, from a community perspective, a potential drawback could be resultant increases in through-traffic on local roads.

Conversion candidates must have a platform width that meets or exceeds the minimum standard width for the traffic volume of the road, including shoulders. The Township should also exercise discretion in applying hard-top treatments to gravel roads that include vertical and horizontal alignments where the advisory speed is less than the posted speed, as it can be assumed that hard surfaced roads support higher operating speeds, and are more inviting to through-traffic.

Additionally, for a hard-topping treatment to deliver a lasting benefit, the gravel road base must be able to perform without rutting or deformation during all 12 months of the year. Any apparent deficiencies within the road platform (typically due to poor subsoils, insufficient granular base, or localized groundwater anomalies) should be addressed prior to undertaking a hard-top conversion. As per the condition rating methodology set out in the MTO Inventory Manual, the inspection of gravel roads is only undertaken during spring thaw conditions. This is to enable the identification of any soft spots or frost boils in the road platform, which would result in a reduced structural adequacy score.

Drainage is a critical feature need to achieve desirable road asset performance. In many instances, roadside drainage repairs and cross-culvert replacement and/or extension are required to carry out a hard-top conversion project that will deliver lasting performance (assuming the presence of a legal adequate outlet). As a best practice, any preparatory improvement works should be monitored over the course of at least one year to ensure satisfactory performance.

During the period from year 2020 to 2022, a total of about 9.6 centreline kilometres of gravel roads have been, or are scheduled to be, subject to hard-top conversion resulting in an average of 3.2 centreline kilometres annually. For the most part, these converted gravel roads were converted at an ADT threshold of about 300.

7. Transportation – Bridges and Structural Culverts

7.1. Service Delivery Overview

The municipal road network is supported by a total inventory of 73 municipal bridge structures, comprising 48 bridges and 25 structural culverts. The following definitions should be noted:

Bridge – a structure that provides a roadway for the passage of vehicles across an obstruction, gap, or facility, and is greater than 3 metres in span.

Structural Culvert – a structure that is greater than 3 metres in span and that forms an opening through soil.

Bridge Structure – either a "Bridge" or "Structural Culvert", as defined above.

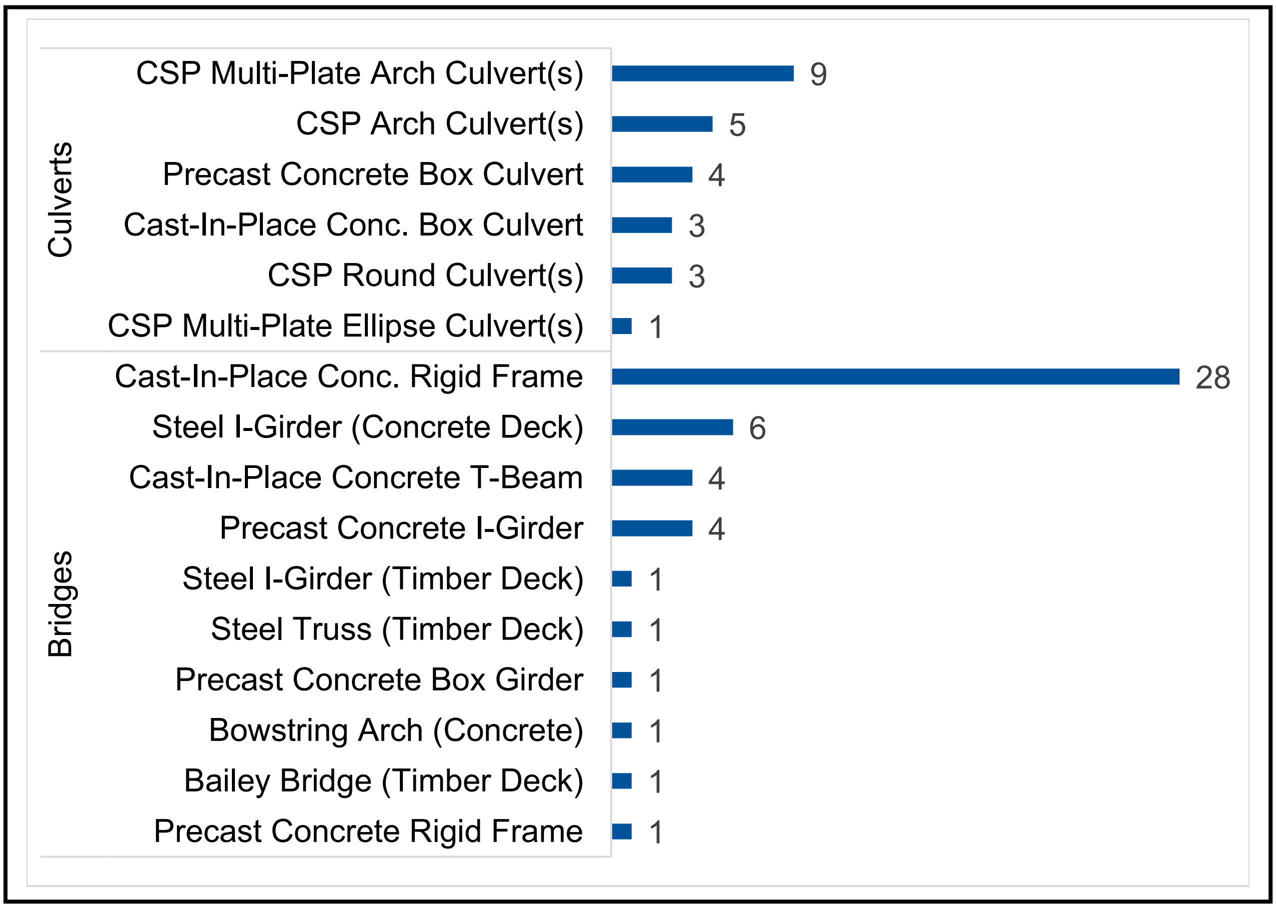
All the Township's bridge structures are water crossings. The geographic area of the Township is situated in the headwaters and valley lands of the Upper Nottawasaga Valley Subwatershed and the Main Upper Humber River Subwatershed. Given the abundance of natural water features within the municipal geographic land area, Bridge Structures serve an integral role in providing a well-connected local transportation network. The

Township's inventory includes many large bridges which span rivers including the Humber River, Nottawasaga River, Boyne River, Pine River, and Mad River. The inventory also includes many smaller and mid-sized structures spanning named creeks and unnamed tributaries.

In addition to passenger vehicles and commercial vehicles, the Township's bridge structures support the delivery of public services that rely on the use of roads, such as emergency response, road maintenance and winter control, postal service, waste collection, and school buses. Annual capital investment and routine operational maintenance is essential for public services that rely on the use of interconnected roadways and integral bridge structures and for the general motoring public at large.

Figure 7-1 provides a summary of the types and quantities of bridge structures within the Township's inventory.

Figure 7-1: Inventory of Bridge Structures by Type (to 2022)



It is noted that not every bridge structure situated within the Township's municipal road network is under Township jurisdiction; certain bridge structures are the responsibility of the County of Simcoe as the upper-tier municipality, such as those located on roads formerly under County jurisdiction, as well as those situated on roads forming a boundary between upper-tier municipalities.

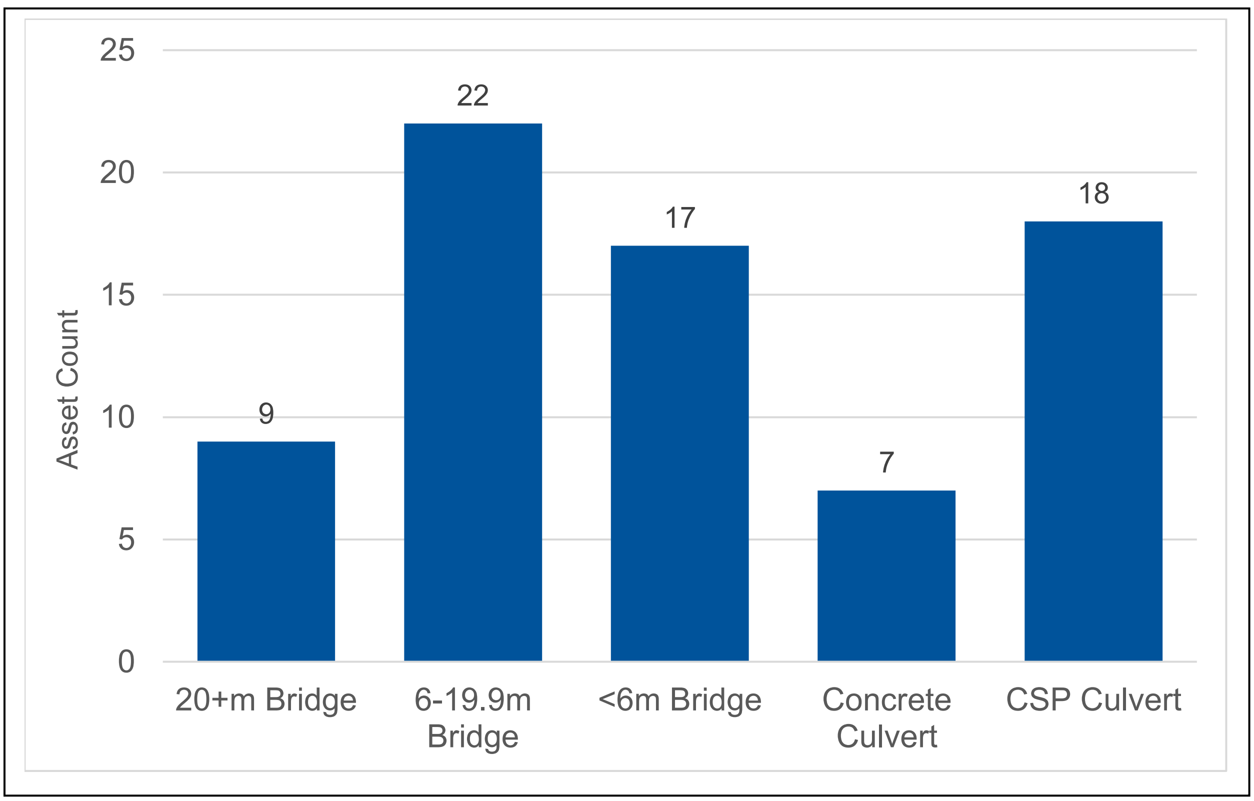
7.1.1. Bridge Structure Asset Profiles

Each structure type has unique physical aspects that need to be considered from a rehabilitation and maintenance perspective. It is generally structure type that governs the applicability and timing of lifecycle activities; however, it also noted that bridges of similar span generally share commonalities with respect to their lifecycle recommendations. Accordingly, the AM framework also categorizes bridge structures within three groups according to their spans: *20+ metres*, *6 metres to <20 metres*, and *<6 metres*.

All the Township's structural culverts have spans <6 metres; therefore, instead of being grouped by span, Structural Culverts are grouped according to their material type, as either a *CSP Culvert* or a *Concrete Culvert*. This distinction is important due to differences in their modes of physical deterioration and the potential rehabilitation technologies which can be unique to each.

Figure 7-2 summarizes the number of Bridge and Culvert assets grouped within each Asset Profile.

Figure 7-2: Inventory of Bridge Structures by Asset Profile (to 2022)



7.1.2. Functional Performance

The percentage of bridges in the Township with loading or dimensional restrictions serves as a measure of functional performance and is a prescribed Level of Service measure under O. Reg. 588/17 S.5(2), 1(i), Table 5.

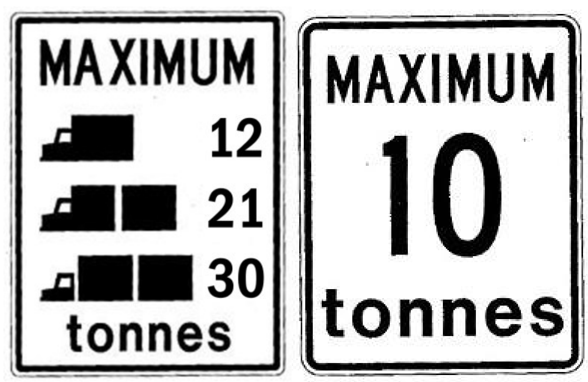
7.1.2.1. Loading Restrictions

Loading restrictions diminish the functional utility of the road network and may present challenging logistical implications with respect to emergency services response time, winter road maintenance, waste collection, and school bus routes.

Loading restrictions are often imposed due to deteriorated physical condition of structural elements. In accordance with the Ontario Structure Inspection Manual (OSIM) methodology, the recommendation for a structural evaluation is triggered when the measured extent of certain deficiencies exceed a prescribed threshold, which could indicate the potential of a structural performance deficiency.

Loading restrictions can either be in the form of a Single load posting, or a Triple load posting (one or the other may be more appropriate based on the characteristics of the applicable roadway). Triple load postings indicate a bridge's weight restrictions based on Gross Vehicle Weight Rating (GVWR), differentiated by truck type and number of vehicle units, and provide operators with the necessary information to determine whether they are allowed to travel over the bridge. The weights in a triple load posting are specific to each bridge and are determined by undertaking a Structural Evaluation in accordance with the Canadian Highway Bridge Design Code (CHBDC). Weight restrictions that supported through Municipal By-law are legally enforceable under the Highway Traffic Act. Examples of regulatory loading restriction signs are depicted in **Figure 7-3**.

Figure 7-3: Examples of Loading Restriction Signage



"Triple Load Posting"   "Single Load Posting"

7.1.2.2. Dimensional Restrictions

Generally, a bridge is dimensionally restricted unless its travelled width accommodates two lanes of opposing traffic and two adequate shoulders; however, there are also criteria provided in the Ontario Structural Manual, 2016, under *Appendix A: Guidelines for the Design of Bridges on Low Volume Roads, Table 1: Minimum Lane, Shoulder, and Bridge Widths,* as shown below in **Figure 7-4.** To accurately assess whether a bridge structure is dimensionally restricted, the bridge width, posted speed limit, and traffic volume are evaluated against these dimensional guidelines; any bridges that do not meet the minimum widths are deemed to be dimensionally restricted.

Figure 7-4: Excerpt from Ontario Structural Manual, 2016 – Appendix A

STRUCTURAL MANUAL

2016 09 01	APPENDIX A GUIDEINES FOR THE DESIGN OF BRIDGES ON LOW VOLUME ROADS	PAGE E1-15

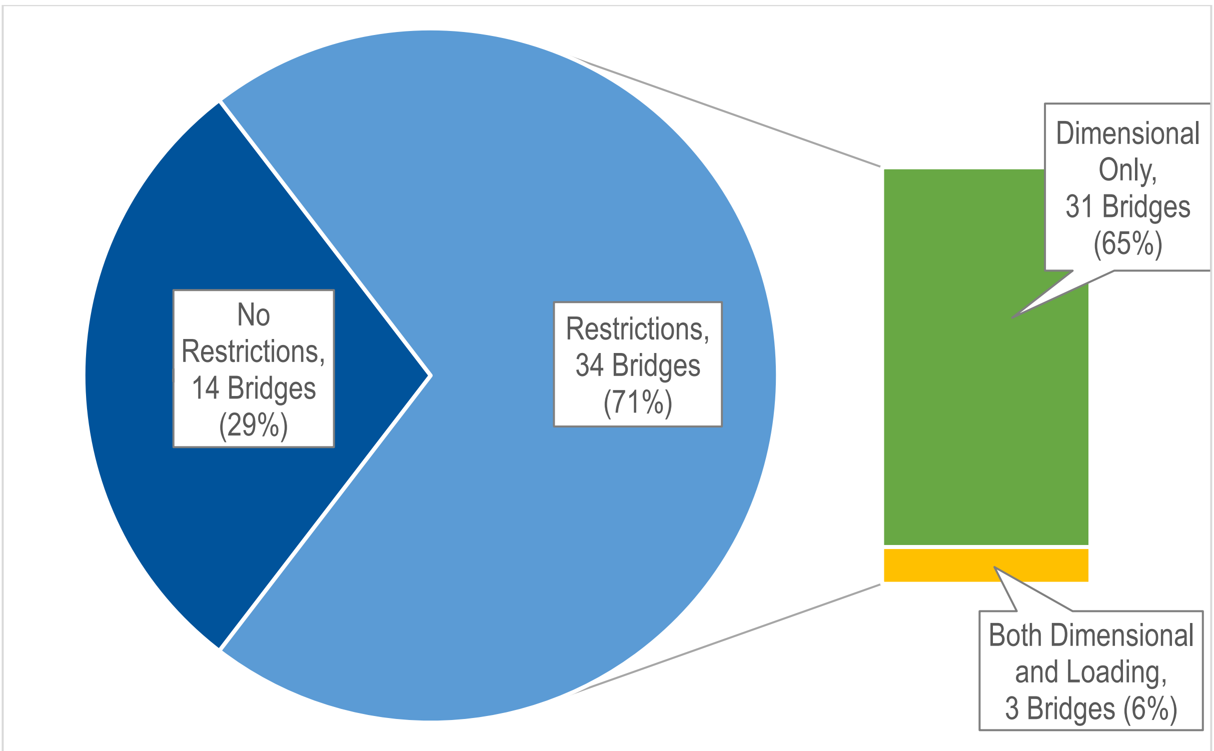
TABLE 1: MINIMUM LANE, SHOULDER AND BRIDGE WIDTHS.

AADT	OPERATING SPEED (km/hr)	MIN. LANE WIDTH (m)	MIN. SHOULDER WIDTH (m)	MIN. BRIDGE WIDTH (m) [1,4]
0 - 200	< 70	3.0	0.5	4.0 [2,3,4]
	≥ 70	3.0	0.5	7.0
200 – 400 [5]	< 50	3.0	0.5	4.0 [2,3,4,6]
	≥ 50 and < 70	3.0	0.5	7.0
	≥ 70	3.25	1.0	8.5

1 - Width measured between the inside face of the barriers, guiderails, or curbs.
2 - Horizontal and vertical sight distances shall be provided to allow approaching motorists to observe an opposing vehicle on a single lane bridge or its far approach. If there are sight distance issues, a single lane bridge should not be used.
3 - Farm or other special vehicles may require larger widths. Consultation shall be made with local officials. It may also be acceptable to have a lower barrier to accommodate these farm or other special vehicles.
4 - New single lane bridges wider than 4.9 m should be avoided as they may give the appearance of a two-lane bridge.
5 - Range also applies to existing roadways with AADT >400, where operational issues have been minimal and Approval for use of these guidelines has been obtained.
6 - For AADT > 400, or for locations where the Seasonal Average Daily Traffic is significantly >400, consideration should be given to using additional traffic control measures at the bridge for single lane structures (i.e. traffic signals, yield sign for one direction, etc.).

Below, **Figure 7-5** illustrates the percentage of bridges with dimensional and/or loading restrictions, based on the total inventory of 48 bridges. Altogether, the total percentage of bridges with loading or dimensional restrictions is 71%. This percentage reflects a total of 34 bridges with dimensional restrictions, including three (3) which also have loading restrictions (all bridges with loading restrictions are also dimensionally restricted).

Figure 7-5: Percentage of Bridges with Restrictions – Dimensional and Loading



It is noted that some structure types, particularly cast-in-place rigid frames, offer versatility to accommodate widening retrofits; therefore, potential exists for improving functional levels of service through planned rehabilitation projects.

7.2. Current Replacement Value

The Township's inventory of 73 structures has a total estimated current replacement value of $69.1 Million (2021$). These assets are broadly grouped into two categories: *Bridges* and *Structural Culverts*; current replacement values are about $54.4 Million and $14.7 Million respectively, as detailed in **Table 7-1**.

Table 7-1: Summary of Bridge Structure Asset Replacement Value

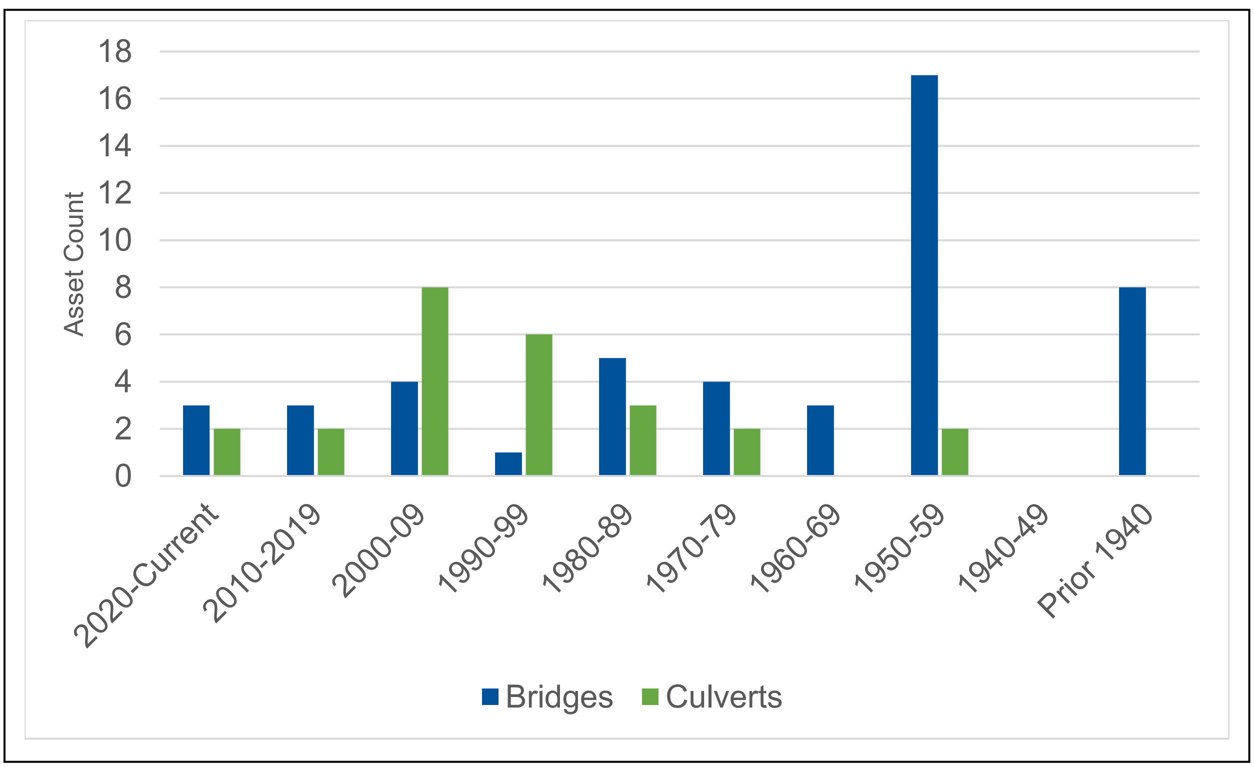
ASSET CATEGORY	QUANTITY	CURRENT ESTIMATED REPLACEMENT VALUE (2021$)
Bridges	48	$54,433,500
Structural Culverts	25	$14,723,000
TOTAL		**$69,156,500**

The replacement costs in **Table 7-1** include any applicable upgrades required for the new bridge meet current standards.

7.3. Asset Age

The ages of bridge structures reported in the AMP are based on available historical records. Where records are unavailable, the reported ages are based on educated estimates that consider the architecture and construction materials used, such as type of reinforcing steel bar, size of concrete aggregate, and evidence of formwork material used in construction. **Figure 7-6** illustrates the age distribution of bridges and culverts by showing the estimated in-service dates for each asset, grouped by decade.

Figure 7-6: Age Distribution of Bridge and Culvert Assets

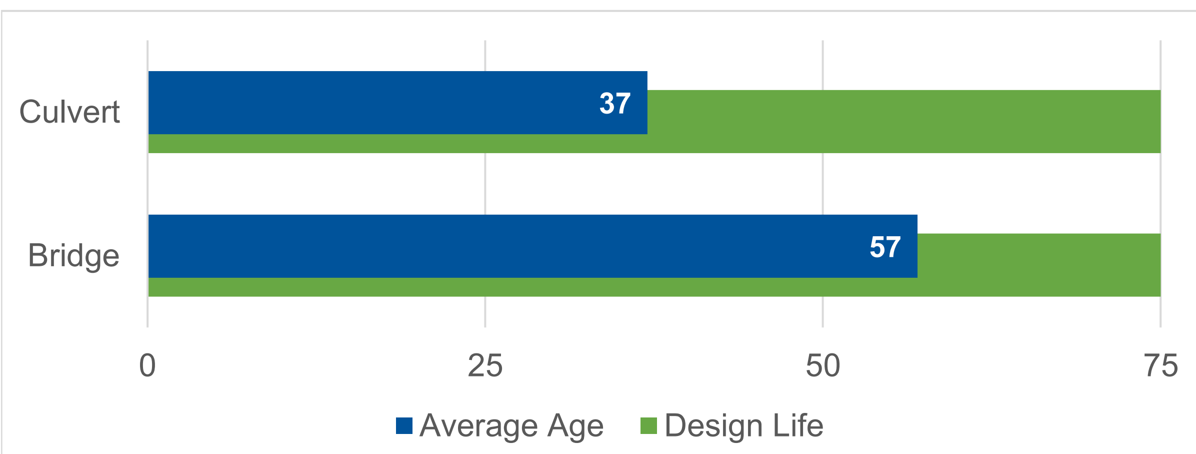


In 1954, Hurricane Hazel was responsible for the failure of many wooden-type bridge structures, which were subsequently replaced with concrete structures. It is not unreasonable to hypothesize that the significant spike in bridges constructed in the 1950's (shown in **Figure 7-6**) is reflective of Hurricane Hazel disaster recovery efforts. It is noted that the majority of the Township's bridges from the 1950's are cast-in-place concrete rigid frame structures with spans less than 6 metres.

As the end-of-life continues to draw near for many 1950's-era bridge structures, the AMP will invariably need a strategy for addressing significant bridge structure capital needs over the short-to-mid term. One strategy, which has already been partially implemented, is to undertake repair and rehabilitation work to extend the life of these assets. Undertaking relatively minor repair and rehabilitation work has the potential to add decades of service life to these structures, thereby helping to spread out the timing of future capital budget pressures, while also minimizing overall asset lifecycle costs relative to replacement. While some rehabilitation work has been completed, there are still more of these 1950's era-bridge structures which are in a "fair" condition and suitable candidates for cost-effective rehabilitation, pending funding availability; alternatively, if they are not rehabilitated within the next 10 to 15 years, they will require either a more costly replacement, or indefinite closure.

Figure 7-7 illustrates the average age of Culverts and Bridges, as compared to their Design Life. Of the Township's 25 Structural Culverts, the average age is 31 years, and of the Township's 48 Bridges, the average age is 57 years.

Figure 7-7: Average Age of Bridge and Culvert Structures Relative to Design Life



Design Life is the period of time which a structure is intended to remain in service, based on fatigue due to cyclic truck loading. **Figure 7-7** measures the average ages of bridges and structural culverts against a Design Life of 75 years, per the current requirements set out under the CHBDC. It should be noted however, that the Design Life requirements set out in the CHBDC have evolved over time, and structures within the Township's inventory would have been subject to the applicable standards at the time of construction. Most recently, the CHBDC has stipulated that the Design Life of new structures shall be 75 years, specifically stating the following:

> *"In earlier codes, a 50-year design life was assumed but not explicitly stated. Increasing the structure design life to 75 years was a pragmatic decision that took into account the desirability of having more durable structures, consistency with other codes (AASHTO 2002), and the slowing of obsolescence and renewal rates as highway systems approach maturity." (C1.4.2.3 Design Life)*

This increased Design Life was made possible by through the introduction of increased thicknesses for structural steel elements such as piles and girders, and also due to technological improvements in concrete durability, such as mixes specifically designed to minimize cracking and deterioration in concrete exposed to de-icing chemicals.

Bridge structures designed and constructed prior to 1983 may have been subject to a 50-year Design Life assumption, however it is important to note that many of the older (pre-1983) bridge structures within the Township are on track to, or have already proven to, outperform the 50-year threshold. This favourable outcome can be partly attributed to the undertaking of planned rehabilitations, repairs, and routine maintenance.

7.4. Condition

Under O. Reg. 104/97: *Standards for Bridges*, all bridge and culvert structures with spans of 3 metres or greater must be inspected under the direction of a Structural Engineer on a biennial basis in accordance with the Ontario Structure Inspection Manual (OSIM). To satisfy these regulatory requirements, the Township retains qualified professionals to inspect all structures south of Highway 89 during odd-number calendar years and all structures north of Highway 89 during even-number calendar years.

Based on the findings of each structure's most recent inspection, an updated Bridge Condition Index (BCI) rating is assigned. BCI is a holistic condition measure that considers all elements of a bridge structure. The BCI rating is expressed on a scale from 0 – 100, based on the relationship between the current element value and total equivalent value. For each bridge structure, the unique factors contributing its BCI calculation need to be well understood, which is why specific treatment recommendations and designs are provided trusted qualified engineering professionals. While BCI is a very useful metric, it should not be construed as a direct measure of the level of safety associated with a particular bridge structure.

Table 7-2 provides general information regarding lifecycle strategies typical of certain BCI ranges; these are general guidelines, and it should be noted that in practice, lifecycle strategies are tailored specifically to each structure.

Table 7-2: Summarized Implications of BCI Ranges

BCI Range	Qualitative Description	Lifecycle Strategy Implications
70 - 100	**Good**	Repair or rehabilitation work is not usually required within the next 5 years, although maintenance activities are still carried out to prevent the development of critical defects, and to slow the rate of deterioration. Examples of maintenance activities include sweeping, washing, sealing, asphalt repairs, and erosion repairs.
50 - 70	**Fair**	Repair or rehabilitation work should be undertaken within the next 5 to 10 years. From an economic perspective, a BCI of about 60 is ideal undertake major rehabilitation. Examples of repair or rehabilitation activities include replacement of deficient elements, concrete repairs, deck waterproofing, wearing surface restoration, and roadside safety upgrades.
<50	**Poor**	Repair or rehabilitation should be scheduled within 1 year unless it is determined that replacement or divestment of the structure would be a more favourable solution, in which case the end-of-life should be scheduled within a 1-10 year range, and it may be prudent to undertake additional monitoring in the interim.

Average BCI can be used a measure of asset stewardship. The Average BCI value for both Bridges and Structural Culverts is a prescribed Level of Service measure under O. Reg. 588/17, S.5(2), 1(i). As shown below in **Figure 7-8** and **Figure 7-9**, the current arithmetic average BCI of Bridges is 67.6, which (coincidentally) is identical to the current average BCI of Culverts (also 67.6).

Figure 7-8: Average BCI of Bridges

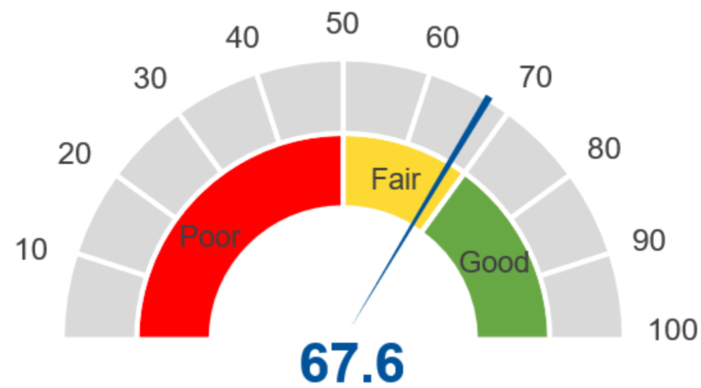
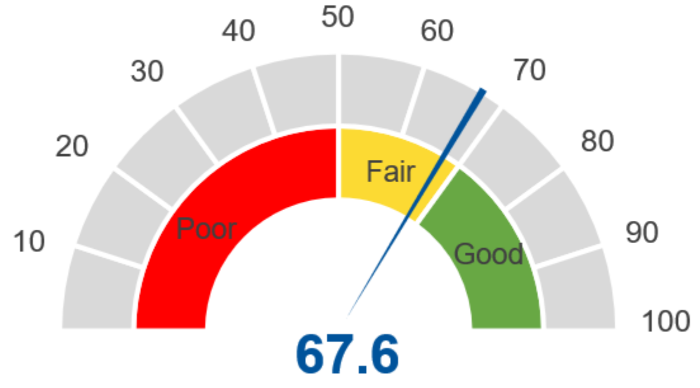
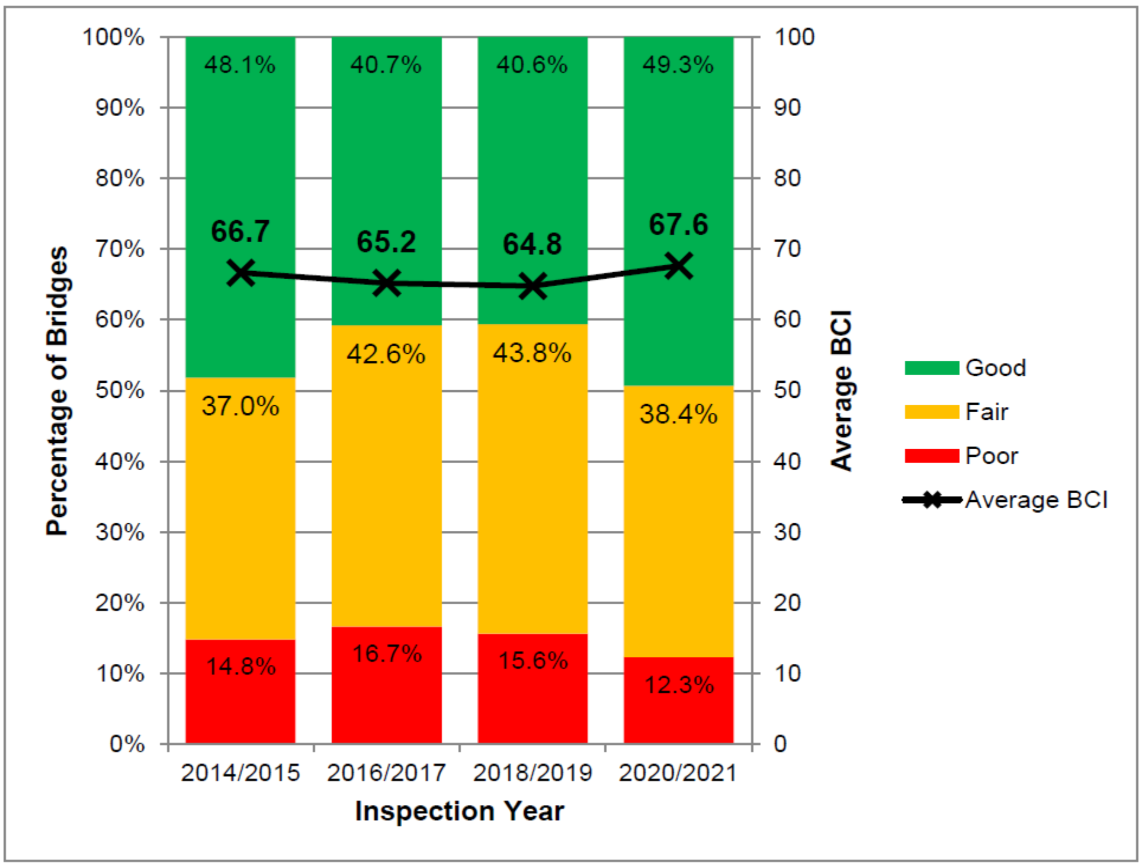


Figure 7-9: Average BCI of Structural Culverts



For context, **Figure 7-10**, below, shows the trending of total combined average BCI of bridges structures over the last several years.

Figure 7-10: Trending of Average BCI for all Bridge Structures



Excerpt taken from 2021 OSIM Bridge Inspections Report by R.J. Burnside & Associates Limited

With respect to **Figure 7-10**, it is critical to note that until recently the bridge structure inventory did not represent all Township-owned assets. The bridge structure inventory was expanded during the 2019/2020 period, when Township staff undertook a comprehensive field review and data collection program for all water crossings (in-stream culverts) within the Township. The bridge structure inventory was subsequently updated to reflect newly identified Structural Culverts that had previously eluded the asset inventory, generally hidden below fill and obscured by vegetation. These bridge structures are now included in the AMP and are subject to appropriate regulatory requirements and engineering due diligence measures. It should be noted however, that the addition of newly identified structures to the inventory generally had a negative effect on the total average BCI and prompted new prioritization for capital work undertaken. Despite these challenges, the most recent average BCI shown in **Figure 7-10** suggests that positive trending may be expected in the future if investment in bridge structures is sustained.

Since 2020, the Township has informally adopted a strategy of bundling Bridge Structure rehabilitation work of similar scope into annual construction contracts as a cost-effective approach to address more widespread rehabilitation needs; this approach has proved to be effective based on the movement in the overall average BCI, shown in **Figure 7-10**. It is also appropriate to also recognize the funding support from Provincial and Federal levels of government, helping to make these projects possible. Since 2018, five (5) bridge structures have been replaced, and eight (8) have been rehabilitated.

7.5. Lifecycle Management

Routine maintenance and appropriately timed, cost-effective rehabilitations are critical to ensuring the longevity of bridge structures, while minimizing overall lifecycle costs. Of particular importance is the time-sensitivity for rehabilitation projects. Generally, structures that have been allowed to deteriorate below 50 BCI may not be suitable rehabilitation candidates. As discussed in **Table 7-2**, The "*Fair*" Condition state (BCI ranging from 50 to 70) is generally the optimal time to carry out planned rehabilitations, and as shown in **Figure 7-10**, currently 38.4% of the bridge structure inventory is within this BCI range.

The risk of deferring viable bridge structure rehabilitations is the lost opportunity to generate a return-on-investment. If rehabilitation opportunities are allowed to elapse, then the need for a much costlier end-of-life replacement should be scheduled within approximately the next 10 years, assuming that current levels of service are to be sustained. Not undertaking viable rehabilitations means it will ultimately cost more to sustain the same level of service. Also, forgoing rehabilitation in favour of replacement effectively intensifies and transfers budgetary pressures to the future, potentially compounding future capital needs in an unsustainable manner.

Possible risks of deferring bridge structure replacement include: loss of function (i.e. need for imposing loading restrictions), increased probability of failure, need for unplanned emergency closure, need for increased monitoring frequency, and future capital funding requirements being compounded unsustainably.

In addition to ROI, other factors may also influence pragmatic decision-making regarding whether to invest in extending the life of a bridge; for example, other factors could include: load limit, structure width, road alignment, changes in traffic or climate patterns, local flooding event history, and timing in conjunction with other infrastructure projects.

Based on ROI analyses and feasibility criteria, the most impactful rehabilitation projects are identified. Consistently, it is found that the economic benefit of rehabilitating a bridge structure is directly related to its replacement cost; therefore, it is the largest, most expensive bridges that should be subject to the most rigorous rehabilitation and maintenance programs. Particularly, when managing the lifecycle of large bridges (i.e. spans greater than 20 metres), it may be prudent to intervene with wearing surface rehabilitations and minor repairs while the bridge structure is still classified as being in "*Good*" condition (i.e. BCI >70). Conversely, for relatively smaller bridge structures, the Township will undertake rehabilitation work on a case-by-case basis, when it is economically feasible, and practical from an engineering perspective. Structures with low vertical clearances may not permit person-entry to undertake repairs to the interior; in these cases, repair and rehabilitation strategies may be limited.

To illustrate the economic value of undertaking planned rehabilitations, two different scenarios can be compared. In the first scenario, the annualized capital needs are $922,087, based on dividing the current replacement value of $69,156,500 (refer to **Table 7-1**) by the Service Life of 75 years. It must be recognized that this annualized capital need does not reflect the capital needs specific to the current 10-year forecast (see **Table 7-3** below). In the second scenario, it is estimated that the long-term annualized cost would be reduced to $607,560 by routinely undertaking planned rehabilitations that extend the useful life of the bridge structures. By taking the difference between replacing bridge structures at end-of-life versus managing them with routine maintenance and planned rehabilitations, the hypothetical financial costs associated with failing to undertake viable bridge structure rehabilitations is $314,527 annually.

The current rehabilitation and maintenance approach generally assumes that the service provided by each existing bridge structure is to be delivered in perpetuity. This assumption is due to the lack of any policy or direction to the contrary.

The 2024 AMP will require the establishment of affordable and consistent Levels of Service. When rationalizing Levels of Services, it should be noted that undertaking a formal rationalization of the bridge structure inventory would be a potential option to address overall long-term budgetary demands. Theoretically, planning to divest, rather than replace certain bridge and culvert assets may be justifiable where replacement costs do not warrant the utility provided.

Over the 10-year forecast, Bridge Structure Capital Needs are broadly categorized into rehabilitation needs and replacement needs. Future needs are projected by applying the most current BCI data to standardized deterioration models specific to each Bridge Structure Asset Profile. The estimated capital costs associated with bridge structure rehabilitation and replacement needs over the next 10-year period are summarized in **Table 7-3**.

Table 7-3: Bridges and Structural Culverts – 10-year Capital Needs Forecast

TIME OF NEED	ESTIMATED COSTS TO MAINTAIN CURRENT SERVICE LEVELS		
	Bridge Structure Rehabilitation	Bridge Structure Replacement	**TOTAL CAPITAL NEEDS**
NOW	$ 2,623,000.00	$ 3,557,500.00	$ 6,180,500.00
1 - 5 Years	$ 5,747,000.00	$ 5,238,500.00	$ 10,985,500.00
6 - 10 Years	$ 1,636,450.00	$ 617,500.00	$ 2,253,950.00
TOTAL 10-YEAR CAPITAL COST PROJECTION			**$ 19,419,950.00**

Comparing the capital needs to the Township's current and historical levels of funding, it is evident there is a significant funding gap. Funding levels must be significantly increased to sustain current service levels over the long term. In the short term, it is noted that debt financing is an option that would allow capital needs to be addressed, while spreading out the budget impacts over time. Furthermore, in the absence of available funding, a business case could be made that time-sensitive rehabilitation treatments capable of delivering a ROI which is greater than the interest rate of borrowing are attractive projects for debt-financing, provided the Township has room within its *Annual Repayment Limit* (ARL).

Otherwise, to attain sustainable and affordable service levels, it may prove necessary to undertake a pragmatic rationalization of the Township's bridge structure inventory and determine if any bridge structures would be suitable for indefinite closure at their end-of-life, based on holistic analyses of all relevant considerations, such as: traffic characteristics, emergency response implications, detour times, replacement costs, and coordination with other capital plans.

References:

The following background information and reports were referenced in development of the 2022 AMP:

4 Roads Management Services Inc. 2020. "2020 Asset Management Readiness Assessment and Level of Service for Core Assets."

4 Roads Management Services Inc. 2020. "2020 State of the Infrastructure and Asset Management Plan for Roads."

Ontario Clean Water Agency. 2020. "2020 Asset Management Plan for Water and Wastewater Infrastructure."

Ontario Clean Water Agency. 2018. "Facility Optimization Report for the New Horizon Wastewater Treatment Plant."

Ontario Clean Water Agency. 2020. "Water and Wastewater Facility Assessment and Capital Plan ."

R.J. Burnside & Associates Limited. 2020. "2020 OSIM Bridge Inspections Report."

R.J. Burnside & Associates Limited. 2021. "2021 OSIM Bridge Inspections Report."

Statistics Canada. 2022. *Census Profile, 2021 Census of Population.* https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E.

Watson & Associates Economists Ltd. 2021. "2021 Development Charges Background Study."

Watson & Associates Economists Ltd. 2021. "Ontario Regulation 453/07 Water Financial Plan."

Watson & Associates Economists Ltd. 2021. "Water and Wastewater Rates and Connection Charges Study and Water Financial Plan."

These documents and information are either publicly available on the Township's website, the worldwide web, or otherwise may be available through the Freedom of Information and Protection of Privacy Act, R.S.O. 1990, c. F.31.

Appendix A: Level of Service Measure Summaries

Summarized below are the prescribed Level of Service Measures, adapted from Tables 1 through 5 of O. Reg. 588/17 (S.5(2), 2).

Additional Level of Service Measures can be included at the direction of Council.

The purpose of providing this information as an appendix is to facilitate the annual review of AMP progress required under O. Reg. 588/17, S.9. Annual review requirements begin upon the completion of the 2025 milestone deliverable.

It is intended that this Appendix will be updated and presented to Council on an annual basis to serve as a “report card”, showing progress toward meeting the proposed Levels of Service.

*Note that Proposed Levels of Service are a future AMP requirement, and as such, have not been populated for the 2022 AMP.

Table 1: Levels of Service for Drinking Water Assets

Service Attribute	Qualitative	Quantitative		
	Community Level of Service	Technical Levels of Service		
		Measure	Proposed	Actual
Scope	1. Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system. 2. Description, which may include maps, of the user groups or areas of the municipality that have fire flow. **Refer to Figures 3-1 and 3-2.**	Percentage of properties connected to the municipal water system.	-	**25%**
		Percentage of properties where fire flow is available.	-	**16%**
Reliability	Description of boil water advisories and service interruptions. **Refer to Section 3.1. and Figure 3-3.**	The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.	-	**nil** (2021)
		The number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system.	-	**nil** (2021)

Table 2: Levels of Service for Sanitary Wastewater Assets

<table>
<tr><th rowspan="3">Service Attribute</th><th>(Qualitative)</th><th colspan="3">(Quantative)</th></tr>
<tr><th rowspan="2">Community Level of Service</th><th colspan="3">Technical Levels of Service</th></tr>
<tr><th>Measure</th><th>Proposed</th><th>Actual</th></tr>
<tr><td>Scope</td><td>Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system. Refer to Section 4.1.</td><td>Percentage of properties connected to the municipal wastewater system.</td><td>-</td><td>2.4%</td></tr>
<tr><td rowspan="3">Reliability</td><td rowspan="3">1. Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes.
2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.
3. Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes.
4. Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in paragraph 3.
5. Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.
Refer to Section 4.1.</td><td>The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system.</td><td>-</td><td>N/A</td></tr>
<tr><td>The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system.</td><td>-</td><td>N/A</td></tr>
<tr><td>The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.</td><td>-</td><td>N/A</td></tr>
</table>

Table 3: Levels of Service for Stormwater Assets

<table>
<tr><th rowspan="3">Service Attribute</th><th>(Qualitative)</th><th colspan="3">(Quantative)</th></tr>
<tr><th rowspan="2">Community Level of Service</th><th colspan="3">Technical Levels of Service</th></tr>
<tr><th>Measure</th><th>Proposed</th><th>Actual</th></tr>
<tr><td rowspan="2">Scope</td><td rowspan="2">Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system. Refer to Section 5.1. and Figure 5-1.</td><td>Percentage of properties in the municipality resilient to a 100-year storm.</td><td>-</td><td>42% Resilient
58% Unknown</td></tr>
<tr><td>Percentage of the municipal stormwater management system resilient to a 5-year storm.</td><td>-</td><td>100%</td></tr>
</table>

Table 4: Levels of Service for Roads Assets

Service Attribute	(Qualitative) Community Level of Service	(Quantative) Technical Levels of Service: Measure	Target (*)	Actual
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity. **Refer to Section 6.1.**	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.	-	Arterial: **N/A**
			-	Collector: **1.219**
			-	Local: **0.432**
Quality	Description or images that illustrate the different levels of road class pavement condition. **Refer to Section 6.4. and Table 4-4.**	For paved roads in the municipality, the average pavement condition index value.	-	Weighted Average **28.1** (out of 100)
		For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor).	-	Weighted Average **70.6** (out of 100)

Table 5: Levels of Service for Bridge and Structural Culvert Assets

<table>
<tr><th rowspan="3">Service Attribute</th><th>(Qualitative)</th><th colspan="3">(Quantative)</th></tr>
<tr><th rowspan="2">Community Level of Service</th><th colspan="3">Technical Levels of Service</th></tr>
<tr><th>Measure</th><th>Target (*)</th><th>Actual</th></tr>
<tr><td rowspan="2">Scope</td><td rowspan="2">Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).
Refer to Section 7.1.</td><td rowspan="2">Percentage of bridges in the municipality with loading or dimensional restrictions.</td><td>-</td><td>Loading Restrictions:
6%</td></tr>
<tr><td>-</td><td>Dimensional Restrictions:
65%</td></tr>
<tr><td rowspan="2">Quality</td><td>Description or images of the condition of bridges and how this would affect use of the bridges.
Refer to Section 7.3 and Figure 7-8</td><td>For bridges in the municipality, the average bridge condition index value.</td><td>-</td><td>67.6
(out of 100)</td></tr>
<tr><td>Description or images of the condition of culverts and how this would affect use of the culverts.
Refer to Section 7.3 and Figure 7-9</td><td>For structural culverts in the municipality, the average bridge condition index value.</td><td>-</td><td>67.6
(out of 100)</td></tr>
</table>