ASSET MANAGEMENT PLAN

The Corporation of the Township of St. Clair

2021-12-20

ASSET MANAGEMENT PLAN

ST. CLAIR TOWNSHIP

St. Clair Township is a lower tier municipality located in the County of Lambton, in the Province of Ontario, Canada. We are committed to providing efficient, effective, and economical services to our taxpayers.

Home to approximately 14,000+ residents in southwestern Ontario. Nestled along the beautiful St. Clair River of the Great Lakes network, featuring the St. Clair River Trail actively connecting communities and waterfront parklands.

The Township of St. Clair is '**a great place to live, work and play!'**

Situated 15 minutes North and South of international border crossings with the United States, and boasting a thriving industrial park, and other large industries.

If you seek sporting amenities including a two pad Arena and Golf Course, Cultural Museums and Fairs, Parks and Camping, serene countryside and quaint small communities, it can all be found HERE!

The preparation of this project was carried out with assistance from the Government of Canada and the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them."

REVISION AND REVIEW

ASSET MANAGEMENT PLAN					
Revision Number	**Section**	**Details**	**Completed By**	**Adopted By**	**Date**
000	AMP WHOLE / EXECUTIVE SUMMARY	First AMP, to Building Together	S. Agar, PW Engineering	Council	30-May 2014
001	AMP WHOLE / EXECUTIVE SUMMARY	AMP Update, to New Regulations	PW Engineering & Dillon Consulting		20-Dec 2021

EXECUTIVE SUMMARY

The following Asset Management Plan is an update to the previous plan completed in May 2014. This report includes Township-owned core and non-core (as defined in O.Reg. 588/17) public works assets:

- Roads
- Bridge Structures
- Sidewalks & Trails
- Streetlights & Signalized Intersections
- Water Network
- Stormwater Assets
- Wastewater Assets

The Township has a separate asset management plan that includes other assets, such as buildings and improved assets, Community Services and Emergency Services assets.

STATE OF INFRASTRUCTURE

The asset inventory is maintained in Cartegraph OMS operations management system and integrated with ESRI GIS mapping and Vadim finance system.

The asset value for each category and class was determined using updated replacement unit costs, or inflation of historical construction costs.

The condition rating for the assets was determined using actual condition data (from inspection or condition assessment programs), or in the absence of that information, using predictive estimations based on the age and material of the asset.

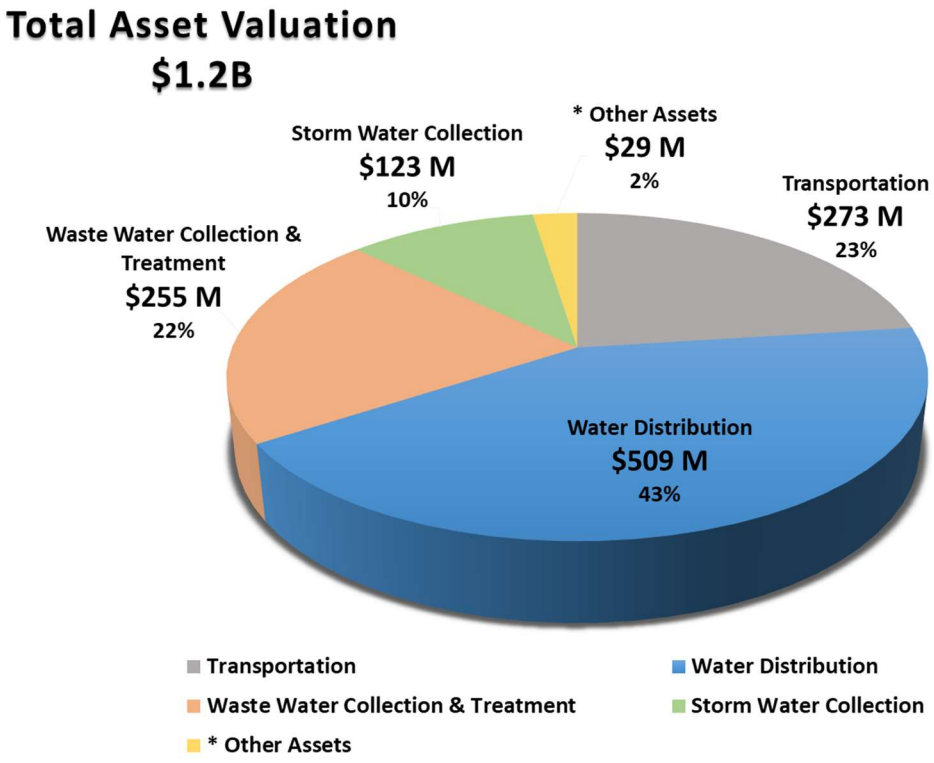
A summary of the asset inventory, total valuation, and average condition rating is in **Table 0-1**.

Table 0-1: Summary of AMP Inventory				
Category	**Class**	**Inventory**	**Asset Value (2021)**	**Average Condition Rating**
Roads	Surfaced	235 km	$141,162,459	Fair
	Unsurfaced	328 km	$70,789,998	Good
Bridges Structures	Bridges	92	$51,388,046	Fair
	Culverts			Good
Sidewalks	Sidewalks	36 km	$1,996,633	Excellent
Trails	Trails/Walkways	34 km	$3,393,520	Excellent
Street Lighting	Fixtures	1,471	$1,176,800	Excellent
	Supports	643	$2,263,950	
Signalized Intersections	Signalized intersections	2.75	$432,865	Excellent
Water Distribution	Water mains	475 km	$503,647,689	Excellent
	Water Tower	1	$5,412,910	Fair
Storm Assets	Storm Culverts	13 km	$20,000,860	Good
	Storm Pipe	72 km	$102,087,744	Good
	Pumping Stations	1	$375,000	Excellent
	SWM Ponds	2	$254,716	Excellent
Wastewater Collection & Treatment	Force main	35 km	$188,147,098	Good
	Gravity main	90 km		
	Pumping stations	31	$6,800,000	Excellent
	WWTP	1	$30,000,000	Excellent
	Lagoons	3	$30,000,000	Assumed Condition???

ASSET VALUE

Asset Valuation is determined by using current Estimated Unit Replacement Costs against inventory by category.

Typical Unit Replacement Cost x modifier x asset data (length, area, or number of) = **Asset Replacement Value**



[1]

Figure 0-1: Distribution of Public Works Asset Valuation by Category

With a Public Works Total Network Replacement Value of $1.2 Billion, the Township should theoretically allocate over $35 Million per year to ensure future sustainability of these assets. This represents the industry recommendation of 2% -4% yearly investments in renewal activities.

[1] *Other Assets are other significant assets not included in this AMP but identified for valuation purposes only.

ASSET CONDITION

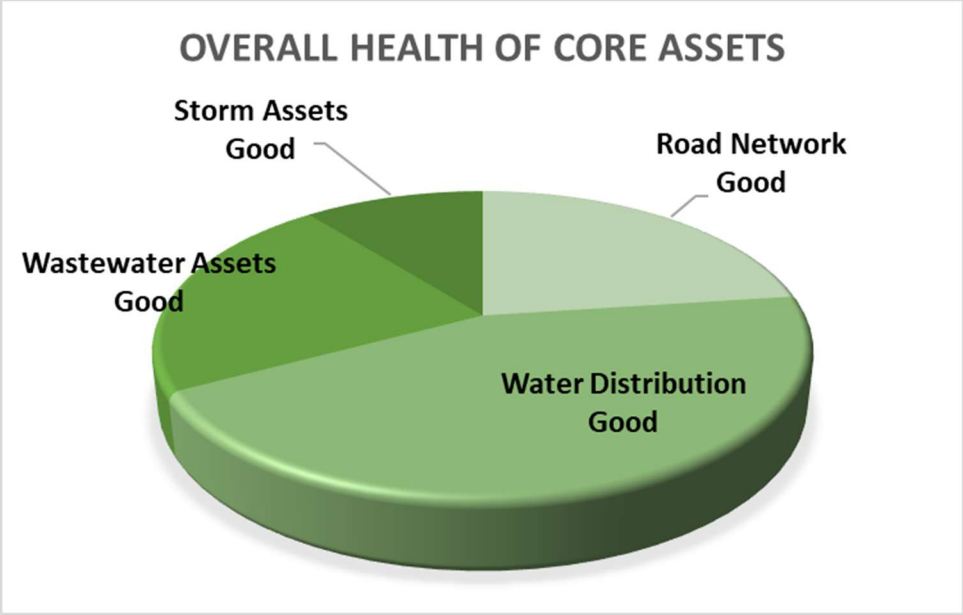


Figure 0-2: Overall Asset Condition

The overall condition of our infrastructure is Good. Current estimated overall condition of each asset is typically based on Age and Material over its expected useful life. Where actual condition assessment is performed the Inspection rating is used, and then continues to deteriorate on the predictive curve.

LEVEL OF SERVICE (LOS)

Levels of Service mandated under O.Reg. 588/17 are outlined with Technical and Community LoS expectations. The Township has further established Levels of Service parameters, targets, and responses.

LIFECYCLE MANAGEMENT STRATEGY

The lifecycle management strategy for the stewardship of our infrastructure implements an array of lifecycle activities with improvement impacts to be executed at the most cost-effective 'window of opportunity' in the assets expected useful life and that the necessary funds are available at that time based on the financing strategy.

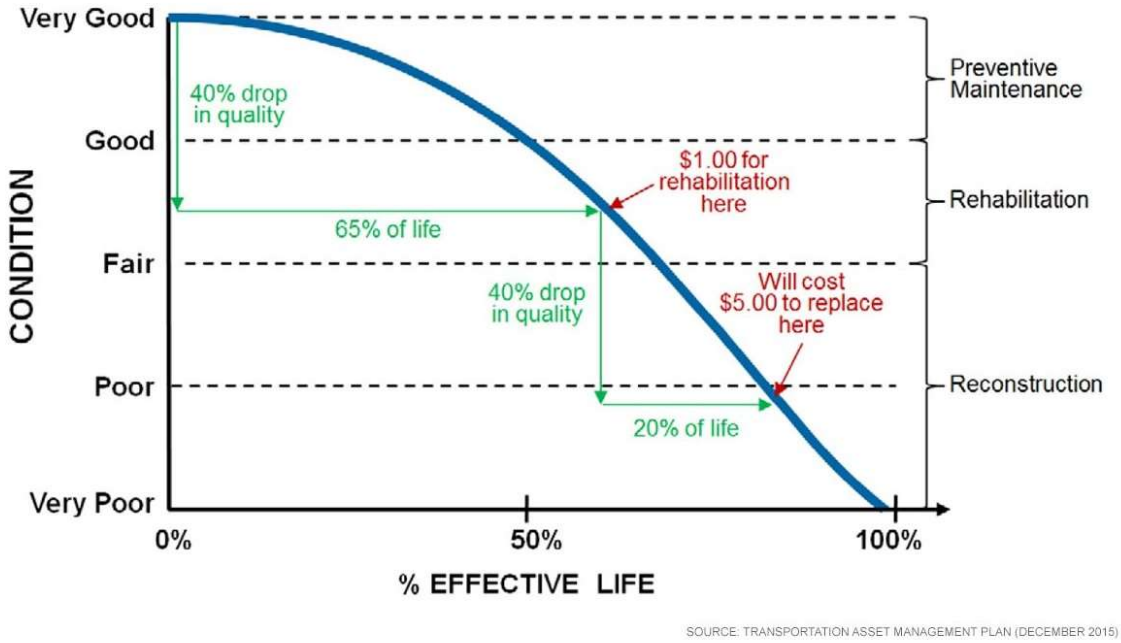


Figure 0-3: Windows of Opportunity, (City of Barrie, Pavement Management)

A 10-year projection of works, evaluation of levels of service and annual expenditure was developed based on the condition of the infrastructure and levels of service being provided by the Township. Different yearly budget allocations were analyzed to determine the appropriate annual budget which would result in achieving or maintaining the target level of service offered to the residents for the next 10 years, and to analyze the impact of maintaining current budget amounts. Scenarios were analyzed using the Cartegraph OMS system for most asset categories. Other categories were considered using funding allocations and lifecycle costs.

FINANCIAL STRATEGY

Funding comes from a variety of sources including:

- Tax levy
- Debt Financing
- Reserves
- User Fees
- 3rd Party Contributions

Typically, the Budgeting and Planning Scenarios analyzed for comparison over a timeframe are:

- **Actual** Budget – Identify the effect of current funding on an asset class
- **Target** LoS Budget – Identify funds required to maintain a Target LoS
- **Unlimited** Budget – To determine backlog of works
- "**What-if**" Budget" – Various scenarios to consider other LoS and funding strategies

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GLOSSARY

AODA - Accessibility for Ontarians with Disabilities Act

AGL – Applied GeoLogics Inc. (Cartegraph Support Service Provider)

AMP – Asset Management Plan

Asset Managers – Municipal staff responsible for the decisions and outcomes from the AMP

BCI – Bridge Condition Index (Ontario Ministry of Transportation standardized bridge condition rating)

Bridge (Structures) – shall infer Bridges and Culverts greater than 3m in Span (>3m)

Cartegraph/CMMS –Software for Computerized Maintenance Management System

CCTV – Closed-Circuit Television (used for sewer pipe inspection)

CIP - Capital Improvement Plan

ESRI/GIS – Software for Geographic Information System

DWQMS – Drinking Water Quality Management System

HCB – High Class Bituminous (e.g., Asphalt Paved Road)

KPI's - Key Performance Indicators

LAMC – Lambton Asset Management Committee

LCB – Low Class Bituminous (e.g., Surface Treatment Paved Road)

LoS – Level of Service

MMS – Minimum Maintenance Standard

Municipality – shall infer The Corporation of the Township of St. Clair

OCI – Overall Condition Index

OSIM - Ontario Structural Inspection Manual

PACP – Pipeline Assessment and Certification Program (standardized defect coding)

SCT – St. Clair Township

Sewers – can infer either Sanitary Sewers and Storm Sewers

TCA – Tangible Capital Assets

Township – shall infer The Corporation of the Township of St. Clair

1 INTRODUCTION

St. Clair Township is a lower tier municipality located in the County of Lambton and regulated under the Province of Ontario, Canada. Home to over 14,000 residents in southwestern, Ontario.

Population and dwellings	
Population, 2016 [1]	14,086
Population, 2011 [1]	14,515
Population percentage change, 2011 to 2016	-3.0
Total private dwellings [2]	6,243
Private dwellings occupied by usual residents [3]	5,785
Population density per square kilometre	22.8
Land area in square kilometres	619.17

Figure 1-1: Population Statistics from Statistics Canada

1.1 CONTEXT OF ASSET MANAGEMENT AT ST. CLAIR TOWNSHIP

Asset management involves making coordinated decisions about maintaining, replacing, and repairing municipal infrastructure. This practice allows municipalities to handle their assets in a sustainable way and provide reliable services to their citizens.[2]

The Corporation of the Township of St. Clair will employ a Corporate Asset Management (CAM) System that aligns actions with strategic goals and objectives. It provides direction to guide Council, Management and Staff in conducting corporate business in a sustainable manner, while being economically, socially, and environmentally responsible.

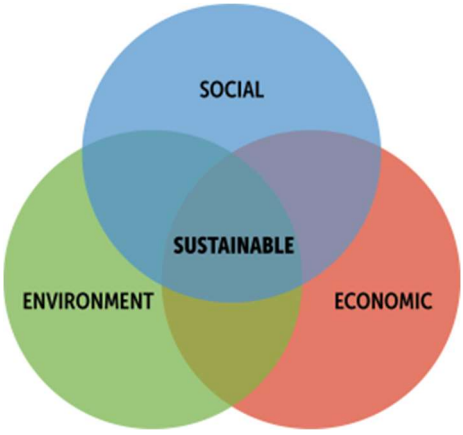

Figure 1-2: Triple Bottom Line

The Asset Management System (AMS) shall support corporate strategic objectives, while delivering safe and reliable municipal services.

[2] https://fcm.ca/en/case-study/mamp/changing-organizational-culture-in-tangible-way

1.1.1 ASSET MANAGEMENT POLICY

The Township established an asset management policy, in accordance with requirements of O.Reg. 588/17, which was approved by Council in May 2019.

The current AM Policy can be found in **Appendix A.1 Strategic Asset Management Policy.**

1.1.2 ASSET MANAGEMENT VISION

To make Asset Management (AM) a comprehensive part of St Clair Township's integrated approach towards efficiently and effectively managing our assets, to meet or exceed the expectations of all stakeholders.

1.1.3 CORPORATE STRATEGY

We have looked outside to leading organizations such as FCM (Federation of Canadian Municipalities), AMOntario and Engineering firms for guidance, funding, training, and resources to advance our knowledge, skills, and behaviours around Asset Management, in the following 5 competencies:

- Policy and Governance
- People and Leadership
- Data and Information
- Planning and Decision-making
- Contribution to Asset Management practice

1.1.4 OUR ASSET MANAGEMENT JOURNEY

August 2005 – January 2007. Public Works initiated the undertaking of an Asset Management System (AMS) with Dillon Consulting Limited, in association with Monteith & Sutherland Limited, ASI Technologies Inc. and Harfan Technologies Inc. Initial Inventory and asset data collection for Road, Sewer and Watermain networks were stored in the Cartegraph work management system and integrated with ESRI GIS mapping. The Consultants Final Report- 'Development of Integrated Asset Management Plan (IAMP)' was never adopted or implemented and key driving personnel were lost.

October 2012 - September 2013. Council supported the recommendation from the finance committee, to adopt an AMP. Objective was adoption, for implementation and continuous improvement, that would thereby meet the new requirements for grant opportunities. The Municipality applied for and obtained funding under the Ontario Municipal Infrastructure Investment Initiative (MIII) to improve asset management planning following the Ontario's Ministry of Infrastructure guide "*Building Together: Guide for Municipal Asset Management Plans*." Council further supported recommendations that they adopt an AMP as input into the budget process for decision making and the asset management strategies be updated from time

to time in accordance with best practices, technology changes, financial constraints, and condition assessment outcomes.

May 2014. Our first Asset Management Plan for PW Infrastructure created in-house and adopted by Council as a whole, for implementation and continuous improvement, thereby meeting the new requirement for applying for any provincial capital funding by demonstrating project prioritization on a standardized and consistent level. This Plan was shelved and lacked ownership, support, or direction.

December 2016. AMP it UP Municipal Action Plan, Hemson Consulting Limited. Finance Department created a separate Asset Management Plan for Facilities and Improved Assets. This Plan was shelved and not maintained.

January 2017. (MAMP) Municipal Asset Management Program for Implementation of a New Asset Management Platform (AM Towards 2). A change management in PW Department direction to advance our AM Maturity to Level 2 and commence an Organizational Shift in Culture and Technologies around Asset Management.

October 2020 - Present. (MAMP) Municipal Asset Management Program for

- Gathering Community Input regarding the Township's Core Services
- Updating and Finalizing the Township's Core Asset Management Plan
- Integrating Financial Assets into the Asset Management System through the Tangible Capital Asset Program
- Update of existing asset management plan to meet requirements of O. Reg 588/17 for core assets.

The Township endeavors to continue to improve and update asset management as we continue our journey.

1.1.5 GUIDING PRINCIPLES

The following will serve as overarching principles of St. Clair Township's asset management practice.

- Customer Focused: Defined Levels of Service align with Community Expectations.
- Service Focused: Consideration given to Assets and their interrelationships, in the context of their service delivery and reliability.
- Risk Based: Manage assets through resources, expenditures and priorities based on associated risks and corresponding health & safety and cost/benefit prioritization.
- Value Based Affordable: Choose practices, interventions and operations that reduce the asset lifecycle cost in balance with risk and costs while satisfying levels of service.

1.1.6 ORGANIZATIONAL PLANS AND POLICIES

The following organizational plans and policies should be referenced in conjunction with this plan, for supporting information:

- Water Financial Plan
- Procurement Policy
- Capital Budget Financing Policy
- Tangible Capital Asset Policy

Additional strategic planning and asset management documents have been developed at the Township, including:

- Strategic Plan
- Official Plan
- Asset Management Plan
- Facilities AM Plan
- Level of Service document
- DWQMS Operational Plan

In support of organizational procedures and asset management, the Township intends to put in place the following:

- Reserve Fund Policy
- Risk Management Plan
- Climate Change Plan

1.1.7 BUDGETING

The Municipality will migrate away from a departmentalized process to a unified cross-departmental prioritization and ranking, in alignment with organizational goals and strategies.

The asset management planning process shall identify and prioritize asset spending needs and provide the input for the forecasted Capital & Operating budgets, and Long-term Financial Planning.

Departmental Management staff shall monitor and review their asset management plans for an overall Capital and Operations budget plan to achieve optimized risk/cost benefit.

This policy applies to all assets owned by the Municipality whose service delivery role requires deliberate management by the Municipality.

1.1.8 COMMUNITY PLANNING

Asset based community planning will be aligned with the Municipality's Strategic Plan as well as Official Plan and the 2014 Provincial Policy Statement of the Planning Act. Internal and External Stakeholder input shall be incorporated into our Organizational Plans and Policy's and

the Asset Management Plans reflective of how the community is projected to change and the related asset impacts. Cross-referencing of these Plans will ensure that sustainable community planning occurs within the Municipality.

1.1.9 CLIMATE CHANGE

Climate Change will be considered part of our asset management Environmentally Conscious guiding principle. This approach is intended to balance organizational capacity, financial and stakeholder support and the potential risks and vulnerabilities related to climate change. The development of actions will be required in addition to acquiring or modifying assets based on greenhouse gas reduction targets.

1.1.9.1 ASSET MANAGEMENT AND CLIMATE CHANGE ADAPTATION REPORT

In 2019, with PSD, the Township procured a report assessing Asset Management and climate Change Adaptation at the Township. This report (attached as **Appendix B.6**) assessed through survey the state of asset management, using PSD's Asset Management Self-Assessment Tool. The findings gauged the Township at an 'intermediate' level. Specific assessment was also included around asset and climate change data, noted to be the foundation of a sustainable asset management and climate change adaptation program. Again, the Township was assessed at an 'intermediate' level.

St Clair Township will continue to review and improve asset resiliency based on changing climate factors and the impact/risk toward specific assets. The Township will also beef up its information related to climate which will provide more informed decisions related to adjusting asset resiliency.

1.1.10 STAKEHOLDER ENGAGEMENT

The Municipality recognizes the importance of stakeholder engagement as an integral component of a comprehensive asset management approach. The Municipality recognizes the residents, businesses, institutions, stakeholders and neighbouring municipal bodies, provincial agencies, and regulated utilities partners. Accordingly, the Municipality will foster informed dialogue with these parties using the best available information.

Table 1-1: Listing of Stakeholders

Internal Stakeholders	Roles and Responsibilities
Municipal Council	• Ultimate authority, responsible for support of Organizational Strategic Plans (OSP's) and Asset Management Plans (AMP's) and Resources Support ongoing implementations and improvements of OSP's & AMP's • Approve by Resolution AMP's at least every 5yrs • Review annually AM planning progress and strategy prior to July 1st
CAO	• Responsible for Compliance with AM Policy and Regulations • Ensure sufficient asset status /plan reporting to all stakeholders

Finance	• Responsible for assessing the funding available to support Financial Plans & Asset Management Plans (AMP).and aligning the budgeting process
Executive Lead/ Asset Management Steering Committee	• Responsible for Asset Management planning led by the Director of Public Works & meeting at a minimum 4x/year • Endorse AM Plans for approval • Set & execute annual asset management objectives • Maintain compliance with appropriate regulation • Report annually on AM planning and progress prior to July 1st • Monitor AM planning progress & impediment and identify strategies • Ensure that the asset management program is evaluated for continuous improvement on a regular basis
CAO/Division Directors	• Responsible for the execution and support of AM under their direction • Review and Update AMP's under their direction at least every 5yrs • Provide stakeholder communication through service metric/ KPI reporting
External Stakeholders	
Provincial Agencies	Other Municipalities
Regulated Utilities	Ratepayers/Community

1.1.10.1 COMMUNITY SURVEY

In 2020, with Probe Research Inc., the Township undertook a community survey. The survey was used to gather information from citizens on the following concepts:

- Satisfaction with Township services
- Taxes and municipal spending priorities
- Service interaction and communication
- Waste collection

The key findings and survey information is summarized in a report, in **Appendix B.5.**

Results of the Community Input Survey generally indicate that St. Clair Township residents are generally happy with the condition of the municipal core assets as well as the level of service they are provided related to these assets. Residents are also not interested in increasing taxes any further than is necessary to maintain current levels of service.

1.1.11 GOVERNANCE AND CONTINUOUS IMPROVEMENT

In support of the Municipality's AM Vision & Goals, the Asset Management Steering Committee (AMSC) shall provide leadership, direction, and governance to engage the entire Municipality in establishing, sustaining, and improving Asset Management throughout the Organization.

The Municipality shall ensure continued communication by providing information through various media to educate, facilitate utilization & communicate changes/ interruptions regarding Corporate Asset Management.

Continuous Improvement of our Asset Management System will be ongoing through the general strategy shown in **Figure 1-3**.

(Hamilton, n.d.)

Figure 1-3: Plan>Do>Check>Act Figure for Continuous Improvement (www.guru99.com/a-complete-guide-to-test-process-improvement.html)

Some methods for continuous improvement at the Township can include (but are not limited to) the following:

- Following best practices,
- Looking for guidance from FCM/ MAMP – Readiness Scale,
- Looking to peer communities for improvement ideas LAMC Committee,
- Following AM Regulations,
- Working with consultants, (such as AGL, Dillon, AMOntario),
- Identifying improvements as we work through various initiatives such as the AM Plan – captured in the plan as future improvements.

1.2 AM SUPPORT AND LEADERSHIP

The **Asset Management Steering Committee** was reformed in 2017, to support the renewed push around building a Corporate Asset Management System. The Team consists of the Asset Management/Work Management Lead, cross-departmental Directors, and two Councillors, to align Organizational AM Practice.

Figure 1-4: Asset Management Steering Committee 3P's

This Committee is the building block for corporate asset management in the absence of a current Corporate Strategic Plan.

Deliver Top Down while Building from the Bottom Up

The Public Works Director and Department tend to be leaders in AM practice and work towards continuous improvement through Departmental **Asset Management Development** meetings. Hope to be an example for other Departments and offer support.

1.3 SHAPING ASSET MANAGEMENT CULTURE

The Township has identified the following components and action items that can continue to shape asset management culture:

- AM Education and Training
  - Standing Item on Asset Management Objectives
- Newly Create Roles to support AM objectives.
  - Field Planner
  - Public Works Technician
- Setting Roles and Responsibilities around AM – Empowerment

- Training on AMP and Systems and their relation to Roles and Responsibilities.

- Shift in mindset
  - Keep the AM Conversation Going
- Communications
  - Formal
    - Standardized AM Reporting (Internal & External)
    - LAMC Committee, Council, Public etc.
  - Informal
    - AMSC Shares
    - OMS Shares

1.4 BENEFITS OF IMPLEMENTING AN ASSET MANAGEMENT PLAN

An effective Asset Management Plan based on an integrated approach will ensure the ongoing integrity and sustainability of the infrastructure assets. Many benefits can be achieved from a full implementation.

Informed and timely decisions will help municipalities optimize investments, reduce asset lifecycle costs in the long run, and better manage risks. Improved municipal asset management will ensure financial sustainability and direct limited provincial resources to the most critical needs.

The AMP will assist the decision makers in the preparation of short-term Capital Improvement Plans (CIP) and prediction of long-term Life Cycle Plans. It will also contribute to improved day to day operations through efficiencies.

It should be understood, however, that an AMP is only a *network tool* to assist in the preparation of a Capital Improvement Plan (CIP). It should be used by decision makers in reaching educated decisions, supported by reliable and objective technical data, for the infrastructure to be repaired. An AMP will help the user in comparing asset condition throughout the network on the same basis. It will provide a consistent approach in comparing the performance of each element of the infrastructure networks and identify components of the networks in need of rehabilitation. An AMP is a powerful tool to assist decision makers in identifying where they should concentrate their efforts and money. It is a network-level instrument which, when utilizing an integrated approach, will determine and prioritize where renewal activities should be carried out at the network level. However, input will still be required by the decision-makers to finalize the CIP.

The final decision on capital improvement work is, in most cases, based on factors that are difficult to incorporate into an AM model. ("Political" issues or socio-economic considerations from public stakeholders are examples of such factors.) As is always the case, practical engineering expertise is essential in the decision-making process. Typically, before the final decision is made, more detailed investigative work will be required to confirm the results.

Implementation will ensure the Township can meet new demands in a fiscally responsible and environmentally sustainable framework while preserving the Townships' quality of life.

1.5 DEVELOPMENT OF THE ASSET MANAGEMENT PLAN

This AMP includes the Public Works assets only, including:

- Roads
- Bridge Structures
- Sidewalks & Trails
- Streetlights & Signalized Intersections
- Water Network
- Stormwater Assets
- Wastewater Assets

A separate AMP was developed for Facilities and Improved assets, which has been received by Council and found in **Appendix A.4 Facilities AMP 2016**.

Emergency Services assets and Fleet remain managed outside of either plan.

This AMP shall include the short-term Implementation plans and long-term Life Cycle strategies for Public Works assets.

To properly accomplish this goal, it is essential to have an accurate knowledge and understanding of the physical and operational characteristics of the Township's infrastructure networks and be able to identify and provide recommendations to address deficiencies in the system to ensure an acceptable Level of Service to the residents.

1.5.1 STATE OF INFRASTRUCTURE

This section on the state of local infrastructure sets out:

- The type of assets and their quantity or extent
- The financial accounting valuation and replacement cost of valuation for all assets
- The asset age distribution and asset age as a proportion of expected useful life for all assets
- The asset condition based on standard engineering practice for all assets.

1.5.1.1 ASSET INVENTORY

Asset data (inventory and lifecycle data) is stored in the Cartegraph OMS operations management system and integrated with ESRI GIS mapping. These Core Assets are also integrated with Vadim Financial Reporting. Data refining and cleaning is an ongoing process, and will be required continuously as assets are added, constructed, or changed. Cartegraph OMS is the source for most inventory reporting.

1.5.1.2 ASSET VALUE

The Township asset valuations are based on the current estimated replacement costs and assumptions detailed in the SCT Unit Cost Calculations Sheet.

The total replacement cost for all assets considered within this plan is $1.16B (in 2021 dollars)

The distribution of this replacement cost is shown in **Figure 1-5**.

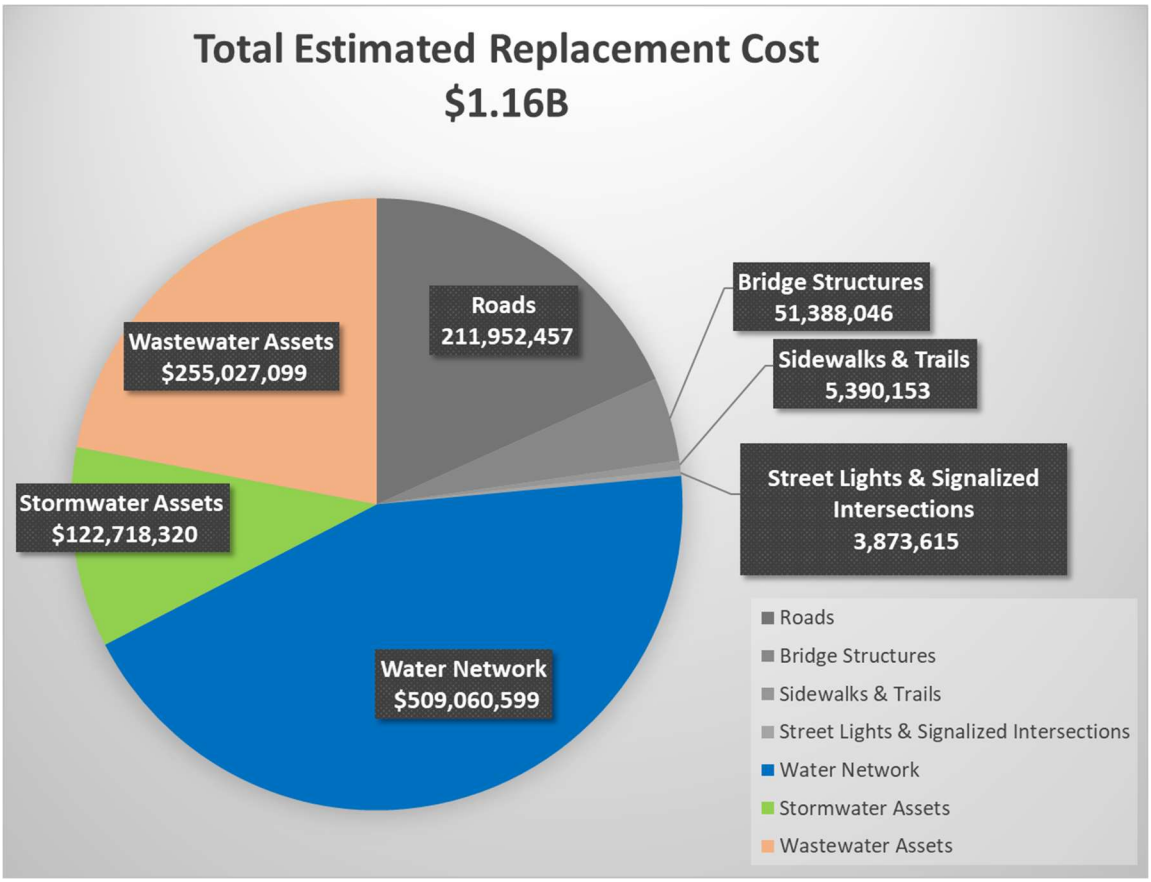

Figure 1-5: Total Estimated Replacement Cost

1.5.1.3 ASSET CONDITION

The Township undertakes some asset condition or inspection programs which provide up to date details about asset conditions. Where actual condition information is unavailable, estimated condition assumptions were developed based on known or estimated install dates upon initial inventory import. Ongoing condition information is collected on assets during routine inspection and maintenance activities, or during contracted inspection services. Newly constructed assets are initially given an assumed perfect condition rating.

Appropriate condition monitoring reduces the likelihood of critical asset failure.

Figure 1-6 is the comparison of condition index mappings to which our assets are rated.

Index Value		SCT OCI Rating	Pavement PCI Index	Pavement PCI Rating	Bridges BCI Rating	Sewer Pipe PACP Index	Sewer Pipe PACP Rating
100	5	Excellent	100	Excellent	Good	1	Excellent
90	4.5		90				
80	4		85	Good			
70	3.5	Good	70			2	Acceptable
60	3		60	Fair	Fair		
50	2.5	Average	55	Poor	Poor	3	Fair
40	2		40				
30	1.5	Fair	30	Very Poor		4	Poor
20	1		25	Serious			
10	0.5	Poor	10	Failed		5	Failed
0	0	Failed	0				

Figure 1-6: Comparison of Condition Index Mapping

The overall asset condition summary, for assets considered under this plan, is shown in **Figure 1-7**.

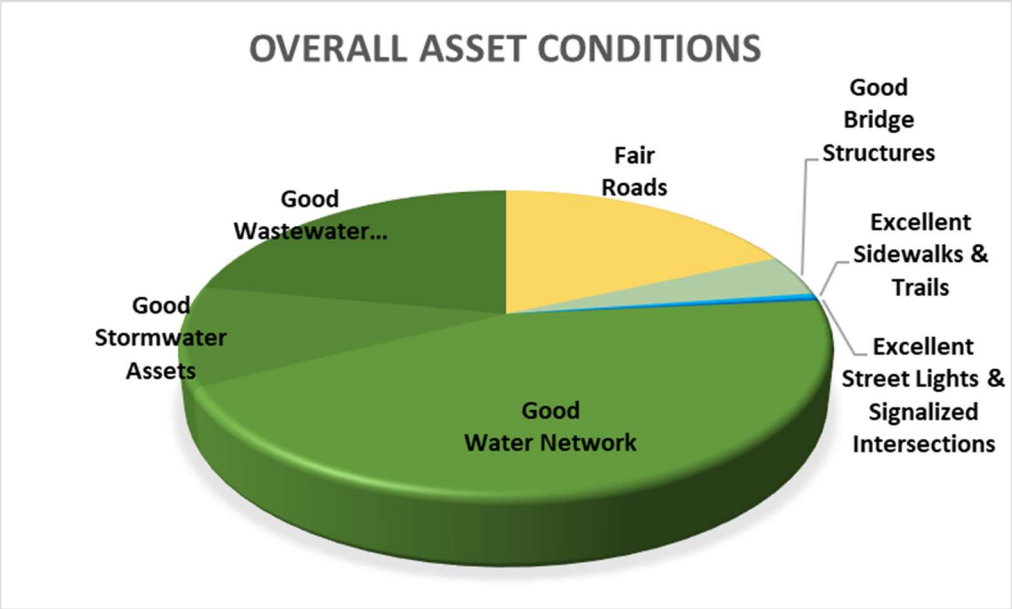

Figure 1-7: Overall Asset Condition

1.5.2 ASSET RISK

The Township is initiating a review of asset risk.

The Township currently considers risk in their asset management program through the following:

- Consideration of risk when assigning criticality factors to assets within the OMS
- Most issues incurred are addressed per OMS
- Water network has its own risk analysis system within the Municipal DWQMS
- Budget considerations include subjective project priorities. The evaluation metric is shown in **Table 1-2.** Other priorities such as need, or environmental concerns are noted.

Table 1-2 Project Priority Risks

Project Priority	Indicate High/Medium/Low
Health or Safety Issues	
Cost Saving/Paybacks	
Asset Maintenance/Replacement	
Growth Related Needs	
Service Enhancement	
Other	

Assets should be managed in a proactive manner with consideration to the probability of failure and the consequence of failure.

1.5.3 LEVELS OF SERVICE (LOS)

The Township has defined levels of service indicators that measure how service is being provide to ratepayers, and allows the Township to track, compare and adjust the Levels of Service as required. Asset Managers at the Township recognize that to continue to provide an adequate Level of Service to their ratepayers, it is essential to first develop a strategy that would ensure the sustainability of those assets. Levels of Service are currently established by the Township, documented, and are to be tracked on an annual basis.

In addition, current and proposed levels of service are described in O.Reg. 588/17 in terms of technical metrics and qualitative descriptions for each asset type. These descriptions are prescribed for core assets (including water, wastewater, stormwater, roads, and bridges and culverts) within Ontario Regulation (O.Reg.) 588/17.

As required by O.Reg. 588/17, the current levels of service are defined for two different audiences as follows:

- *Community Levels of Service*: intended to be customer-focused, provide a qualitative description of scope and quality
- *Technical Levels of Service*: provide technical metrics for scope and quality.

The Township has previously established levels of service parameters, definitions and targets for all assets considered within this AMP. These are generally consistent with the definitions in the regulation, including specific customer and technical level of service definitions. The Township has further established community expectations, performance measures, actual values, and associated costing information for each asset type. Within this AMP, the level of

service parameters defined under the regulation are outlined, as well as the broader level of service information.

The Township has defined current levels of service (through tracking of the indicators) and has established proposed levels of service (targets) to inform their asset management planning. These levels of service targets are established based on minimum maintenance standards, current levels of service, Township risk tolerance, and input from the ratepayers.

Current Service Levels are considered acceptable and are based on historical infrastructure management practices.

Additional information on Levels of Service including the indicators, definitions and values is included in **Appendix B.1 LoS Levels of Service**.

1.5.4 LIFECYCLE ACTIVITIES

The lifecycle activities include activities that can be undertaken over an asset's useful life. These activities, under O.Reg. 588/17, are defined to include constructing, maintaining, renewing, operating, and decommissioning of assets and all engineering and design work associated with these activities. Further, Building Together – Guide for Municipal Asset Management Plans (Municipality of Infrastructure) categorizes lifecycle activities into the following categories:

- non-infrastructure solutions,
- maintenance,
- renewal/rehabilitation,
- replacement,
- disposal, and
- expansion activities.

Lifecycle activities have been defined for each of the asset categories considered within this AMP.

1.5.5 ASSET MANAGEMENT STRATEGY

Decisions are presently made on the renewal of assets to replace, rehabilitate, or continue with current maintenance activities based on Council/Political directions within short electoral terms, instead of over long-term life-cycle management of the asset.

Our goal is to move Roads, Water, Sewer analysis to an Optimized Life/Minimal Cost method. This method utilizes a calculation to allocate funding to the assets which will see the greatest increase in life, for the minimal amount of funds. This favours performing treatments on assets at optimized life cycle points. This means that some assets which are in poor condition may be allowed to deteriorate further until the benefit of replacement is sufficient to divert funds from preservation and rehabilitation activities.

The implementation of an AMP is to ensure adequate financial reserves are set aside for the preservation, rehabilitation and replacement of aging and expanding infrastructure assets,

To estimate an infrastructure's remaining service life, it is essential to know its actual state and the projected service life of its family type. The remaining service life estimates will assist staff in the determination of "when" and "how much" to invest in immediate and long-term scenarios, to counter the effects of deterioration and to ensure the timely renewal of infrastructure. These assumptions are documented in **APPENDIX A.2 - Tangible Capital Asset Policy.**

There is an extensive list of planned and unplanned maintenance and repair activities incorporated into our Cartegraph operations management system (OMS). Some of these activities are associated and tracked on the individual asset history, for further evaluation of asset condition and behaviors to assist in identifying and prioritizing improvement needs. We are striving to be more effective in this area as the organization is still growing at different levels of utilizing and understanding the system.

Consideration of alternative procurement methods and new technologies should be given to reduce costs of addressing infrastructure needs. In accordance with the Municipality's current **BYLAW 25 of 2018 - Being a Bylaw to provide for procurement procedures**.

1.5.5.1 INTEGRATED APPROACH

To make the most cost-effective decisions regarding renewal of infrastructure assets, an integrated approach to acknowledge the proximity and high level of interaction between the infrastructure networks. In simple terms, it is essential to look at the condition of all components of infrastructure within a road segment before selecting an improvement strategy.

The advanced use of the "Windows of Opportunity" concept can be used to coordinate the timing for repair with other components of infrastructure reducing the total cost of repairing the assets. The following figure illustrates the concept of "Windows of Opportunity".

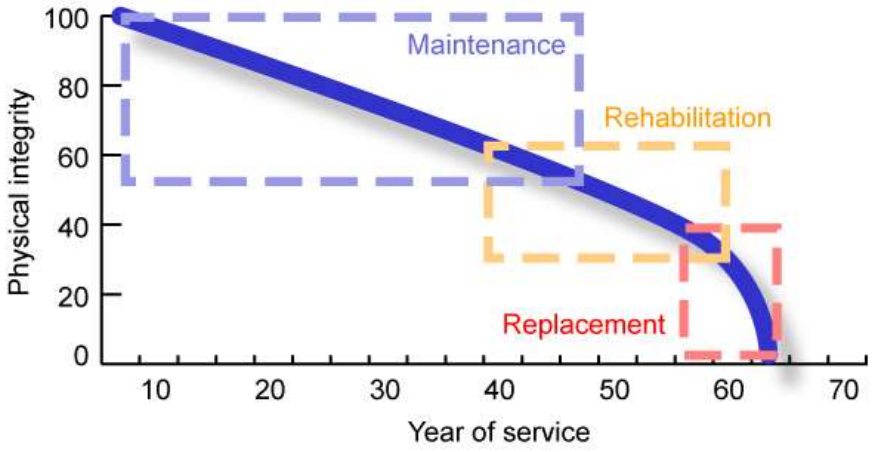

Figure 1-8: "Windows of Opportunity" Concept

The next step is to further prioritize the improvements, determine when they should take place, establish what kind of improvement should be applied and determine how much it would cost.

1.5.6 FINANCING STRATEGY

Typically, Unlimited and Actual budget scenarios are analyzed along with multiple "What if" Scenarios for comparison.

It is very important for a municipality to determine if the current level of funding is appropriate to continue to provide an adequate Level of Service to its residents. It is also essential to allocate adequate funding to ensure sustainability of the assets in the future. It is often suggested in literature that 2% to 4% of the value of an asset should be spent yearly to ensure sustainability of the assets.

Funding remains the biggest challenge in reaching sustainability. Particularly with property tax funded core services such as Roads and Bridges.

Taxation and user rates have historically fallen short of recognizing the true life-cycle cost of infrastructure assets resulting in a growing list of deferred capital projects. Further shortfalls can be contributed to the yearly reductions in provincial funding, the loss of OPG property tax revenues, increases in policing and other costs to maintain the same levels for other tax-based services.

Currently, there has not been a formal commitment to address Long Term Capital Investment needs.

1.6 CONCLUSIONS & RECOMMENDATIONS

The Township of St. Clair has historically been in a reactive, worst-first environment. With the increase in communication and understanding of our systems, our direction is moving towards a proactive, optimized life management of our assets. There is the need to look ahead long term with our financial strategies instead of to the past.

Levels of Service and Key Performance Indicators need to be tracked to benchmark our plan.

To continue good asset management, the Township should consider reviewing current practices for potential costs savings and optimized asset improvement in our operational methods

Further considerations should be given to multi-year contracts and seeking partnerships with neighboring municipalities.

Recommendations for funding include the utilization of third-party contributions and the dedication of the AMO Gas Tax to Paved Roads.

External communication of our progress can be posted on our Municipal website (www.stclairtownship.ca) and in The Beacon our household newsletter.

1.7 PLAN IMPROVEMENT AND MONITORING

The Township of St. Clair has taken worthy initiative with the introduction and integration of the Cartegraph Operations Management System to manage our assets. The Township has considerable investment in this system and is dedicated to updating, maintaining, and progressing with the utilization of this resource for assessing and prioritizing asset needs, incorporating Levels of Service and risk tolerance, as well as integrating with the financial system. Continuous dedication and improvement is necessary for advancement.

The Asset Management Plan is an integral living document.

The Asset Management Plan as a whole, is expected to be updated and communicated to Council every five years. The Executive Summary will be rewritten at the same time. Individual sections should be updated as new relative data and information become available.

Future reviews should include a look at other supporting plans and policies within the context of this AMP.

2 ROADS

2.1 STATE OF INFRASTRUCTURE – ROADS

The Township roads network includes surfaced (paved) and unsurfaced (granular and earth) roads. This section excludes County Roads within the Township. The following table describes the current state of roads assets.

Category	Class	Condition	Total Length / Count	% Rated	Current Value	Average Age	Avg Years to Re hab/ Replace
Pavement	Surfaced	Good 	235.21 km	100.00 (BM: 100.00)	$141,162,458.65	42	10
Pavement	Unsurfaced	Unrated 	327.57 km		$70,789,998.48		

Figure 2-1: Excerpt from Infrastructure Report Card (2021) for Roads

Current Infrastructure Report Card can be found in **Appendix B.2**.

Additional description of the information presented in the above table are detailed below.

2.1.1 ASSET INVENTORY

The Township-owned Road network is approximately 563 km in length. A summary of the road surfaces and inventory is in **Table 2-1**.

Table 2-1: Roads Inventory by Surface Type

Category	Surface Type	Sum of Length (m)
Surfaced	High Class Bituminous	160,861.69
	Low Class Bituminous	74,200.27
	Concrete	145.86
Unsurfaced	Earth	4,102.21
	Gravel	323,467.56

2.1.2 EXPECTED USEFUL LIFE

The expected useful life of the roads assets differs by type of road surface and function, and are:

- HCB Collector/Arterial – Rural: 40 years
- HCB Collector/Arterial – Urban: 30 years
- HCB Local - Rural: 50 years
- HCB Local – Urban: 40 years
- LCB Local: 40 years
- Concrete: 50 years
- Gravel: 50 years
- Unsurfaced: 50 years

2.1.3 ASSET VALUE

The asset value is based on the current network size and current unit replacement costs. Unit costs for the road network were estimated using recent tender information from Township projects, and were established for reconstruction of each road type, as well as the other lifecycle activities. The reconstruction activity costs were used to estimate the asset value. A summary of the road asset unit replacement costs is shown in **Table 2-2**.

Table 2-2: Road Unit Replacement Costs

Surface Type / Function	Unit Cost ($/sq.m.)
Rural Collectors and Arterials	
PV HCB Full Depth Reclamation - Rural	$47
Rural Local	
PV HCB Full Depth Reclamation - Rural	$47
Urban	
PV HCB Reconstruction - Urban	$134
LCB Local	
PV LCB Reconstruction	$40.25
Concrete Surface	
PV HCB Reconstruction - Urban	$134
Earth	$1
Gravel	$20

Table 2-3: Road Asset Values				
Road Type	**Length (km)**	**Estimated Replacement Cost 2021**	**Estimated Replacement Cost 2013**	**Estimated Replacement Cost 2007**
Roads (Surfaced)	235 km	$141,162,459	$103,098,918	$80,772,000
High Class Bituminous	*161 km*	*$116,799,658*	---	---
Low Class Bituminous	*74 km*	*$24,264,345*	---	---
Concrete	*0.1 km*	*$98,456*	---	---
Roads (Unsurfaced)	328 km	$70,789,998	$24,682,477	$21,087,400
Earth	*4 km*	*$26,408*	---	---
Gravel	*324 km*	*$70,763,591*	---	---

The value of the road network is the cost that would be required if all existing assets were to be reconstructed in present day dollars. A comparison of current and past replacement values is shown in **Table 2-3**. Variation in assessment value across years is attributed to changes in the network and valuation methods.

2.1.4 LIFECYCLE UNIT COSTS

Unit costs for the road network were estimated using recent tender information from Township projects, and were established for each road type, for all other lifecycle activities. The reconstruction activity costs were used to estimate the asset value. A summary of the road asset unit costs is in **Table 2-4.**

Table 2-4: Lifecycle Activity Unit Costs by Road Type		
LC Activity	**LC Strategy**	**Unit Cost**
PV HCB Crack Seal	Preservation	$4.80/m
PV HCB Microsurface	Preservation	$7/sq.m.
PV LCB Single Surface Treatment	Preservation	$4.75/sq.m.
PV LCB Double Surface Treatment	Preservation	$9/sq.m.
PV HCB Overlay - Rural	Rehabilitation	$17.50/sq.m.
PV HCB Mill and Overlay - Urban	Rehabilitation	$25/sq.m.
PV HCB Cold in Place (Partial Depth)	Rehabilitation	$37/sq.m.
PV LCB Major Rehabilitation	Rehabilitation	$25/sq.m.
Gravel Placement	Rehabilitation	n/a
PV HCB Full Depth Reclamation - Rural	Reconstruction	$47/sq.m.
PV HCB Reconstruction - Urban	Reconstruction	$134/sq.m.
PV LCB Reconstruction	Reconstruction	$40.25/sq.m.
Gravel	Reconstruction	$20/sq.m.

2.1.5 OTHER ROADS ASSETS

In addition, other assets important to the road network have been identified and an estimation of their inventory and value is shown in **Table 2-5**.

Table 2-5: Other Road Asset Values

Asset Type	Quantity	Estimated Replacement Cost (2021)
Guide Rails	11,020	$ 2,810,100
Shoreline Protection	2,380 m	$8,330,000
Signs	3,200	$ 544,000
Parking	5,560 sq.m.	$361,400
PW Fleet & Equip	N/A	$ 5,383,750

While critical for roads service delivery, these assets are not currently analyzed as part of the asset management plan. These assets should continue to be maintained, operated, and renewed as required. Consideration of these other assets will be given for future iterations of this report.

2.1.6 ASSET CONDITION

There is no condition assessment for unpaved roads. Gravel roads are considered to be in Good condition based on routine maintenance practices, and Gravel Placement program.

Unsurfaced (earth) roads are not maintained.

The condition of the paved roads was assessed in 2020 through use of Street Scan technology. This included conducting a driving assessment of the roads, where cameras recorded the road surface as images and videos, from which analysis and identification of defects could be undertaken to attribute each road section a PCI condition index.

A summary of the PCI index and corresponding PCI rating descriptors is shown in **Table 2-6**.

The current Condition Assessment is included in **Appendix B.3 Pavement Condition Assessment Report.**

The ASTM divides the PCI into seven classes, but in practice a PCI lower than 40 is almost impassable.[3]

The 2020 findings put the overall paved road at a network average PCI of (68) Fair.

Average Condition	68
% below Critical Condition (55)	25%
% above Critical Condition (55)	75%

(StreetScan, 2020)

The inspected condition for the paved road network, by length, is shown in Figure 2-2.

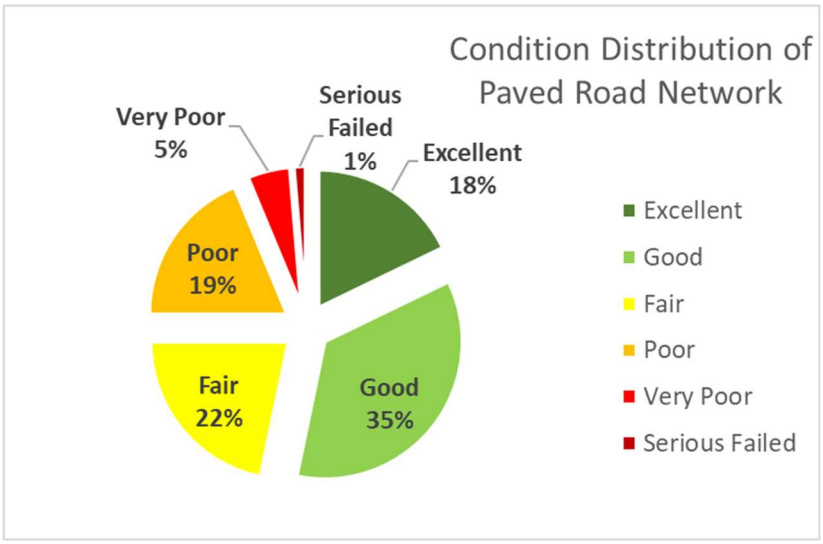

Figure 2-2: Condition Distribution of Paved Road Network (2020)

Table 2-6: Road PCI Index & Rating

PCI	PCI Rating
100	Excellent
90	
85	Good
70	
60	Fair
55	Poor
40	
30	Very Poor
25	Serious
10	Failed
0	

[3] https://en.wikipedia.org/wiki/Pavement_condition_index

The Township's current OCI target for condition is in the range of 65-75 (varying depending on road type), which is considered Fair condition. The average network OCI was found to be 68, which lies within this range. A comparison of the LoS condition targets and actual conditions by surface type and function are shown in **Figure 2-3**.

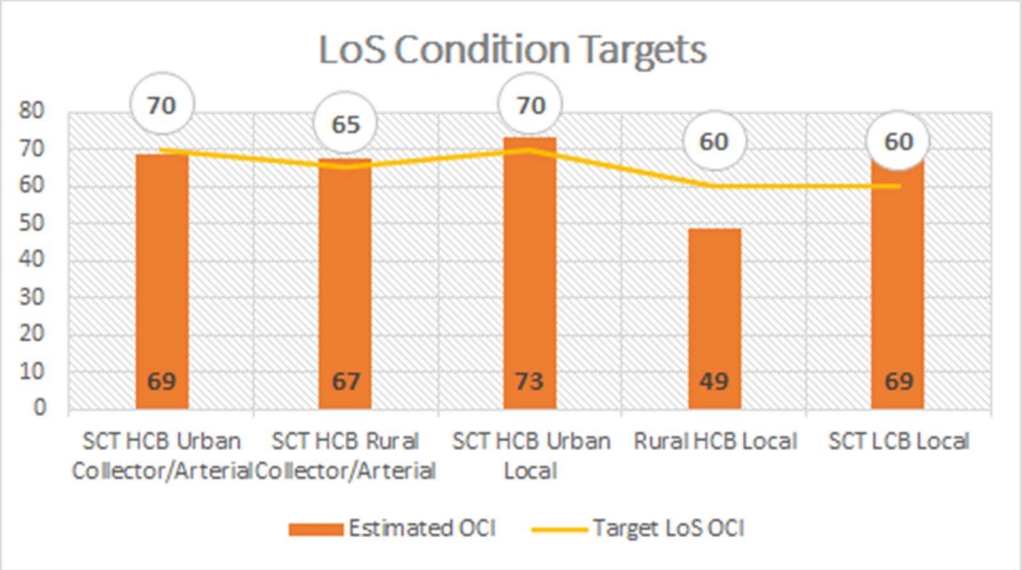

Figure 2-3: Comparison of LoS Condition Targets by Road Type and Function

2.2 LEVELS OF SERVICE (LOS)

Levels of service (current and proposed), and performance measures are prescribed by O.Reg. 588/17 and defined by the Township. LoS information can be found in **Appendix B.1 LoS Levels of Service**.

2.3 LIFECYCLE ACTIVITIES

The following section describes the lifecycle activities that can be implemented within the asset management strategy for road assets. The lifecycle activities include construction, maintenance, renewal, and decommissioning/disposal.

2.3.1 CONSTRUCTION

Construction of new road assets is recommended to be in line with recommendations as part of growth, master plan, or other municipal strategies. The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines, and local conservation authority requirements.

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and future projections.

2.3.2 MAINTENANCE

Maintenance activities are undertaken on the assets throughout their useful life to preserve their operating condition and performance. There are a variety of maintenance activities including:

Maintenance activities can include the full road surface or can be used to address localized repairs on the road surface.

The selection of the maintenance activity is dependent on a variety of factors, including road surface type (material, urban/rural classification), condition (surface and road base), road works history, importance, among others.

2.3.3 RENEWAL/ REHABILITATION

Renewal or rehabilitation of the road assets can be undertaken when maintenance works are no longer sufficient to address road surface deficiencies. The typical activities utilized by the Township include:

Rehabilitation activities can include the full road surface or can be used to parts to renew the overall asset condition to its desired function.

2.3.4 OPERATING AND DECOMMISSIONING

Operating activities for the road assets include those activities that do not directly deal with the physical state of the road but work to extend the assets useful life. The operating activities can include non-infrastructure solutions (such as policies, limiting truck traffic, planning reports), and monitoring/inspection of the assets. Inspection of the road assets can be completed internally (on an ad hoc or recurring basis), to larger programs conducted by third parties (such as StreetScan inspection conducted in 2020). The inspection program can include a combination of the effort types to suit the needs of the Township.

Decommissioning activities of the road assets includes removal of the road from service. A road may be removed by disposal of the asset components, or establishment of a barricade to prevent continued usage of the asset. Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at an appropriate or approved facility.

2.4 ASSET MANAGEMENT STRATEGY

The strategy for managing the road network assets uses the lifecycle activities in a manner that seeks to achieve the levels of service targets and optimize the lifecycle and costs of the assets.

The primary indicator used in the development of a lifecycle strategy is the condition of each asset. However, the strategy should also consider other factors, such as:

- Importance of the asset
- Asset risk score

- Condition of adjacent sections
- Replacement requirements for adjacent infrastructure (watermain, storm or roadworks)
- Upstream dependency and expansion requirements.

As the Township Road assets continue to age and the network is further developed, these factors will continue to change, and each have an impact on the lifecycle of an asset. Consideration of these factors should be given when devising capital project outlooks and budgeting and updating of the asset management plan.

The assets will deteriorate on a non-linear basis, and the various lifecycle activities can be implemented at varying stages within an asset's deterioration.

Condition indices were derived from the results of the condition assessment processes described previously in the report. The generation of indices, using consistent and repeatable techniques, is essential to be able to compare assets and identify needs in all linear infrastructure networks. Once all assets have been assigned a condition rating, it becomes possible to determine, based on knowledge of the assets and technical expertise, what rating represents the minimal acceptable level of condition that relates to the acceptable Level of Service provided to residents. Any components of infrastructure rated below that minimal rating should be rectified to improve the level of service. That rating is called the "Threshold of Acceptability" of an asset.

Accordingly, the Township should maintain a recurring condition assessment program for the road assets. The types of condition assessment programs vary and can include Township-wide assessment such as through StreetScan (per the latest condition assessment), or smaller scale driving assessments on an ad hoc basis. Condition assessment can be a combination of methods and should suit the needs of the Township. As the Township has recently captured condition assessment information (finalized in 2020), ad hoc road inspections by the operations teams can supplement the condition information, particularly in areas where the condition is very poor or near to failure. Small scale assessments like this can allow the Township to closely monitor the deterioration of a road surface to help accurately prioritize the required capital works. When the condition of the asset has degraded such that, an intervention is required, it is recommended that maintenance (or preservation) be reviewed as the first opportunity to extend the useful life. Operating activities and some maintenance activities can be implemented throughout the lifecycle of the asset.

When the condition of the asset has degraded such that maintenance (or preservation) is no longer an adequate activity to address deterioration, the segment can be considered for renewal/ rehabilitation. Activities currently used by the Township, and the OCI threshold at which it is considered include:

Where performance and condition have deteriorated to the point where maintenance and rehabilitation are not adequate solutions, the asset should be considered for reconstruction. The Township should follow best practices and local design guidelines when designing the reconstruction works. Assets at the end of their useful life should be abandoned in place or removed.

A summary of the typical road lifecycle activities and the OCIs at which each becomes a consideration are summarized in **Table 2-7**.

Table 2-7: Lifecycle Activities by Road Type

Road Type	Activity Type	Lower bound of OCI for consideration	Upper bound of OCI for consideration
HCB Pavement			
PV HCB Crack Seal	Preservation	85	100
PV HCB Microsurface	Preservation	80	90
PV HCB Overlay	Rehabilitation	65	75
PV HCB Partial Depth Rehab	Rehabilitation	55	60
PV HCB Full Reconstruction	Reconstruction	0	60
LCB Pavement			
PV LCB Single Surface Treatment	Preservation	70	90
PV LCB Double Surface Treatment	Preservation	55	70
PV LCB Major Rehabilitation	Rehabilitation	0	55
PV LCB Full Reconstruction	Reconstruction	0	55

An additional consideration in selection and implementation of a lifecycle activity is understanding any capital works plans for adjacent assets, such as sewer, or water. Coordinating infrastructure projects can be useful in optimizing money spent and reduce rework.

In determining prioritization of the works to the assets, the Township has developed some direction regarding criticality of the assets. By default, road assets are assumed to have the same criticality, unless they meet the following criteria:

- Roads classified as 'Roads of Importance' (i.e.: primary and secondary winter patrol routes) are considered more critical than other road assets. The 1.2 criticality factor included within the model is increased by 20% of default.

2.4.1 SCENARIO ANALYSIS

To understand the needs and projected works on the paved road assets within a 10-year outlook, lifecycle activities were reviewed under varying budget scenarios to understand the impact on overall network condition. Scenarios were run beginning on 01-Jan 2022, therefore the Scenario Beginning OCI's are the 2022 predicted deterioration from any prior actual condition assessment. The budget scenarios analyzed include:

1. **Unlimited** Budget – To determine backlog of works
2. **Target 75** OCI – Budget required to achieve a 75 overall OCI at the end of the timeframe
3. **Target 65** OCI – Budget required to maintain a 65 overall OCI throughout the timeframe

4. **Actual** Budget (Best First) – changes in OCI using a $14,000,000 budget across the timeframe addressing the best assets first
5. **Actual** Budget (Worst First) - changes in OCI using a $14,000,000 budget across the timeframe addressing the worst assets first

All scenarios were run using the following assumptions and parameters:

- 10-year timeframe, beginning in the next calendar year
- Recommend Single Activity determined by Best Value basis (lowest cost)
- Activity sequence is determined by Asset Criticality and Lowest Estimated OCI for Scenarios 1-3,5, and by Asset Criticality and Highest Estimated OCI for Scenario 4
- Total budget used across scenarios is $14,000,000.

The overall network / scenario beginning OCI is predicted condition from actual road condition assessment. For this report, the beginning OCI (predicted from the 2020 assessment) is 67.28.

The results of the scenarios provided works to be conducted on the roads assets over the timeframe according to the scenario budget and the goal of the scenario (target OCI, etc.). A summary of the analysis is outlined in **Table 2-8** below.

Table 2-8: Road Network Scenario Results (Beginning 2022-1-1)

Scenario	Budget Scenario	Scenario Type	Average Annual Investment Over Timeframe	Total Investment over Timeframe	Assets Included	Average OCI (End of Timeframe)
1	Unlimited Budget	Unlimited	$7,955,288	$79,552,882	1,196	95.71
2	Target 75 OCI	OCI Target	$6,766,770	$67,667,698	229	75.21
3	Target 65 OCI	OCI Target	$4,140,883	$41,408,831	120	65.29
4	Actual Budget - Worst First	Budget Limitation	$1,393,837	$13,938,368	137	50.01
5	Actual Budget - Best First	Budget Limitation	$1,394,377	$13,943,770	367	52.57

In the first year of **Scenario 1 –Unlimited Budget**, the total cost of works on the assets is $79,552,882, including 1,196 assets. This indicates that there is a significant portion of the assets that have a condition value less than the target OCI, and therefore a backlog of works exists on the network.

In the Levels of Service, the Township currently targets a network average OCI of 70 for urban roads and an OCI of 65 for rural roads. As such, the most likely scenario for implementation is Scenario 3, with a target OCI of 65 (average) across the network throughout the scenario. This

scenario carries an average annual cost of just over $4 million, and addresses 120 assets across the timeframe, addressing the assets on a best value basis.

Note that the LoS target for road assets differs between road classifications. For simplicity of modelling, the minimum average OCI specified for roads (65) was applied across all paved road assets. As the OMS system continues to be developed, individualized, or grouped target OCI values can be considered to refine the model and investment strategy.

Using a scenario budget of $14 million (total across all 10 years in the scenario) for **Scenarios 4 and 5** achieves a lower annual investment (approximately $1.4 million), however in the best first and worst first scenarios, the average OCI at the end of the timeframe is 50 and 52 respectively, which is well below the targeted 70 or 65.

Based on the results of these scenarios, it is expected that **Scenario 3 – Target 65 OCI** (maintain) will be considered going forward at the Township, based on its result in maintaining the target LoS of the road assets. The annual cost and changes in OCI are shown in Figure 2-4

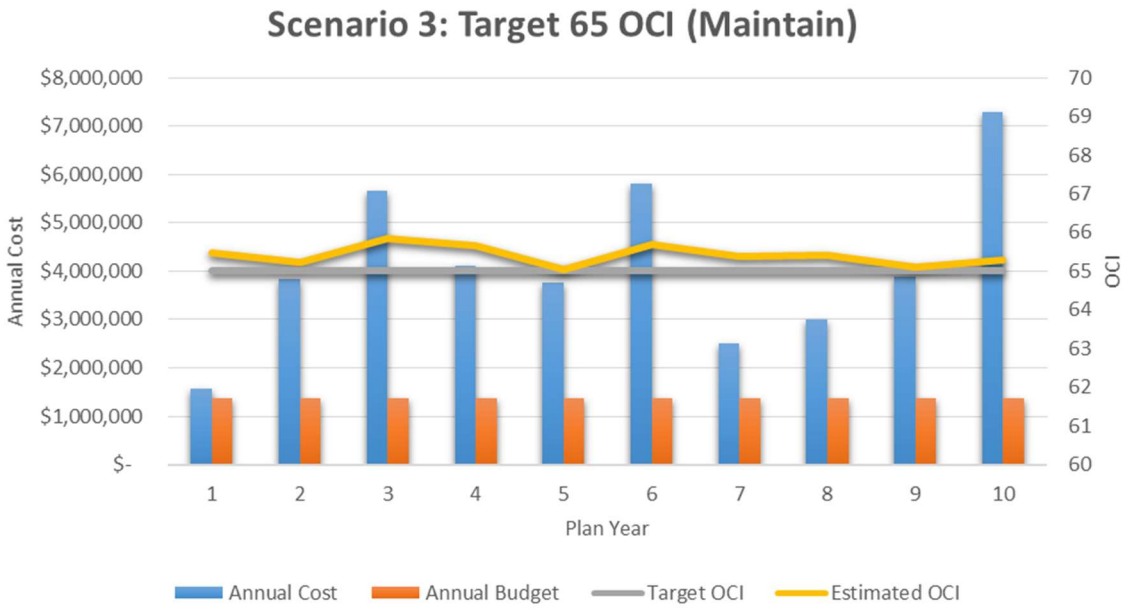

Figure 2-4: Annual Cost and OCI from Scenario 3

The existing strategy for addressing the road assets has been to utilize the current funding allocation to address outstanding needs and to address the backlog of works. In general, this strategy should be maintained – though based on scenario results, the funding request should be increased.

2.5 FINANCIAL STRATEGY

The financial strategy for road assets considers the projected funding requirements identified through analysis and existing funding mechanisms to identify any funding surplus or shortfalls. The Township can utilize these findings to strategize funding and asset management priorities.

2.5.1 SOURCES OF FUNDING

Funding comes from a variety of sources including:

- Tax levy
- User Fees
- Debt Financing
- 3rd Party Contribution
- Reserves

2.5.2 FUNDING STRATEGY

The Township currently has one capital and one operations budget through which the paved roads are managed, and an operations budget through which the gravel roads are managed. A summary of the operational budgets and their purpose is summarized in **Table 2-9** below.

Table 2-9: Road Network Capital and Operating Budgets

Budget Name	Annual Budget	Lifecycle Activities	Asset	Notes
Operations	$20,000	Crack Sealing	Paved Roads	Actual Annual Budget
Capital	$1,380,000	All Renewal/Replace Activities	Paved Roads	Combined Rehab/Replacement Budgets
Operations	$550,000	Gravel Placement	Gravel Roads	Actual Annual Budget

To address works for the paved road assets, the Township maintains an operations budget and a capital budget (see **Appendix C.1 Road Capital Plan**). The gravel road maintenance works are completed using the gravel operations budget and are completed on an ongoing basis.

A fully funded financial strategy to address a backlog of road renewals remains beyond the acceptable financial capacity of the current funding practice.

Based on the analysis using Cartegraph, to maintain the current and target OCI, the Township will require:

- $4,140,883 annually for capital works
- $41,408,831 over a ten-year timeframe.

The current annual allocation for paved road capital works is $1,380,000. This value is considerably less than the funding required for maintaining the current OCI. This results in funding gaps:

- $2,760,883 annually (on average)
- $27,608,831 over a ten-year timeframe

This level of increase is perceived to be beyond affordability to Council and residents. Sustainable funding for paved roads remains outstanding with significant backlogs of works. Based on the past and current budget plan for paved roads versus the investment level required to maintain the target OCI, the Township must consider ways to address the funding gap, including:

- Seek an increase in capital budget allowance for paved roads
- Adjust the asset management strategy (including OCI thresholds for intervention) to reduce annual expenditure while addressing critical assets and assets close to failure
- Continue condition assessment program to maintain current condition information, to incorporate into prioritization and scenario projections
- Adjust the LoS – change in target OCI, or change to LoS being provided by the roads (change in surface type, etc.)
- Utilize third-party funding sources such as grants or government funding to increase available budget

During the road network scenarios, the annual investment level fluctuates around the noted average. The fluctuations can be managed using various options:

- Annual budget requests can fluctuate to match the output of the scenario and cost of expected works
- Consistent budget requests can be made, with surplus annual budget being allocated into reserves to address the years in excess of the budget
- Modifications can be made to the plan of works including shifting of projects to other plan years to minimize peaks in investment and provide a more consistent investment level across the plan (this may also be achieved through scenario build options).

3 BRIDGE STRUCTURES

Any reference to Bridge or Structures shall infer Bridges and Culverts greater than 3m in Span (>3m).

3.1 CURRENT REPORTING

Inspections are conducted in accordance with the Ontario Structural Inspection Manual (OSIM) 2008 and is referred to as the OSIM or Bridge Inspection Report.

All bridge structures are inspected and reported by an outside Engineering firm. This is currently performed under a 4-year contract, starting in 2020. All structures were inspected and reported in 2020 except for those under construction: Sites 15 and 47. It is anticipated that the frequency will continue to be done with all structures in one inspection year, every other year.

Historically the inspections have taken place on Biennial Reports, all structures over 2 years.

Current bridge reporting can be found in **Appendix B.4 OSIM Bridge & Culvert Inspection Summary Report**

3.2 STATE OF INFRASTRUCTURE – BRIDGE STRUCTURES

The following section describes the current state of bridge assets.

Category	Class	Condition	Total Length / Count	% Rated	Current Value	Average Age	Avg Years to Re hab/ Replace
Bridge Structures	Bridges	Fair 	37	100.00 (BM: 100.00)	$37,011,400.00	54	43
Bridge Structures	Culverts	Good 	55	100.00 (BM: 100.00)	$14,376,645.60	55	45

Figure 3-1: Excerpt from Infrastructure Report Card (2021) for Bridges

Current Infrastructure Report Card can be found in **Appendix B.2**.

Currently three bridges have load restrictions, including Bridge 14, 47, and 104. At the time of reporting, only 14 has a bylaw for restrictions.

3.2.1 ASSET INVENTORY

The Township owns and maintains 92 Bridge Structures with spans greater than 3m. Two bridges are pedestrian use, and the remainder are vehicular.

3.2.2 EXPECTED USEFUL LIFE

The expected useful life was reviewed for bridge structures. The design life of a structure as per the CHBDC is 75 years, which was adopted as a base value and used to determine the remaining useful service life of the structures. (This useful life value is more conservative than what has been used in prior AMPs, which was 90 years). However, many of the older structures have already exceeded 75 years in age and are still in service due to ongoing maintenance and rehabilitation that has been performed over the years, allowing the bridges to maintain serviceable condition longer.

3.2.3 ASSET VALUE

In 2021, a supplemental technical report to the 2020 OSIM report was provided for updating asset valuation. The new asset valuation method differed from the previous asset by asset replacement costs that varied depending on the structure type and size.

The current method for calculating the replacement costs uses bridge deck / top of culvert areas, multiplied by a uniform "industry standard" cost per square meter for a typical replacement cost.

- bridges ($4,000 /sq.m)
- culverts ($3,000/sq.m)

This was done as the structures may not all be like-for-like replacements, and since we do not know what type of structure the existing will be replaced with, an estimate based on average costing was attributed for all bridges and all culverts. The replacement costs are calculated on an asset-by-asset basis, and this methodology is now built and maintained within our OMS asset inventory. Values are listed in .

Table 3-1: Bridge Asset Values

Structure Type	Quantity	Estimated Replacement Cost 2021	Estimated Replacement Cost 2019	Estimated Replacement Cost 2013	Estimated Replacement Cost 2007
Bridge Structures	92	$51,388,046	$54,830,000	$54,358,000	$33,513,000
Bridges	*37*	*$37,011,400*	---	---	---
Culverts	*55*	*$14,376,646*	---	---	---

In the previous reports, individual Bridge replacement values varied depending on the different structure types and sizes of bridges and culverts. The difference in reported replacement cost from 2019 to 2021 reflects this change in methodology.

3.2.4 ASSET CONDITION

The assessed condition of the bridge and culvert assets were captured as part of the **OSIM Bridge & Culvert Inspection Summary Report** (**Appendix B.4**). The BCI (Bridge Condition Index) is based on the MTO method for evaluating Bridges, and values are grouped into three categories (Good, Fair, and Poor).

A summary of the BCI and ratings are shown in **Table 3-2**.

A summary of the recent inspected condition of bridge structures, by deck area, is shown in and **Figure 3-3.** The majority of the Bridge Network is of "Good" rating.

Table 3-2: Bridge BCI Rating and Descriptors

BCI	BCI Rating
100	Good
90	
85	
70	
60	Fair
55	Poor
40	
30	
25	
10	
0	

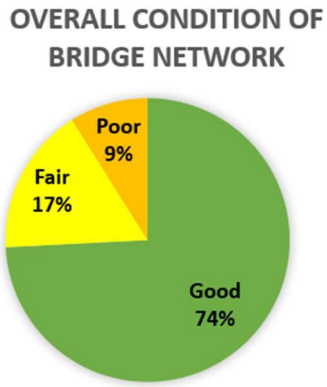

Figure 3-2 Overall Bridge Network Condition (OMS 2020)

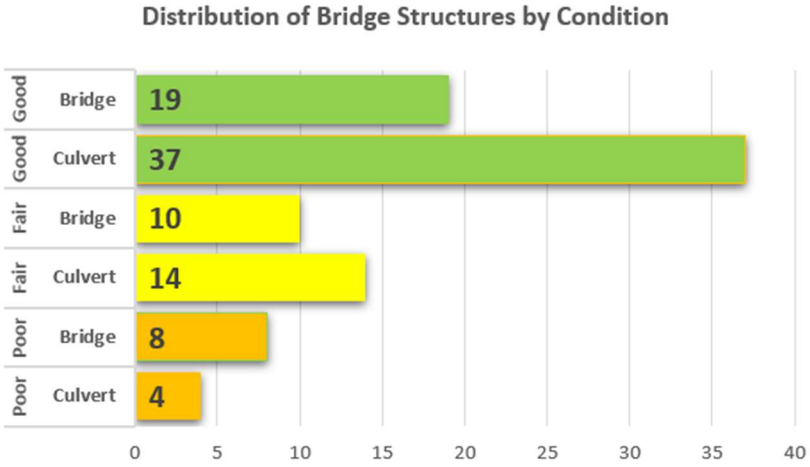

Figure 3-3: Distribution of Bridge Structures by Condition (OMS 2021)

The overall average BCI for the bridge and culvert structures were determined and are summarized in **Table 3-3** below with a comparison of the level of service targets.

Table 3-3: Bridge & Culvert BCIs and Targets

Asset Type	2020 Average BCI	LoS BCI Target	Current Result
Bridges	66	Minimum 70 - Good	Below Target
Culverts	73	Minimum 70 - Good	Higher than target
Overall Bridge Network	70	Minimum 70 – Good	At Target

A comparison was done of prior structure inspection results to identify any trends in condition changes in the past 3 condition review cycles. The number of assets found to be in 'good' condition (at LoS target) is shown in **Figure 3-4**.

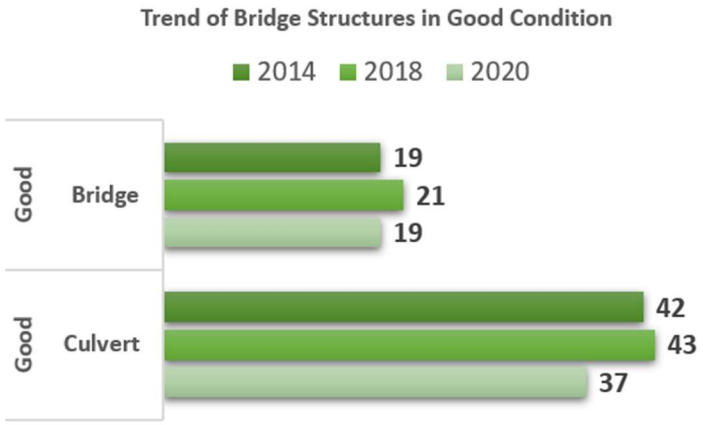

Figure 3-4: Trend of Bridge Structures in Good Condition

The 2020 OSIM report further reviewed the structure condition index as it compares with age, shown in **Figure 3-5.**

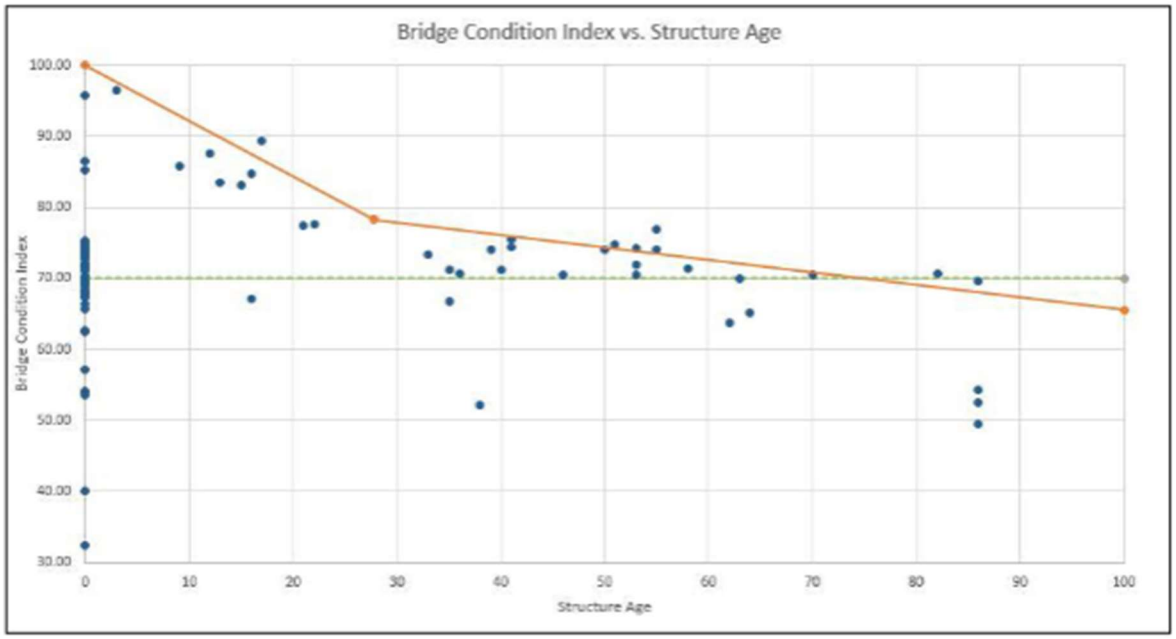

Figure 3-5: Structure Age vs Condition (excerpted from 2020 OSIM Report)

3.3 LEVELS OF SERVICE (LOS)

Levels of service (current and proposed), and performance measures are prescribed by O.Reg. 588/17 and defined by the Township. LoS information can be found in **Appendix B.1 LoS Levels of Service.**

3.4 LIFECYCLE ACTIVITIES

The following section describes the lifecycle activities that can be implemented within the asset management strategy for bridge and culvert assets. The primary lifecycle activities include construction, inspections, maintenance and repair, replacement, and decommissioning/disposal.

The strategy for the Township is to use the OSIM report to identify and forecast lifecycle activities for bridge and structural culvert assets. For detailed recommendations of asset management strategies refer to the current **Appendix B4 OSIM Bridge & Culvert Inspection Summary Report**.

3.4.1 CONSTRUCTION

The start of an asset's lifecycle is its construction. The bridge or structural culvert should be constructed to adhere with the requirements of the *O.Reg. 160/02*: Standards for Bridges, CSA S6 Canadian Highway Bridge Design Code, and any and all other applicable regional codes and

requirements for the bridge and its use. Each bridge or structural culvert should be designed and constructed to provide the services for which it is intended.

3.4.2 INSPECTIONS

Under *O.Reg. 160/02*: Standards for Bridges, the Township is required to complete one inspection of all bridges and structural culverts every two years to identify condition and produce a report outlining the recommended work for a 1-to-10-year period. The inspection uses the Ontario Structural Inspection Manual (OSIM) 2008 and is referred to as the OSIM or Bridge Inspection Report. The most recent condition assessment and study was completed in 2020, with the next scheduled assessment planned for 2022.

3.4.3 MAINTENANCE AND REPAIRS

Bridge and culvert assets are long-lived assets with estimated useful lives of 75 years. Throughout the lifecycle of these assets, the majority of expected needs will be maintenance and repair work.

Routine maintenance works are typically used to prolong the lifespan of assets and include both preventative and reactive activities designed to maintain the asset condition and function. Preventative activities are implemented to provide a predictive response to deterioration or possible performance issues by managing the contributing factors prior to an event occurring. Reactive maintenance is conducted in response to a condition or performance issue and designed to correct the issue before it causes asset deterioration, possible deficiencies, and interruption of service. The scale of maintenance activities varies widely and is dependent on a variety of factors including the age, asset utilization, environment, and design. Maintenance should be completed based on recommendations in biennial OSIM reports and industry best practices.

The Township undertakes cleaning and washing on a routine basis for all bridge structures. Other maintenance activities are undertaken accordingly, based on recommendations outlined in the OSIM reports. These recommended activities may include (but are not limited to):

- Railing system maintenance
- Painting of steel bridge components
- Bearing maintenance
- Pest control
- Deck drainage maintenance
- Embankment erosion control/protection
- Scaling of loose concrete and ACR Steel.

A description of the current bridge washing program is shown **Figure 19**.

1) Bridge Washing Program:

In 2018 the Public Works Department established a joint bridge washing/cleaning program with surrounding Municipalities. Prior to the joint venture the Township washed each bridge on a two year cycle, now each bridge is washed yearly at a cost. *$ 18,398.04 + HST*

Figure 3-6: Current Bridge Washing Program

Repair works are driven by the identification and treatment of deficiencies to prevent the continued deterioration of the deficiency which may cause a reduction in asset condition, performance and LoS delivered. Timing of repairs varies widely as they may be prescheduled based on estimated deterioration, in response to biennial condition reporting, or on an emergency basis. Repairs to bridges vary widely and can be in relation to structural and deck surface components.

3.4.4 REPLACEMENT

Replacement of a structure is based on current age, estimated lifespan and recommendations from condition assessments. Replacement can be used when an asset is nearing or has reach the end of its life, repairs are not technically feasible, estimated future repair costs are greater than replacement cost, or increases to capacity or LoS are required. Replacement activities are typically large in scale and involve the issuance of a capital project. Timing of replacement activities must consider the impact on adjacent infrastructure, the impact on near-by asset LoS and replacement or maintenance requirements of connected infrastructure.

3.4.5 DISPOSAL

Disposal activities from bridges and culverts can include the removal from service of a bridge or culvert, through:

- Closure of the bridge from access
- Change in level of service of the bridge to limit access (e.g., vehicular bridge to pedestrian bridge)
- Deconstruction (removal) of the bridge.

Disposal activities should be implemented when a bridge or culvert structural has reached the end of its useful life or has degraded to such a state that it can no longer provide the level of service for which it is intended. Removal of a bridge from service without replacement or decrease in level of service should be undertaken only when it is decided to no longer be required to provide level of service to residents.

Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at appropriate or approved facility.

3.5 ASSET MANAGEMENT STRATEGY

The asset management strategy for bridges and structural culverts in the Township will employ the lifecycle activities to maximize the useful life of each asset. Capital and Major Maintenance work is prioritized based on OSIM Reports and available funding.

Priority of works to be undertaken was assigned within the OSIM reports, with timelines for needs being set out in ranges from urgent to 6-10 years. Additionally, a criticality factor for each structure is a consideration during decision making. These criticality factors are integrated into the OMS system.

Within the Cartegraph model of Township assets, a default criticality factor of 1 is applied. Bridge structures on HCB and LCB arterial and collector roads are considered at higher criticality and have been attributed a Criticality Factor of 1.2 (20% more critical).

The primary indicator used in the development lifecycle strategy is the condition of each asset, however, the strategy must also consider other factors, such as:

- Consequence of asset failure
- Asset risk
- Condition of adjacent assets
- Replacement requirements for adjacent infrastructure (watermain, storm, sanitary or roadworks)
- Community growth and capacity requirements.

As the Township bridge and culvert assets continue to age, these factors will continue to change, and each have an impact on the lifecycle of an asset. Consideration of these factors should be given when devising capital project outlooks and budgeting and updating of the asset management plan.

It is recommended that the Township continue to use the OSIM reports to identify and forecast lifecycle activities for bridge and structural culvert assets.

3.5.1 SCENARIO REVIEW

The bridge and culvert structures are captured within the Cartegraph OMS system. The system can run a scenario to identify overall condition changes and predict large expenditures when an asset has reached the end of its lifecycle. The scenarios cannot model the level of detail and maintenance activities identified within the OSIM reports, and therefore cannot replace the outputs of the OSIM reports in optimizing an asset management strategy.

The scenario was used for bridge and culvert assets to estimate the starting OCI of the assets, and the ending OCI as the assets deteriorate over their expected useful life. At the start of the scenario, the beginning estimated OCI was 71. At the end of a 10-year scenario, the average OCI has reduced to 61. With the implementation of the needs identified within the OSIM reports, it is expected that the actual BCI at the end of the 10-year timeframe may be higher than that

identified through the scenario. Continued OSIM reporting throughout the 10-year timeframe of this AMP will allow the Township to assess how the BCI is changing over time.

3.6 FINANCIAL STRATEGY

The financial strategy for the bridge structures considers current sources of funding, and projected needs.

3.6.1 SOURCES OF FUNDING

Funding comes from a variety of sources including property taxes, user fees, debt issuance, 3rd party contributions and drawing on reserves.

- Tax levy
- Debt Financing
- 3rd Party Contribution
- Government Funding

3.6.2 FUNDING STRATEGY

To understand the needs and projected works on the bridges and culverts within a 10-year period, a summary of the recommendations from **Appendix B.4 OSIM Bridge & Culvert Inspection Summary Report** is included in **Table 3-4**.

The prices provided are in Canadian Dollars and are reflective of the quantity of work required at the time of reporting. Costing includes material only, and does not include engineering, mobilization, or other construction costs. Quantities are expected to increase over time as assets continue to deteriorate.

Table 3-4: OSIM Bridge Network Estimated Works Projection

Timing of Needs	Maintenance Costs	No. of Structures	Rehabilitation Costs	No. of Structures	Total Estimated Costs
Urgent	$7,500	2	$60,000	2	$67,500
1 Year	$48,500	9	$40,000	4	$115,000
2 Years	$221,000	75	$-	0	$225,500
1-5 Years	$5,000	1	$2,566,500	72	$2,571,500
6-10 Years	$-	0	$1,482,500	12	$1,482,500

Note that the total estimated costs are extracted from the 2020 OSIM report, and each total is a composite of multiple projects of works. The details of these works can be found in **Appendix B4 OSIM Bridge & Culvert Inspection Summary Report**.

In addition to the maintenance and rehabilitation, the OSIM reports identified monitoring and evaluation costs. This included a total of

- $17,500 for monitoring (normal timeframe),
- $90,000 for evaluation (normal timeframe), and
- $10,000 of evaluation (urgent timeframe).

The needs identified within the 10-year timeframe of the OSIM reports a

- total expenditure of $4,598,500.

In addition, the Township estimates approximately $20,000 annually to complete cleaning works on the bridges, however this cost is sourced from an operations budget and not capital, which would be used to fund the OSIM-identified needs.

The current bridge network funding allocations for major maintenance and capital works are detailed in **Table 3-5**.

Table 3-5: Bridge/ Culvert Capital and Operating Budgets

Type of Needs	Annual Funding Allocation	Works included	Details
Mandatory OSIM Bridge Inspections	$40,00	OSIM Bridge Inspection and Reports	Biennial Expense
Major Maintenance	$190,000	Cleaning & Maintenance	Routine maintenance (guardrail replacements, cleaning), and as a reserve account. Includes a $20,000 annual for bridge cleaning. (*Source: 5-year budget 2021.)*
Capital	$700,000	Renewal/ Replace Activities	Source: average annual funding request.

The average annual funding request to address needs on bridge structures is $700,000. This is based on planned upcoming capital bridge works. A summary of the current requested capital funding for planned bridge works is shown in **Table 3-6**.

Table 3-6: Bridge Network Planned Funding Forecasts

Project Name	2021	2022	2023	2024	2025	2026	2027-2030
Planned Capital Spend	$890,000	$990,000	$1,240,000	$740,000	$770,000	$1,090,000	$1,200,000

For estimation of funding requirements and identifying funding gaps, the average of $700,000 throughout the 10 plan years, outside of where specified in **Table 3-5** above. The actual capital funding requests each year may vary according to needs.

Using this as a placeholder for annual expected budget request, there is an expected gap in funding to address needs currently identified within the OSIMs.

The needs projection (from OSIM report) was compared with the funding allocation to identify any gaps in funding, summarized in **Table 3-7**. Note that the capital works budget was used to identify the funding gaps, and the works identified within the OSIM are outside of the scope of the major maintenance activities.

Table 3-7: Bridge Network Estimated Works Projection (2020)

Timing of Needs	Total Estimated Costs	Total Expected Funding Allocation	Funding Gap (surplus)
Urgent	$67,500	$4,630,000	($1,655,000)
1 Year	$115,000		
2 Years	$221,000		
1-5 Years	$2,571,500		
6-10 Years	$1,482,500	$2,290,000	($807,500)

In each year of the Capital Improvement Plan, the requested funding surpasses the needs identified within the OSIM reports. The OSIM report limited spending over the next 10 years to maintain the bridges condition. However, there is an immediate strategy to manage the backlog of at-risk bridge structures in the short term. Therefore, any surplus shown is currently allocated to Bridge Rehabilitation and Replacement, within this timeframe.

There is 9% of the bridge & culvert network that falls into the "Poor" condition category, according to **Figure 3-2** Overall Bridge Network Condition (OMS 2020). This equates to 8 bridges and 4 bridge culverts that are reaching end of life (**Figure 3-3**.)

Therefore, after Year 2026 the required annual spend is significantly reduced below the average $700,000 for the remainder of the 10year forecast.

An estimation of the BCI for bridge network assets found a reduction in BCI from the beginning of the timeframe to the end. The BCI at the end of the timeframe (61) is theoretical and does not take into account the needs identified within the OSIM reports, which would likely improve the BCI of the assets. The BCI at the end of the timeframe is still within the acceptable target range set by the Township. A change in funding is not expected to be required within the timeframe of this report, however the change in BCI over the analyzed timeframe may suggest that larger investments may be required beyond the 10-year timeframe as the BCI continues to decrease. Ongoing OSIM reporting and updating of inspected BCI will allow the Township to monitor the costs and adjust funding requests as required to maintain the target BCI.

4 SIDEWALKS & TRAILS

4.1 STATE OF INFRASTRUCTURE – SIDEWALKS & TRAILS

The sidewalk and trail assets include sidewalks, trails, and walkways. Sidewalks are typically of concrete and Trails and Walkways are typically asphalt.

Category	Class	Condition	Total Length / Count	% Rated	Current Value	Average Age	Avg Years to Re hab/ Replace
Sidewalks/ Trails	Sidewalks	Excellent 	36.3 km	100.00 (BM: 100.00)	$1,996,632.99	38	20
Sidewalks/ Trails	Trails	Excellent 	33.94 km	100.00 (BM: 100.00)	$3,393,520.00	19	20

Figure 4-1: Excerpt from Infrastructure Report Card (2021) for Sidewalks & Trails Network

Current Infrastructure Report Card can be found in **Appendix B.2**.

Currently none of the existing sidewalk and trail inventory has been confirmed to be in alignment with the new AODA standards.

4.1.1 ASSET INVENTORY

OMS Asset Inventory contains the current length of sidewalk and trails, shown in **Table 4-1**.

Table 4-1: Sidewalk/ Trail Inventory

Asset Type	Length (m)
Sidewalks	36 km
Trails	34 km

4.1.2 EXPECTED USEFUL LIFE

The expected useful life of the sidewalk assets differs by type of asset, with an expected useful life of 50 years for sidewalks, and 30 years for trails and walkways.

4.1.3 ASSET VALUE

Asset values were determined based on current replacement unit costs for sidewalk and trails:

- Sidewalks: $55/m (typ. 1.5 m width)
- Trails: $100/m (typ. 2.6 m width)

A summary of the total expected replacement cost for all sidewalk/trail assets, and comparison is shown in **Table 4-2** below.

Table 4-2: Sidewalk/ Trail Asset Value

Asset Type	Value (2021)	Value (2013)
Sidewalk	$1,996,633	$6,071,000
Trails	$3,393,520	

Difference in valuation between 2013 (combined) and 2021 is due to change in methodology for estimating valuation and improved inventory.

4.1.4 ASSET CONDITION

An annual Inspection and Condition survey is completed by Public Works staff on sidewalks as per the Ontario MMS. Trails & Walkways are also inspected for deficiencies and condition.

The primary focus of the inspections is to identify areas of sidewalk or trail that require maintenance, repair, replacement, or removal. Each length of sidewalk or trail is inspected based on a Township developed 1–5-star rating with criteria for each condition category, shown in **Figure 4-2**.

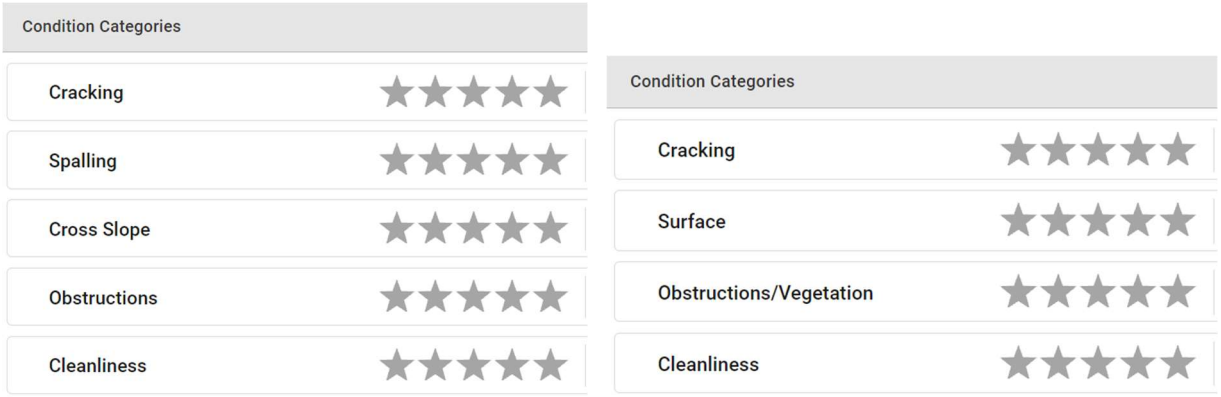

Figure 4-2: 1-5 Star Condition Categories for Sidewalks (L) and Trails (R)

The equivalent index, values, ratings, and descriptors for the condition is shown in **Table 4-3**.

Table 4-3: Sidewalk & Trail Condition Indices

OCI Index	Value	SCT Rating	Description
100	5	Excellent	Excellent (Minor defects) - Repair / replacement not required for foreseeable future
90-99	4.5		
80-89	4		
70-79	3.5	Good	Defects that have begun to deteriorate - Limited cracking present. Defects not causing major cracking for 10 - 20 years
60-49	3		
50-59	2.5	Average	Moderate defects that will continue to deteriorate - Moderate cracking and defects present. No major safety concerns. Replacement expected in 10 - 20 years
40-49	2		
30-39	1.5	Fair	Severe defects that will continue to deteriorate - Severe cracking and defects present. Causing minimal safety risk. Will probably fail in 5 to 10 years
20-29	1		
10-19	0.5	Poor	Defects requiring immediate attention - Severe cracking and is a major safety risk. Has failed or will likely fail in next 5 years. Replacement required immediately
0-9	0	Failed	Out of Service - Replacement required immediately

The target LoS condition by length for sidewalks and trails is a Network OCI value of 70 - Good.

The Township has sidewalk and trail inspection and condition rating history in OMS starting in 2020. The current condition distribution for sidewalk and trail networks (by length) are shown in **Figure 4-3**.

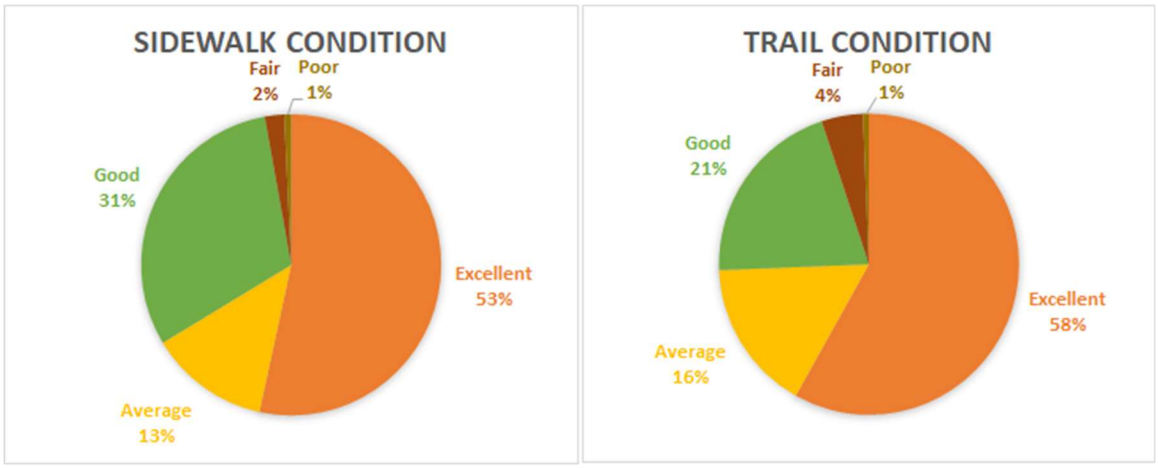

Figure 4-3: Sidewalk and Trail Network Condition (2021)

A summary of the current inspected network condition for both asset types and a comparison to the LoS condition targets is shown in .

Table 4-4: Sidewalk and Trail Conditions and Targets

Asset Type	2021 Average Inspected OCI	LoS Condition Target	Current Result
Sidewalks	83	70	Higher than target
Trails	84	70	Higher than target

The current percentage of sidewalk and trail network (by length) that meet or exceed the current LoS targets is shown in **Figure 4-4**.

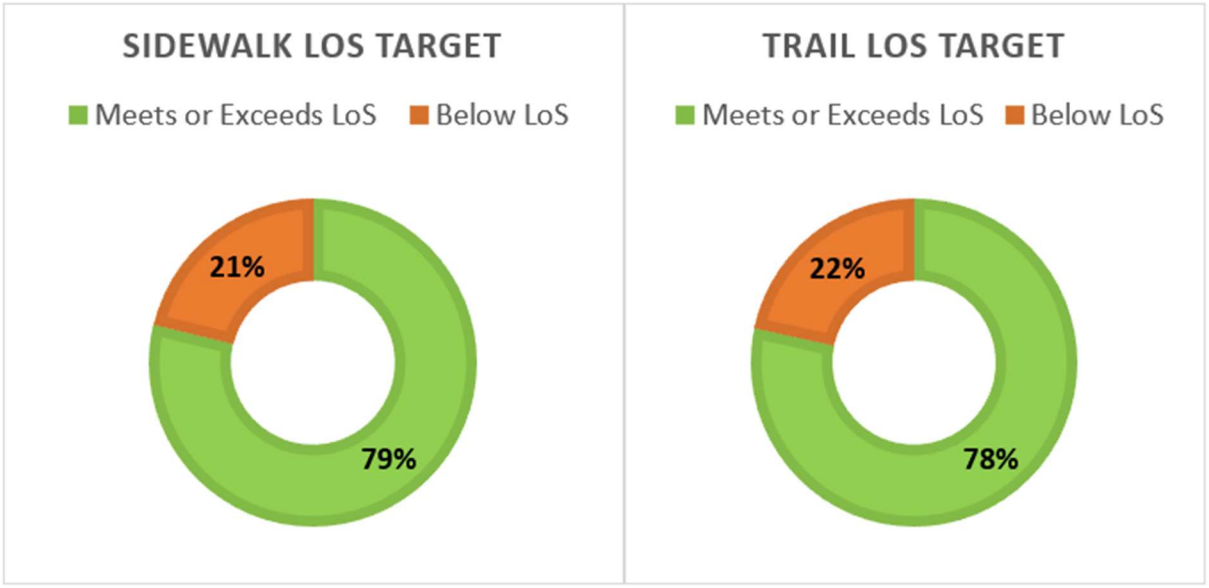

Figure 4-4: Sidewalk and Trail LoS Targets

4.2 LEVELS OF SERVICE (LOS)

Levels of service (current and proposed), and performance measures are defined by the Township. LoS information can be found in **Appendix B.1 LoS Levels of Service**.

4.3 LIFECYCLE ACTIVITIES

4.3.1 CONSTRUCTION

The initial lifecycle activity of a sidewalk asset is its construction. The sidewalk asset should be designed and constructed to adhere to applicable requirements, codes, and design guidelines. Design of the sidewalk asset should consider the level of service expected to be provided by

that particular asset. Current practice by the Township is construction of a standard concrete sidewalk on urban road cross-sections, and trails in specially identified locations. Sidewalk construction is often conducted as part of road reconstruction projects and assumed under development.

4.3.2 MAINTENANCE

Maintenance works on sidewalks and trails can be preventative or in response to an issue and can occur to address localized issues or to larger segments.

Maintenance works can be identified through inspections, complaints, or other mechanisms, and can address safety or aesthetic concerns. Maintenance activities and inspections should be undertaken according to best practices and applicable regulation (O. Reg. 239/02, for example). Maintenance completed by Public Works staff can include the following activities:

- milling of tripping hazards
- filling cracks/potholes
- removing encroachments (trees)
- trail sweeping

4.3.3 REHABILITATION/RENEWAL

Rehabilitation of Sidewalk: panels of sidewalk that require replacement due to heaving, settling, cracking, spalling, etc. are completed under contract and are prioritized based on conditions and falls into several categories as follows:

- due to deterioration and defects, identified in condition survey and/or public
- due to missing sidewalk (sidewalk removed during repair of other infrastructure)
- due to damage construction related activities

Rehabilitation of Trail/Walkway: Rehabilitation of trails/ walkways are undertaken as follows:

- A minimum of one section of asphalt trail (approx. 1-1.5km) is replaced annually as a Council approved capital project. The area selected for replacement is based on the trail/walkway condition survey of each previous year. Work completed on the designated “St. Clair River Trail” is completed in conjunction with the St. Clair River Trail Committee (private citizen group).
- Sections of trail that utilize an asphalt paved shoulder (on-road sections) are often replaced/renewed during capital road construction projects, in combination with the road work. The Township strives to renew trails in conjunction with other projects, however when required, the trails will be refurbished independently.

Sidewalk and Trail Rehabilitation work is conducted under annual RFQ Miscellaneous Asphalt and Concrete Work.

4.3.4 DECOMMISSIONING/DISPOSAL

Disposal activities can include the removal from service of a sidewalk segment. These activities can be implemented when a sidewalk segment has been determined to be no longer required. A sidewalk may be removed from service by removal and disposal of the asset components, or establishment of a barricade to prevent continued usage of the asset. Sections of sidewalks that are no longer required, do not serve any significant purpose, have reached the end of their serviceable life, and meet the requirements of the sidewalk removal policy, are identified during the annual condition survey. Notices are sent to all affected abutting private property owners and pending Council approval; all removal work is collectively awarded to a specialized contractor. Removed sections are retired from the asset inventory.

Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at an appropriate or approved facility. Decommissioning or disposal of a sidewalk asset can be done in conjunction with road works, as required.

4.4 ASSET MANAGEMENT STRATEGY

The management strategy for sidewalk and trail assets is to provide maintenance and repairs to comply with the MMS and meet the Level of Service targets as established by Council.

Occasional capital sidewalk projects have been tendered on an individual basis. Trail work has been completed in conjunction with the St. Clair River Trail Committee and assumed for maintenance. Some On-Road sections comprise of converting gravel shoulders to Paved Shoulder Trail.

Larger Significant Repairs and operations work is currently undertaken under a 'Request for Quotation' named 'Miscellaneous Asphalt and Concrete Work'.

The asset management strategy for the sidewalk assets seeks to use the lifecycle activities in a manner that will achieve cost-effective and sustainable management of the road assets.

Construction of a sidewalk/trail asset is achieved through multiple programs, including:

- construction as part of road construction works,
- capital sidewalks work tendered on an individual basis (occasional),
- trail works completed in conjunction with the St. Clair River Trail Committee
- conversion of gravel shoulders to paved shoulder trails

Following initial construction of the sidewalk/ trail asset, the majority of lifecycle activities will be maintenance, which will be informed by inspection and observation of condition of the assets. Selection of the appropriate improvement activity will depend on the type of deterioration being experienced on the asset, and the condition of the asset.

The Township has recognized that the majority of their sidewalk/ trail networks do not meet new AODA requirements. To be compliant, the Township has introduced AODA standards into construction and renewal work.

High priority repairs and defects identified during the MMS Inspection are immediately repaired by staff (milling tripping hazards, potholes, etc.).

Management of the sidewalk and trail assets at the Township is through both capital and maintenance programs:

- Sidewalks - Inspections, replacements & maintenance are conducted through an operational program
- Trails - Replacements / Rehabilitation are conducted through a capital program
- Trails - Inspection & minor maintenance are conducted through an operational program.

4.5 FINANCIAL STRATEGY

4.5.1 SOURCES OF FUNDING

Funding comes from a variety of sources including property taxes, user fees, debt issuance, 3rd party contributions and drawing on reserves.

- Tax levy
- St. Clair River Trail (only minor projects)
- Debt Financing
- Development
- 3rd Party Contribution

4.5.2 FUNDING STRATEGY

The Township currently has three funding budgets through which the sidewalk and trail assets are maintained. A summary of these budgets and their purpose is summarized in **Table 4-5** below.

Table 4-5: Sidewalk/ Trail Capital and Operating Budgets				
Budget Name	**Annual Budget**	**Lifecycle Activities**	**Asset**	**Notes**
Operations	$50,000	Inspections, replacements & maintenance	Sidewalks	Annual budget
Capital	$100,000	Replacements / Rehab	Trails/ Walkways	Annual Budget rehab/replace River Trail and other misc. trails
Operations	$50,000	Inspection & minor maintenance	Trails/ Walkways	Operational budget to maintain, including small patches, spraying, sweeping, etc.

A method of predicting the expected annual cost of an asset is through calculation of its lifecycle cost. This cost considers the replacement cost of an asset spread out across the expected useful life. A total of this cost across all assets in the category can give an indication of what annual level of investment may be required to maintain these assets.

Using the parameters set out in the State of Local Infrastructure section, we can estimate the lifecycle costs for the sidewalk and trail assets, as shown in **Table 4-6**.

Table 4-6: Sidewalk/ Trail Capital Lifecycle Costs			
Asset Type	**Total Length**	**Lifecycle Unit Cost**	**Total Annual Lifecycle Cost**
Trails	33,940 m	$3.33 (annual cost per meter)	$113,020
Sidewalks	36,300 m	$1.10 (annual cost per meter)	$39,930

The capital budget allocation of $100,000 for the rehabilitation and replacement of trail assets is slightly below the total lifecycle cost. However, with consideration of the additional $50,000 operational budget allocation, it is likely that the funding for trail assets is sufficient to maintain these assets at the current standard. As material costs increase over time, the Township should consider increasing this budget.

The operational budget for sidewalks of $50,000 includes costing for inspection, maintenance, and replacement of sidewalks. The total annual lifecycle cost for sidewalks falls under this $50,000 cost, however when considering the additional works conducted under the operational budget (inspections, etc.), the budget is likely sufficient to maintain these assets at the current standard.

The implication of the investment levels over the term of the AMP on the overall condition index for the sidewalk and trail assets is difficult to determine as the works to sidewalks and trails is planned annually as a result of inspections or conducted reactively based on urgent condition or performance concerns. Ongoing assessment of condition can allow for trends to be identified, from which the Township can adjust the program according to the anticipated needs (for example if condition is dropping continuously, a proactive replacement on a larger scale can be considered).

5 STREETLIGHTS & SIGNALIZED INTERSECTIONS

5.1 STATE OF INFRASTRUCTURE – STREET LIGHTS/ SIGNALIZED INTERSECTIONS

The following table describes the current state of streetlight and signalized intersection assets.

Category	Class	Condition	Total Length / Count	% Rated	Current Value	Average Age	Avg Years to Re hab/ Replace
Streetlights/ Traffic	Signalized Intersection	Excellent 	2.75	66.67 (BM: 66.67)	$432,865.00	9	31
Streetlights/ Traffic	Fixtures	Excellent 	1471	98.78 (BM: 98.78)	$1,176,800.00	4	19
Streetlights/ Traffic	Supports	Unrated 	643		$2,263,950.00	46	

Figure 5-1: Excerpt from Infrastructure Report Card (2021) for Street Lights & Signalized Intersections

Current Infrastructure Report Card can be found in **Appendix B.2**. Additional description of the information presented in the above table are detailed below.

5.1.1 ASSET INVENTORY

The inventory for streetlights and signalized intersections tracks assets by component, as summarized by category in **Table 5-1**.

Table 5-1: Street Light & Signalized Intersection Inventory

Streetlight/Signalized Intersections	Inventory
Light Fixtures	1,471
Supports	643
Signalized Intersections	2.75

Streetlights:

The Township owns and maintains light fixtures and supports throughout the Township. Their function includes roadway illumination, walkway, and municipal property lighting. Streetlights are inventoried by component and managed in Cartegraph OMS with GIS integration.

- *Light Fixtures* – Include Fixtures and Arms
- *Supports* - Include municipally owned support poles and the inventory breakdown by type is shown below in **Table 5-2**.

Table 5-2: Inventory of Support Pole Types

Support Pole Type	Inventory
Aluminum Pole	290
Wooden Pole	104
Decorative Post Top	103
Concrete Pole	86
Decorative Double	36
Galvanized Steel	19

Signalized Intersections:

The Township owns and maintains 2.75 sets of Traffic Signals within the hamlet of Corunna. This includes the following:

- One set is located at the intersection of St. Clair Blvd and St. Clair Parkway,
- One set serves as a pedestrian crossing at the intersection of Beckwith Street and Lyndoch Street,
- Traffic signals at Lyndoch St. and Hill St. are under ¾ Cost Sharing/Ownership with the County of Lambton.

Signalized intersection assets contain multiple components, including:

- Signal cabinet
- Signal controller
- Signal head
- Support
- Traffic Detector.

5.1.2 EXPECTED USEFUL LIFE

The expected useful life of streetlights and signalized intersections varies depending on the component of the asset. The expected useful life is shown in **Table 5-3**.

Table 5-3: Street Light & Signalized Intersection Life Expectancy

Streetlight/Signalized Intersections	Life Expectancy (Years)
Light Fixtures	20
Supports	60
Signalized Intersections	40

5.2 ASSET VALUE

The asset valuation for the assets is summarized in **Table 5-4**.

Table 5-4: Street Light & Signalized Intersection Value

Streetlight/Signalized Intersections	Value (2021)	Value (2021)	Value (2018)
Light Fixtures	$1,176,800	$3,848,625	$4,159,600
Supports	$2,263,950		
Signalized Intersections	$432,865		

The asset value was estimated using unit costs for each of the streetlight/ signalized intersection components. Further, installation costs were estimated so the Township has a valuation that considers full replacement of the assets.

The current estimated unit replacement costs were determined in 2021 dollars, and included the following:

- Streetlights
  - LED: $800.00
    - includes Photocells and typical 6ft alum Arm
  - Supports
    - Decorative Double (Assumed Underground Feed: $9,250
    - Decorative Post Top (Assumed Underground Feed: $3,650
    - Aluminum Pole (Assumed Underground Feed: $3,500
    - Galvanized Steel (Assumed Underground Feed: $2,800

  - Concrete (to be replaced w/ Aluminum Pole): $3,500
  - Wooden (Assumed Overhead Feed): $1,600
- Signalized Intersections
  - St Clair Blvd & Lyndoch St: $170,000
  - Hill St & Lyndoch St: $212,500
  - Beckwith St & Lyndoch St Pedestrian Crossing: $103,500

5.3 ASSET CONDITION

The operation of the light fixtures and traffic signal assets are captured as part of routine inspections. And concrete support poles are inspected for prioritization, as part of a budgeted replacement program.

Streetlights

a) An annual inspection of streetlighting fixtures (as per MMS regulation) is completed by Township staff, during nighttime hours. The primary focus of this inspection is to identify illumination problems and faulty fixtures. Identified corrective actions are addressed under contract to MMS Timelines.
   a. Throughout the remainder of the year, faulty fixtures are reported by the public and Township staff and are addressed under contract to MMS Timelines.

b) Aging Concrete support poles are reaching the end of their serviceable life. They are inspected for replacement prioritization. The most recent concrete pole assessment of condition was captured in OMS in 2020. Due to the quantity of replacements identified through this assessment, inspections for 2021 were not carried out. Inspection is expected to resume in 2022.

The concrete support poles are assessed on a SCT Overall 1–5-star rating scale with descriptors shown in **Table 5-5**.

Table 5-5: Concrete Support Pole Condition Indices

OCI Index	Value	SCT Rating	Description
100	5	Excellent	Minor defects – Failure unlikely in foreseeable future
90	4.5		
80	4		
70	3.5	Good	Defects that have not begun to deteriorate, unlikely to fail for at least 20 years
60	3		
50	2.5	Average	

40	2		Moderate defects that will continue to deteriorate, may fall in 10 to 20 years
30	1.5	Fair	Severe defects that will continue to deteriorate, will probably fall in 5 to 10 years
20	1		
10	0.5	Poor	Defects requiring immediate attention, has failed or will likely fail in next 5 years
0	0	Failed	Asset has failed and does not provide service

Signalized Intersections

An annual inspection (as per MMS regulation) of each location is completed by a qualified contractor, providing recommendations/report to Township staff for regular and preventative maintenance. The overall condition of the signalized intersection systems within the Township is considered "very good", as much of the equipment and hardware has been installed and/or replaced within the previous 15 years.

5.4 LEVELS OF SERVICE (LOS)

Levels of service (current and proposed), and performance measures are defined by the Township. LoS information can be found in **Appendix B.1 LoS Levels of Service**.

5.5 LIFECYCLE ACTIVITIES

5.5.1 CONSTRUCTION/ ACQUISITION

Acquisition of a new streetlight and traffic signal asset should consider the location and intended usage of the asset. Acquisition should be undertaken based on an understanding of the requirements of the asset for providing service delivery and should follow municipal procurement procedures. The design of new assets should be consistent with jurisdictional design requirements, including provincial design guidelines and Township design specifications

5.5.2 MAINTENANCE

Maintenance activities will vary across the streetlight and traffic signal assets due to the variability in type and usage of assets. The maintenance activities should be undertaken according to manufacturer specifications and as required to address condition and performance issues that arise through regular usage. Maintenance activities should include regular inspections for condition and recording of maintenance activities undertaken. Maintenance activities can include (but are not limited to) replacement or changeout of fixture (lighting fixtures, bulbs, arms posts), in responses to damage, or end of lifecycle,

5.5.3 DECOMMISSIONING/DISPOSAL

Disposal activities for streetlight and traffic signal assets typically include the removal from service through disposal of the asset. Disposal activities should be conducted such that health and safety protocols are being followed, and out of service assets are disposed of at appropriate or approved facility.

5.6 ASSET MANAGEMENT STRATEGY

The asset management strategy for the streetlight and traffic signal assets seeks to use the lifecycle activities in a manner that will achieve cost-effective and sustainable management of the assets.

Throughout the lifecycle of the assets, routine maintenance should be conducted. As required, specific maintenance should be conducted, which is expected to be determined annually through inspection of condition and performance. As an asset ages and approaches the end of its useful life, it is expected that the risk and maintenance costs associated with the asset will increase.

There will be a point in the lifecycle where the risk and maintenance costs are such that replacement of the asset will be the preferred solution. This point will vary depending on the type of asset and the services delivered by each.

Streetlights

The current strategy for the management of the streetlight assets is generally to achieve the minimum maintenance standards, and to meet the Township-defined levels of service.

In addition, the Township has identified specific strategies that will help focus the management of these assets, including:

- Focus on the highest risk structures. Replace a minimum of six (6) reinforced concrete poles per year with aluminum poles, until all are eliminated from inventory.
- Limit the addition of new streetlights and continue to use existing poles owned by Hydro One where possible.

An extensive LED retrofit program was completed in 2015/2016, replacing 1,365 high pressure sodium (100-200 watt) fixtures with new 52–69-watt LED fixtures, at an approx. cost of $665,000. The resulting cost savings for electricity is approx. $120,000 per year.

Signalized Intersections

The current strategy for management of the signalized intersection assets is generally to achieve the minimum maintenance standards, and to meet the Township-defined levels of service.

The selection and implementation of the lifecycle activities to achieve these will be based on the results of routine inspection reports from assessment of the assets. The assessment will identify any required works (such as repairs or maintenance) from which the Township can plan the strategy and timeframe for addressing deficiencies. Lifecycle activities such as reactive maintenance measures can also be conducted in response to issues identified outside of the inspection. An estimation of the replacement profile can be undertaken using the expected useful life of the asset, however routine maintenance works, and assessment will help to better inform any works to be done. The Township's specific strategy to help focus the management of these assets is to replace components annually, as recommended within the inspection report.

5.7 FINANCIAL STRATEGY

The financial strategy for the streetlight and signalized intersection structures considers current sources of funding, and projected needs.

5.7.1 SOURCES OF FUNDING

Funding comes from a variety of sources including property taxes, grants, debt issuance, 3rd party contributions and drawing on reserves.

5.7.2 FUNDING STRATEGY

The Township currently has three funding budgets through which the streetlight and signalized intersection assets are maintained. A summary of these budgets and their purpose is summarized in **Table 5-6**.

Table 5-6: Street Lights/ Signalized Intersections Operating Budgets

Budget Name	Annual Budget	Lifecycle Activities	Asset	Notes
Operations	$20,000	Replacements / Repairs Fixing light fixtures and power supply issues	Light Fixtures – Roadway/Property	Annual budget for streetlights (repairs, replacement of a few poles and fixture &, maintenance) is $51,600.
Operations	$30,000	Replacement *Replace broken / damaged supports*	Supports	
Operations	$5,000	Inspections & repairs *3 intersections w/ traffic signals*	Signalized Intersections	

The assets are all maintained through operations budgets, the Township does not currently allocate capital funding to these assets. The majority of lifecycle activities undertaken are maintenance, which are identified through inspection programs. In consideration of the recent retrofit program undertaken, the Township does not currently have significant need for capital expenditures.

A method of predicting the expected annual cost of an asset is through calculation of its lifecycle cost. This cost considers the replacement cost of an asset spread out across the expected useful life. A total of this cost across all assets in the category can give an indication of what annual level of investment may be required to maintain these assets.

Using the parameters set out in the State of Local Infrastructure section, we can estimate the lifecycle costs for the assets, as shown in **Table 5-7**.

Table 5-7: Street Light & Signalized Intersection Capital Lifecycle Costs

Asset Type	Total	Total Annual Lifecycle Cost *(total asset value divided by expected useful life)*
Light Fixtures	1,471	$58,560
Supports	643	$37,409
Signalized Intersections	2.75	$10,821

The Township operations budget allocation of $30,000 for street light supports is within the range of the lifecycle cost for the same assets. The operations budget value is lower than lifecycle cost for both the signalized intersections and light fixtures, by approximately $5,000 and $38,000 respectively. It is important to note that the lifecycle cost is not expected to equate to the amount spent annually on lifecycle activities. Given that the assets are known to be in very good condition, it is likely that at this point in their lifecycle the annual operating costs will be low, however when the assets near the end of their useful lives, the annual costs are expected to increase. The Township may consider reserves for these assets, which can be used for batch replacement of the assets, as was previously done.

6 WATER NETWORK

The Township of St. Clair's DWQMS supersedes any information within this AMP.

6.1 STATE OF INFRASTRUCTURE – WATER NETWORK

The water network includes the linear water distribution mains and appurtenances, and the Bridgen Elevated Water Tower.

Water is treated and supplied from LAWSS Water Treatment Plant (located at 1215 Fort St., Pt Edward). Within our municipality is 71km of supply watermain owned and maintained by the Lambton Area Water Supply System (LAWSS) and serving our residents. LAWSS is owned by its member municipalities and operated by the Ontario Clean Water Agency (OCWA) on behalf of the LAWSS Joint Board of Management.

The Township of St Clair distribution system is included in an existing Water Model that captures all LAWSS member systems including the City of Sarnia. The model is used for understanding function and performance of the water system. LAWSS currently own the most up to date water distribution model which has been operated by AECOM Consulting. AECOM Consulting has been contracted by LAWSS to perform water distribution modelling.

The following table describes the current state of our watermain assets.

Category	Class	Condition	Total Length / Count	% Rated	Current Value	Average Age	Avg Years to Re hab/ Replace
Water Distribution	Water Mains	Excellent 	475.49 km	100.00 (BM: 100.00)	$503,647,689.00	28	69
Water Distribution	Water Towers	Average 	1	100.00 (BM: 100.00)	$5,412,910.00	49	10

Figure 6-1: Excerpt from Infrastructure Report Card (2021) for Water Network

The current Infrastructure Report Card can be found in **Appendix B.2**.

The current state of watermain assets is further detailed by material type in **Figure 6-2**.below

Material	Condition	Total Size	Current Value	Average Age	Est Useful Life
AC	Fair	1.3 km	$399,360.00	61	60
Ferrous Metal	Average	25.43 km	$7,812,096.00	50	69
HDPE	Excellent	5.28 km	$1,622,016.00	12	89
PE	Excellent	0.86 km	$264,192.00	32	96
PVC	Excellent	442.49 km	$135,932,928.00	27	99
Stainless Steel	Excellent	0.1 km	$30,720.00	2	88

Figure 6-2: Current State of Watermain Assets by Material

6.1.1 ASSET INVENTORY

The Township's water distribution system is approximately 475 km in length which excludes the 71km of transmission watermains owned and maintained by the Lambton Area Water Supply System (LAWSS).

The Township's water distribution system has one (1) Elevated Water Storage Tower (Brigden Water Storage Tower) owned and operated by the Township. (There is an additional Water Standpipe (Port Lambton Standpipe) in the Township owned by LAWSS and operated by OCWA.

6.1.2 EXPECTED USEFUL LIFE

The expected useful life of the linear assets is based on the material type and is consistent with TCA (Tangible Capital Asset) data. The expected useful life represents a typical value, and actual useful life of individual assets may vary. Assets will deteriorate on a non-linear basis.

- AC: 60 years
- Ferrous Metal: 60 years
- HDPE: 90 years
- PE: 90 years
- PVC: 90 years
- Stainless Steel: 60 years

The expected useful life of the elevated water tower is 60 years.

6.1.3 ASSET VALUE

The asset value is determined based on the current network size and current unit replacement costs. Unit replacement costs for the water network were estimated using recent tender information from Township projects. The unit prices were developed assuming that all new water linear assets will be constructed of PVC. A summary of the costs is included in **Table 6-1**.

Table 6-1: Water Linear Asset Unit Replacement Costs

Asset Size	2021 Unit Cost ($/m)	New pipe material
Up to (and including) 250 mm diameter	$1,050	PVC
251-400 mm diameter	$1,200	PVC
Over 400 mm diameter	$1,550	PVC

The unit replacement costs are on a per meter basis, and include water main material costs, appurtenances, as well as material to complete trench and restore surface. The cost is further inflated by 10% and 15% to account for engineering and contingency costs.

A comparison of current and past replacement values is shown in **Table 6-2** below. Variation in value across years is due to changes in the network and valuation methods.

Table 6-2: Water Asset Values

Infrastructure Network	Length (km) / Count	Estimated Replacement Cost 2021	Estimated Replacement Cost 2018	Estimated Replacement Cost 2013	Estimated Replacement Cost 2007
Watermains	475 km	$503,647,689	$164,275,174	$142,847,977	$141,530,000
Water Tower & Equipment	1	$5,412,910	$4,953,579	$4,307,460	n/a

6.1.4 OTHER WATER ASSETS

In addition to the major water assets previously listed, the water network includes the following assets:

A summary of the inventory and current valuation of these assets is shown in **Table 6-3**.

Table 6-3: Other Water Asset Values

Asset Type	Quantity	Unit Replacement Cost (2021)	Estimated Replacement Cost (2021)
Utility billing meters (Residential)	5,700	$500	$2,850,000
Utility billing meters (Commercial)	300	$6,500	$1,950,000
Chlorine analyzers	2	---	$ 15,000
SCADA Controller	Part of SCADA Asset	---	$ 60,000

While critical for water service delivery, these assets are not currently analyzed as part of the asset management plan. These assets should continue to be maintained, operated, and renewed as required. Consideration of these other assets will be given for future iterations of this report.

6.1.5 ASSET CONDITION

The expected useful life of the assets and a deterioration model based on age and material was used to predict the physical condition of the water pipes in the network. No condition assessment was carried out on the water distribution system appurtenances (i.e., valves, hydrants, etc.), however during annual routine maintenance appurtenances are inspected for structural and operational deficiencies.

The Township further utilizes the program Cartegraph for modelling the deterioration and capital works projections for the lifecycle of the assets. The deterioration information used within these models is based on the expected deterioration of each linear pipe material. The inputs used for development of the Cartegraph model are consistent with the parameters identified within this report (expected useful life, replacement unit costs, etc.)

Overall, the watermains are in excellent condition. The distribution of asset conditions by service type are shown in **Figure 6-3**.

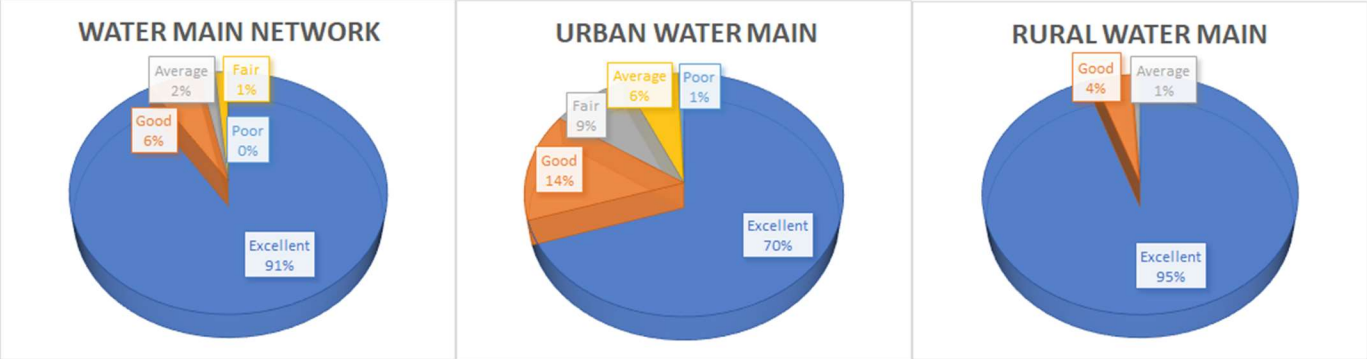

Figure 6-3: Condition of Watermain Network (including Urban and Rural Breakdown)

To provide additional context for the condition of the assets, **Table 6-4** shows the condition ratings, total length of assets, and total replacement costs.

Table 6-4: Water Linear Asset Unit Replacement Costs

Condition Rating	Total Replacement Cost	Total Length (m)
Excellent	$ 457,952,220	432,038.7
Good	$ 29,453,471	27,956.6
Average	$ 8,758,428	8,341.4
Fair	$ 6,947,976	6,617.1
Poor	$ 535,595	510.1

The Brigden Elevated Water Tower is considered in Average condition (based on age and linear deterioration). A detailed internal inspection of the Tower storage vessel is planned for 2022. This infrequent internal inspection will provide valuable information on the actual condition of the water tower, which may refine the remaining life estimate of the asset.

The Township does not currently have a condition index LoS target established for comparison with current condition.

6.2 LEVELS OF SERVICE (LOS)

Levels of service (current and proposed), and performance measures are prescribed by O.Reg. 588/17 and defined by the Township. LoS information can be found in **Appendix B.1 LoS Levels of Service**.

6.3 LIFECYCLE ACTIVITIES

The following section describes the lifecycle activities that can be implemented within the asset management strategy for water assets. The water assets include linear and vertical assets, lifecycle activities for each presented separately. The lifecycle activities for water assets include construction, maintenance, renewal, and decommissioning/ disposal.

6.3.1 LINEAR ASSETS

6.3.1.1 CONSTRUCTION ACTIVITIES:

Construction of assets includes new construction and replacement of existing assets. Construction of new assets is recommended to be in line with recommendations as part of growth, master plan, or other municipal strategies. The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines and local requirements. New construction of assets will occur where no previous water servicing is available. This can be a cost sharing venture on request for servicing or a municipal expense to address growth or looping of the system to improve quality. The risk associated with new construction includes the high cost of brand-new assets relative to ability to recoup costs through user rates or development charges.

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and growth usage projections.

6.3.1.2 MAINTENANCE ACTIVITIES:

Maintenance activities are undertaken on the assets throughout their useful life to maintain their operating condition and performance. Maintenance works includes routine maintenance (flushing), and minor repairs to assets (localized pipe repair, appurtenance repair). Additional maintenance programs include monthly blowoff flushing, and water quality checks, annual Hydrant Maintenance, Inspection and flushing as well as annual Valve Exercising. There exists the risk that a maintenance activity may be implemented that does not adequately mitigate a performance or condition issue, and additional costs are then required for further repair or replacement.

Risks associated with these maintenance activities include improper execution of the activity, thereby reducing the operational condition and performance of the assets.

6.3.1.3 OPERATING AND DECOMMISSIONING ACTIVITIES:

Operating activities for the watermain assets include those activities that do not directly deal with the physical state of the watermains but work to extend the asset's useful life. The operating activities can include non-infrastructure policies, and monitoring/ inspection of the assets. Condition assessment of watermain pipes is challenging to undertake. Reactive maintenance works (watermain repairs, etc.) are tracked such that they can provide additional

information to the Township regarding condition of the pipe segments (beyond the theoretical condition determined through age of pipe and deterioration rate). Operating activities can be used throughout the useful life of an asset.

Decommissioning of the watermain assets includes abandonment or replacement of the asset at the end of its useful life. Removal of the expended asset can provide additional space for new underground assets to be constructed within a right-of-way.

6.3.2 VERTICAL ASSETS

6.3.2.1 CONSTRUCTION

The start of a vertical water asset lifecycle is its construction. The asset should be constructed to adhere with the applicable standards and codes. The design of the facility should suit the purpose of its construction.

6.3.2.2 MAINTENANCE

Throughout the full lifecycle of an asset, the majority of the expected lifecycle activities to be undertaken will be maintenance works. Maintenance activities can be used to improve the level of service of an asset (or component), or to maintain it. Activities that fall under the maintenance category can be varied by response type and scale of maintenance requirements. Activities can be required through routine maintenance works, response to poor condition or performance, or on an emergency basis. In general, the expected types of maintenance activities within the lifecycle of a vertical water asset include:

- Preventative maintenance
    - Maintenance activity is undertaken to prevent failure or poor performance of a building asset component. Preventative maintenance works can be undertaken according to a maintenance schedule. Manufacturer directives and condition assessments should assist in determining frequency of preventative maintenance activities.
- Reactive maintenance
    - Maintenance activity is undertaken in response to an issue or fault in the building or component systems, on an ad-hoc basis. Scale of reactive maintenance works will be variable depending on the system and type of failure or decrease in level of service.
- Major maintenance (replacement)
    - Maintenance activity is undertaken in response to a component which is no longer able to provide adequate level of service. Major maintenance (replacement) will be undertaken for one or more components of a building asset. Major maintenance works can be preventative (in anticipation of end of service life of a component), or in response to a system failure.

The Brigden Water Storage Tower has regular preventive maintenance inspections, and recommended AWWA maintenance.

6.3.2.3 RENEWAL/ ENHANCEMENT

Renewal works can be used to expand on an existing facility, or to renovate to suit changes to services provided. Enhancement works can be similar and can be used to update an asset for modernization, to achieve compliance with updated codes and requirements. These works can include:

- Addition of new components to an existing asset
  - New components can be added to an existing asset with the existing asset largely unchanged.
- Updating of existing components
  - Updating of existing components can prolong the expected lifespan of an asset.

6.3.2.4 DECOMMISSIONING/ DISPOSAL

Removal from service of an asset or component. Disposal can be through decommissioning or sale. Activities should comply with applicable health, safety, and environmental protocols.

As the water vertical assets are specialized for distribution services, there are additional factors that must be considered:

- Water facilities are highly regulated. Any and all lifecycle activities undertaken must be done in compliance with codes and regulations.
- Expansion of existing facilities may be required for additional distribution capacity as a result of growth. Expansion activities may encompass multiple lifecycle stages, such as construction for additional infrastructure required, and renewal for expansion of existing infrastructure.

6.4 ASSET MANAGEMENT STRATEGY - WATER NETWORK

The strategy for managing the water network assets uses the lifecycle activities above in in a manner that seeks to achieve the levels of service targets and optimize the lifecycle and costs of the assets.

The strategy generally follows the following sequence of lifecycle activities:

- Maintenance activities throughout lifecycle of asset
- Operating activities through lifecycle of asset
- Reconstruction to be done when other activities are insufficient to address condition or other issues

6.4.1 LINEAR ASSETS

The current specific priorities of the asset management strategy include to meet the target LoS, and to eliminate cast and ductile iron pipe (ferrous metal) materials from the system.

The primary indicator of intervention requirements is the condition of the asset. The Township plans to establish a condition LoS target for the distribution assets. The assets will

deteriorate on a non-linear basis from perfect condition at initial construction to asset failure. Through the lifecycle there are opportunity windows to conduct lifecycle activities to optimize the lifecycle of the asset. A summary of the condition ranges and recommended lifecycle activities is shown in **Table 6-5**.

Table 6-5: Lifecycle Activities and Condition Ranges

OCI Range	Condition Rating	Lifecycle Activity Category	Lifecycle Activity
100-60	Excellent to Good	Maintenance (maintenance works can be done beyond the 100-60 condition range as necessary)	Maintenance works (cleaning, flushing) Localized repairs
60-35	Good to Fair	Rehabilitation	None
35-0	Poor to Failed	Reconstruction	Pipe replacement or abandonment

All new construction and water main replacement are assumed to be constructed of PVC, with a minimum diameter of 150 mm (subject to feasibility and funding).

The strategy should consider other factors in making asset management decisions in addition to assessment of the condition. Some other important factors include:

- Importance or criticality of the asset
- Risk related factors
- Condition of adjacent sections
- Replacement requirements for adjacent infrastructure (sanitary, storm or roadworks)
- Capacity of infrastructure and growth/ expansion requirements
- Maintenance requirements: frequency and type.

In determining prioritization of the works to the assets, the Township has developed some direction regarding criticality of the assets. By default, assets have the criticality factor of 1, unless they meet the following criteria:

- Mains are given higher criticality when located in high service areas of the Township. This includes urban, population dense environments. The criticality rating included in the model are increased by 10% of the default. (Criticality factor of 1.1)
- Trunk distribution mains are given higher criticality. This includes trunks greater than or equal to 300 mm in diameter (which includes most commercial, industrial, and institutional areas). The criticality rating included in the model are increased by 20% of the default. (Criticality factor of 1.2)

- Supply mains under LAWSS ownership are given higher criticality. The criticality rating is increased by 50% of the default, however these mains are not included within this plan. (Criticality factor of 1.5)

6.4.1.1 SCENARIO ANALYSIS

To understand the needs and projected works on the linear watermain assets within a 10-year timeframe, replacement activities were reviewed under varying budget values to understand the impact on overall asset condition. The budgets analyzed include:

1. **Unlimited** Budget – To determine backlog of works
2. **Actual** Budget – changes in OCI using a $900,000 annual budget across the timeframe (best value)

A 10-year projection was run in Cartegraph for each of the scenarios noted above (from 2022-2031). The results of the scenarios provided works to be conducted on the linear watermain assets over the timeframe according to the scenario budget and the goal of the scenario (target OCI, etc.). The average OCI at the start of all reviewed scenarios is 91. A summary of the scenario analysis is outlined in **Table 6-6**.

Table 6-6: Watermain Scenario Results

Scenario	Budget Scenario	Scenario Type	Average Annual Investment Over Timeframe	Total Investment over Timeframe	Assets Included	Average OCI (End of Timeframe)
1	Unlimited Budget	Unlimited	$977,499	$9,774,990	50	87
2	Actual Budget	Budget Limitation	$817,596	$8,175,959	48	87

The starting average OCI for watermain assets is high at the start of the scenarios. Through the deterioration experienced by the assets through the analyzed scenario timeframes, the average OCI remains high, at 87 for both the unlimited and actual budget scenarios. The results of analysis for watermains demonstrates that the current level of funding resulted in the same performance as with unlimited budget. Therefore, the current budget levels for watermains are adequate to ensure sustainability of the assets for the next 10 years.

The Township does not currently have a target OCI for watermain assets.

The total expenditure, average annual investment, and average ending OCI are very similar in Scenarios 1 and 2, however distribution of the costs across the 10-year timeframe differs significantly. The first year of Scenario 1 incurs $6.6M in repairs, suggesting that there is a backlog of works to be done on the watermain assets. The expenditures in following years

range from $123,000 to $1.2M, with four years in the scenario having no annual expenditure. Scenario 2 achieves similar results, however using the budget limitation, the expenditures are averaged across the scenario years. The current budget of $900,000 annually is expected to be sufficient to address the backlog of works and to continue to have a very good average OCI over the timeframe. A summary of the annual expenditure and resulting OCI is shown in **Figure 6-4**.

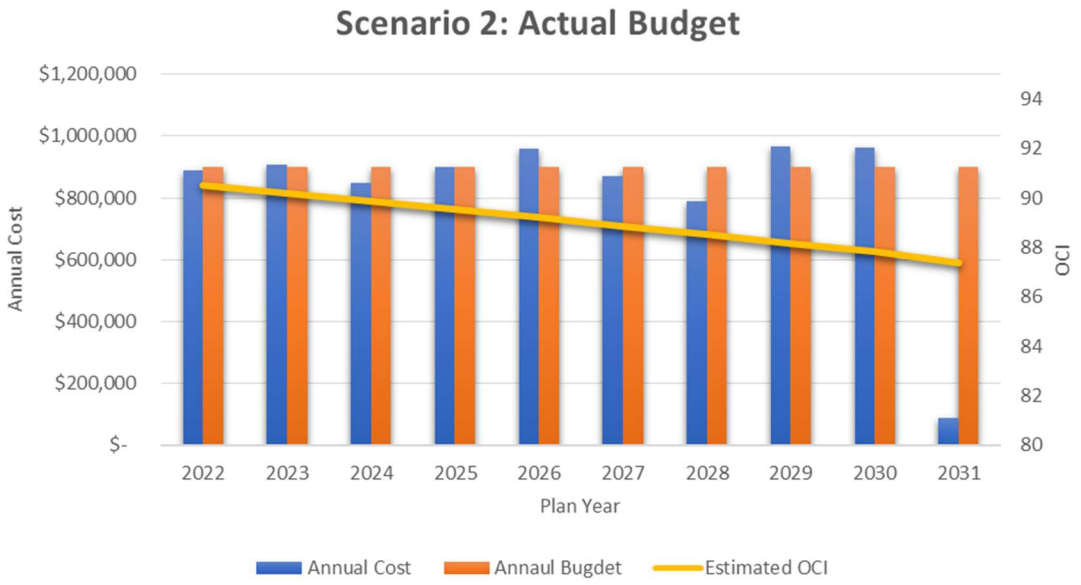

Figure 6-4: Water Network Analysis - Scenario 2: Actual Budget

A third scenario was run to project longer-term needs on the network, to identify any upcoming points in time where a significantly larger or smaller annual investment will be required. This scenario can be a useful planning tool when the current needs (backlog and annual investment) are low. The scenario was run using an unlimited annual budget value and a 30-year timeframe. A summary of the annual expenditure and resulting OCI is shown in **Figure 6-5** (below).

The figure shows a comparison of the annual expenditures (assuming unlimited budget) and the current annual budget of $900,000. Over half of the years within the analyzed timeframe have an annual expenditure at or below the current annual budget. However, there are six years with expenditures over $2M, reaching as high as $11.4M in 2046. Understanding where there may be years of significant expenditure can assist the Township in financial and asset lifecycle planning.

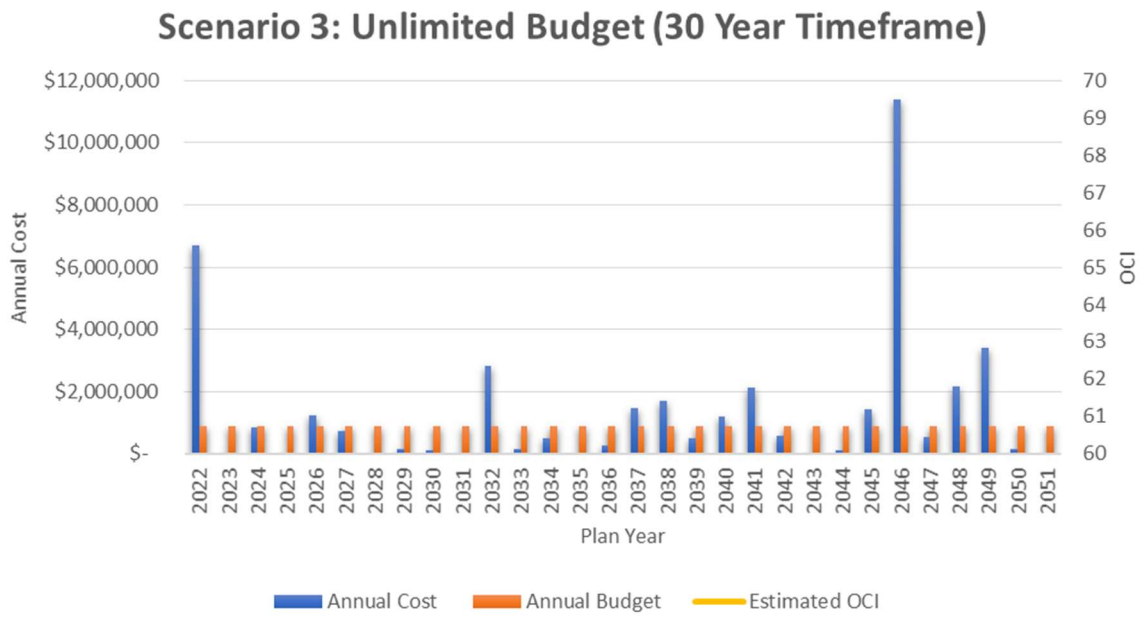

Figure 6-5: Water Network Analysis - Scenario 3: Long-term Unlimited Budget

6.4.2 WATER TOWER

The asset management strategy will utilize the lifecycle activities previously defined to maximize the useful life and economic value of the Brigden Elevated Water Tower. The Township does not currently have LoS targets defined for this asset, however plan to develop them to continue to advance the strategy.

Due to the size and complexity of the water tower asset, the sequencing for lifecycle activities is highly variable, and requires further investigation to appropriately identify actual condition which would help indicated & drive maintenance activity / capital investment & remaining life.

The Township contracts safety assessments of the Brigden Elevated Water Tower, through which any maintenance and rehabilitation works are identified. Any recommended lifecycle activities borne from these assessments are factored into the Township's budget and carried out accordingly. The current inspection report provides the following recommendations regarding an inspection schedule:

- SIR - Safety inspection and report to be undertaken in 2021
- ROC - Remote inspection and reporting to be undertaken in 2023 (three years after cleaning, inspection, and reporting)
- CIR - Cleaning, inspection and reporting to be undertaken in 2026

Due to the complexity and importance of this asset, the strategy currently used by the Township to identify lifecycle activities should be maintained. Continued assessment of the Brigden Elevated Water Tower and tracking of results can assist the Township in future planning for larger capital works on the asset and eventual asset replacement or upgrade.

While inspections provide a good understanding of the condition and useful remaining life of the asset, the Township should be cognizant of the expected useful life of the asset and plan accordingly for eventual replacement of the asset. Given the year of construction of the asset (1972) and its expected useful life (60 years), the asset will require full replacement or major rehabilitation in 2032. Assuming a rate of inflation of 3% annually, we can estimate a replacement value of $7,493,000. Note that this date and expenditure are an approximation based on theoretical useful life and age and following the planned internal storage tank condition assessment the remaining life estimate of the asset may be refined.

6.5 FINANCIAL STRATEGY - WATER NETWORK

Water capital plans continue to be reviewed annually with the engineering 10-year capital plan. Water user fees and water rates fund maintaining the water assets.

6.5.1 SOURCES OF FUNDING

Funding comes from a variety of sources including:

- property taxes
- user fees, (excess which are directed to reserves)
- debt issuance,
- 3rd party contributions and
- drawing on reserves.

6.5.2 FUNDING STRATEGY

The Township currently utilizes seven budget funds through which the water assets are constructed, operated, and maintained. A summary of the operational budgets and their purpose is summarized in **Table 39** below.

Table 6-7: Water Network Capital and Operating Budgets

Budget Name	Annual Budget	Lifecycle Activities	Asset
Operations	$20,000	Curb box replacement	Water services
Operations	$10,000	Replacements/ rehabilitation	Water hydrants
Operations	$25,000	Flushing	Water hydrants
Operations	$25,000	Exercising	Watermain valves
Operations	$20,000	Inspection/ repair	Water tower
Capital	$900,000	Replacements	Watermains
Capital	No fixed annual budget	Maintenance/ rehabilitation	Water tower

Based on the results of the lifecycle scenarios, the current budget of $900,000 annually for capital expenditure related to watermains should be sufficient to maintain the current levels of service.

Going forward, the Township can establish OCIs and level of service targets, and the annual budget can be adjusted higher or lower to suit the targets.

The operations budgets are outside of the scope of this analysis and are assumed to be sufficient.

Based on the results of the scenarios, the current capital budget for replacing watermains is sufficient to maintain the current level of service across the assets within the analyzed 10-year timeframe.

The longer-term scenario identified years in which there was a significant anticipated expenditure, and years wherein there are little to no expenditures. To manage the fluctuation in anticipated annual costs, and to prepare for the years of significant expenditure, the Township can:

- Allocate funding into reserves during years where the annual cost is low.
- Prioritize lifecycle activities and adjust year of works for some assets to 'smooth out' peaks in expenditure across adjacent years (prior and after)
- Seek additional funding (grants, etc.) to help fund the high annual costs where appropriate

6.5.2.1 WATER TOWER

The capital budget for the Brigden Elevated Water Tower maintenance and rehabilitation is not a fixed value. Outstanding capital works are identified during annual capital budget review and carried forward as part of the capital works budget for the following budget year. The variability in this process and anticipated capital works costs is such that a fixed value annual capital budget for water tower works is not meaningful.

The Township currently funds any Brigden Elevated Water Tower capital works through reserve funds. It is expected that the Township can continue to utilize this system to fund, including allocation of some funds to a reserve in years where the capital expenditure is low.

As stated within the strategy section, the Brigden Elevated Water Tower is nearing the end of its theoretical useful life and is likely to require significant investment for rehabilitation or replacement. This is expected to occur just beyond the ten-year timeframe considered within this report, however the Township should consider the requirement to adequately reserve sufficient funding for when the works are required.

The estimated replacement value of the asset in 2021 dollars is $5,412,910. To achieve a reserve fund in the next 10 years sufficient for this replacement value, the Township should target allocation of $541,291 into reserves. Note that this value is subject to increase with

inflation over the course of the remaining life of the asset. When major works are required, it is recommended that the Township seek additional funding sources such as grants, etc.

Following the upcoming planned internal inspection of the Brigden Elevated Water Tower, the annual contribution to reserve can then be reviewed and adjusted accordingly if the extended useful life is found to be significantly different than the current estimate.

Additionally, in 2022, LAWSS plan to replace their Port Lambton Standpipe, which will positively impact the Township's water distribution system.

6.5.3 CURRENT CAPITAL BUDGET

The Township has devised a capital budget that identifies capital water. These projects include both new and replacement activities. A summary of the plan years and anticipated annual budgets are shown in **Table 6-8.**

Table 6-8: Current Water Capital Budget

Plan Year	2022	2023	2024	2025	2026	2027	2028
Annual Budget	$910,000	$810,000	$900,000	$1,075,000	$180,000	$875,000	$1,100,000

The annual expenditures were generated using the same annual budget considered during scenario building. The Township has allocated funding such that there is fluctuation above and below the annual budget of $900,000, however the average expenditure across the plan years in the current capital budget is below that budget threshold, at $835,714.

7 STORMWATER ASSETS

7.1 STATE OF INFRASTRUCTURE – STORM WATER NETWORK

The stormwater assets at the Township include linear storm pipe, culverts, pumping station and stormwater basins.

The following table describes the current state of stormwater assets.

Category	Class	Condition	Total Length / Count	% Rated	Current Value	Average Age	Avg Years to Re hab/ Replace
Storm Drainage	Storm Culverts	Good 	12.54 km	100.00 (BM: 100.00)	$20,000,860.00	32	21
Storm Drainage	Storm Pipes	Acceptable 	71.7 km	100.00 (BM: 100.00)	$102,087,744.00	36	37
Storm Drainage	Pump Stations	Unrated 	1		$375,000.00		
Storm Drainage	Basins	Excellent 	2	100.00 (BM: 100.00)	$254,716.00	0	0

Figure 7-1: Excerpt from Infrastructure Report Card (2021) for Stormwater Assets

Current **Infrastructure Report Card** can be found in **Appendix B.2**.

Additional description of the information presented in the above table are detailed below.

7.1.1 ASSET INVENTORY

The Township owns and operates 71.7 km of storm pipe (urban). The previous storm pipe inventory was one consolidated module. As part of the continuous improvement storm culverts (rural) was separated into the OMS Storm Culvert inventory. Some rural pipe remains in the urban storm pipe inventory as we continue to separate and classify to new O.Reg. reporting.

The Storm Pipe network ranges in size from 150 to 600 mm in diameter. Most of the storm pipe network is composed of asbestos cement, concrete, polyvinyl chloride (PVC), and high-density polyethylene (HDPE).

69 km's of the urban storm pipe was built after 1960.

The Storm Culvert inventory module is considered our rural drainage system. We continue to capture new inventory. We've currently identified 12.5km or rural pipe.

We have not included or inventoried open channel drainage, or fully identified assets owned by Municipal Drains.

The stormwater inventory includes vertical assets, including:

- One storm pumping station located in Port Lambton.
- Two stormwater basin systems
  - Tyler Drive (2,021 cu.m. capacity)
  - Bayhill Drive (7,389 cu.m. capacity)

7.1.2 EXPECTED USEFUL LIFE

7.1.2.1 STORM PIPES & STORM CULVERTS

The expected useful life of the assets is based on the material type and is consistent with TCA data. The expected useful life represents a typical value, and actual useful life of individual assets may vary. Assets will deteriorate in a non-linear manner. The expected useful life for existing materials includes:

- Asbestos Cement: 50 years (material no longer being used in new construction)
- Corrugated Steel Pipe (CSP): 50 years
- PVC: 90 years
- HDPE: 90 years
- Concrete: 90 years
- Polymer Laminated CSP: 100+ years[4]

7.1.2.2 STORM PUMPING STATIONS & STORM BASINS

The expected useful life of the pumping station overall is expected to be approximately 50 years. Further, major components have been identified that have specific expected useful lives:

- Wet Wells and Valve Chambers: 75 years
- Pumps: 30 years

Other stormwater components that were not attributed a specific expected useful life at this time:

- Building
- Standby Generator
- Electrical Panel

[4] *(Galvanized Steel Life from Corrugated Steel Pipe Institute)*

The expected useful life of a stormwater basin varies by component. The basin itself does not have an expected useful life, as it is a passive asset. The ancillary components, such as, inlet/ outlet structures, etc. will require replacement and have expected useful values.

7.1.3 ASSET VALUE

The value of the stormwater assets indicates the cost that would be required if all existing assets were to be reconstructed in present day dollars. A comparison of current and past replacement values is shown in **Table 7-1** below. Variation in assessment value across years is likely attributed to changes in the network and valuation methods.

Table 7-1: Stormwater Asset Values

Infrastructure Network	Length (km) / Count	Estimated Replacement Cost 2021	Estimated Replacement Cost 2013	Estimated Replacement Cost 2007
Storm Pipe	71.7 km	$102,087,744	$39,954,851	$33,358,000
Storm Culverts	12.5 km	$19,989,200		
Pumping Station	1	$375,000	---	$250,514
Stormwater Ponds	2	$354,716	---	---

7.1.3.1 STORM PIPE AND STORM CULVERT ASSETS

The asset value was determined based on the current network size and current unit replacement costs. Unit replacement costs for the storm network were estimated using recent tender information from Township projects. The unit prices were developed for storm pipe (urban) and storm culvert (rural) assets.

The unit prices for Storm Pipe (urban) were developed assuming that all new pipes will be constructed of PVC or concrete, dependent on the diameter. The costs are on a per meter basis and are summarized in **Table 7-2** below.

Table 7-2: Storm Pipe Unit Replacement Costs

Asset Size	Unit Cost ($/m)	New pipe material
Up to (and including) 250 mm diameter	$1,000	PVC
251-400 mm diameter	$1,100	PVC
Over 400 mm diameter	$1,850	Concrete

The unit prices for Storm Culverts (rural) were developed assuming all new construction will be of CSP material. The costs are on a per culvert basis and are summarized in **Table 7-3** below. A typical culvert length of 14 m was used for up to and (including 600 mm diameter), and a typical length of 25 m was used for culverts over 600 mm diameter.

Table 7-3: Storm Culvert Unit Replacement Costs

Asset Size	Unit Cost ($/culvert)	New pipe material
Up to (and including) 600 mm diameter	$11,660	CSP
Over 600 mm diameter	$94,370	CSP

The unit replacement costs include material and construction costs, rip rap, traffic control, and miscellaneous restoration. The cost was further inflated by 10% and 15% to account for engineering and contingency costs.

7.1.3.2 STORM PUMPING STATION AND STORMWATER BASIN ASSETS

Valuation for the storm pumping station was based on the cost of original construction, inflated by 3% for each year since construction. To account for variation and contingency, this cost was further inflated and approved.

One Stormwater basin has been recently constructed and entered service. Based on this known construction cost, a $27/cu.m. unit cost was calculated to estimate basin replacement value based on capacity.

7.1.3.3 LIFECYCLE UNIT COSTS

The Township can also renew their storm pipes at a typical unit cost for relining summarized in **Table 7-4**.

Table 7-4: Storm Sewer Relining Unit Costs

Asset Size	Unit Cost ($/m)
Under 250 mm	$250
250 mm – 400 mm	$400
Larger than 400 mm	$1,000

Visual inspection, another non-infrastructure lifecycle activity, can be through CCTV, or other technology such as Zoom camera. Recent tender information suggests the following unit prices:

- CCTV: $10/m
- Zoom camera: $150/maintenance hole

7.1.3.4 OTHER STORMWATER ASSETS

In addition to the major assets previously listed, the stormwater network includes the following assets with estimated replacement costs as shown in **Table 7-5:**

Table 7-5: Other Wastewater Assets		
Asset Type	**Quantity**	**Estimated Replacement Cost (2021)**
Oil grit Interceptors	6	$120,000

Note: While Critical, these Other Assets are included for information only and are not analyzed within this asset management plan. These assets will continue to be maintained, operated, and renewed as required. Consideration will be given for inclusion in future iterations of this AMP.

7.1.4 ASSET CONDITION

7.1.4.1 STORM PIPE AND STORM CULVERT ASSETS

Existing sewer conditions are updated with any sewer inspection CCTV work that is completed using the SCT method based on PACP. The following current SCT condition assessment is based on the 1-5 PACP standard carried out on current CCTV inspections and recorded accordingly. There is a current backlog of inspection capture in OMS due to technological change and is being addressed. This process is essential to compare infrastructure assets on the same basis and predict performance in the future.

Table 7-6: Stormwater Pipe Condition Indices							
PACP Index	**PACP Rating**	**Index**	**Value**	**SCT OCI Rating**	**Description of Defects**	**Description of Probability**	**Response / Priority**
1	Excellent	100	5	Excellent	Minor defects	Failure unlikely in foreseeable future	None
		90	4.5				
		80	4				
2	Acceptable	70	3.5	Good	Defects that have not begun to deteriorate	Unlikely to fail for at least 20 years	Low
		60	3				
3	Fair	50	2.5	Average	Moderate defects that will continue to deteriorate	May fall in 10 to 20 years	Moderate
		40	2				
4	Poor	30	1.5	Fair	Severe defects that will cause failure within the foreseeable future	Will probably fall in 5 to 10 years	High
		20	1				

5	Failed	10	0.5	Poor	Defects requiring immediate attention	Has failed or will likely fail in next 5 years	Emergency
		0	0	Failed	Asset failure	Failed to provide service	Emergency

Further deterioration of the assets since the time of assessment is modelled within the Cartegraph OMS system. A summary of the current condition distribution of the storm pipes is shown in **Figure 7-2**.

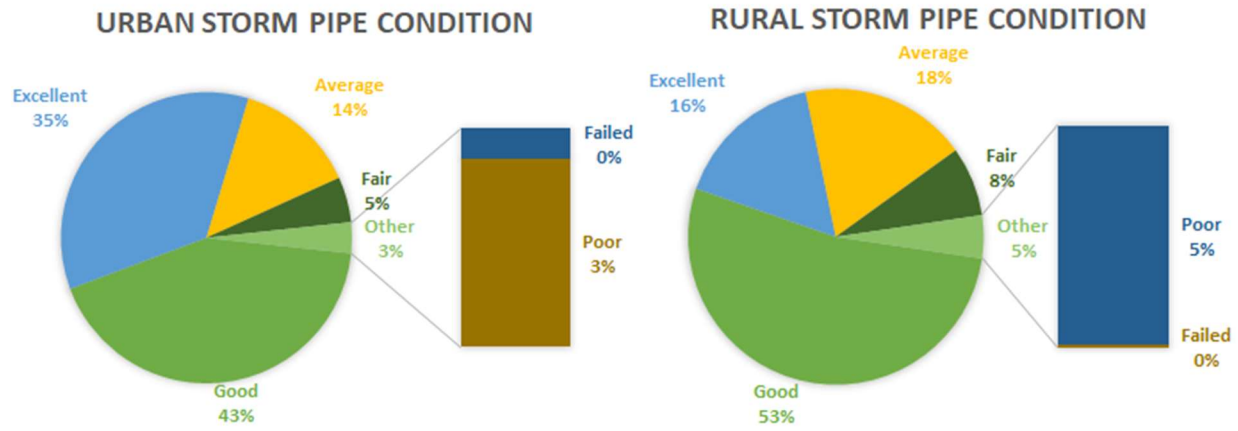

Figure 7-2: Condition of Storm Pipe (Urban Pipe and Rural Culverts)

7.1.4.2 STORM PUMPING STATION AND STORM BASIN ASSETS

The condition of the stormwater pumping station was assessed on a 1-5 Star rating in 2018 and found to be of equivalent condition OCI of 80, or Excellent.

The stormwater basins were incorporated into the stormwater system in 2018 and 2020. With the newness of the system, they are assumed to be in excellent condition.

7.1.4.3 CONDITION TARGETS

The Township has set stormwater condition targets for pipes, culverts, and pumping stations (no current targets set for basins). A summary of the current condition for both asset types and a comparison to the LoS condition targets is shown in **Table 7-7**.

Table 7-7: Stormwater Asset Conditions and Targets			
Asset Type	**Current Condition Rating**	**LoS Condition Target**	**Comparison to Target**
Storm Pipes	69	60	Higher than target
Storm Culverts	66	60	Higher than target
Pumping Station	80	60	Higher than target

It should be acknowledged that these current conditions can significantly change as more accurate condition assessment is captured.

The current condition of pipes and pumping station assets is such that they are exceeding the current LoS targets.

7.2 LEVELS OF SERVICE (LOS)

Levels of service (current and proposed), and performance measures are prescribed by O.Reg. 588/17 and defined by the Township. LoS information can be found in **Appendix B.1 LoS Levels of Service**.

7.3 LIFECYCLE ACTIVITIES

The following section describes the lifecycle activities that can be implemented within the asset management strategy for stormwater assets. The lifecycle activities include construction, maintenance, renewal, and decommissioning/disposal. The lifecycle activities are described for linear and vertical assets.

7.3.1 LINEAR STORMWATER ASSETS

7.3.1.1 CONSTRUCTION

Construction of new assets is recommended to be in line with growth, master plan, or other municipal strategies. The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines, local and conservation authority requirements. New construction of assets will occur where no previous stormwater servicing is available. The risk associated with new construction includes the high cost of brand-new assets, and capacity for treatment and outlet of the stormwater flows.

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and future projections.

7.3.1.2 MAINTENANCE

Maintenance activities are undertaken on the assets throughout their useful life to maintain their operating condition and performance. Maintenance works includes routine maintenance (flushing, cleaning), catch basin inspection and cleaning, and minor repairs to assets. There exists the risk that a maintenance activity may be implemented that does not adequately mitigate a performance or condition issue, and additional costs are then required for further repair or replacement. Assets are maintained through several preventative maintenance programs. Preventative maintenance programs for storm sewers includes:

- Catch basin inspection and cleaning
- CCTV for storm sewer pipe network

7.3.1.3 REPLACEMENT/ RENEWAL

Renewal of the storm sewer assets can include structural or non-structural lining. A lining can be used where the condition has deteriorated, however structurally the pipe segment is still sound. A lining can extend the useful life of an asset and improve performance. Risks associated with lining of a pipe include the improper installation of the pipe or continued deterioration of the original pipe such that the lining does not perform as expected.

7.3.1.4 OPERATING AND DECOMMISSIONING

Operating activities for the storm sewer assets include those activities that do not directly deal with the physical state of the pipe but work to extend the assets useful life. The operating activities can include non-infrastructure solutions (such as policies, planning documents), and monitoring/inspection of the assets. The inspection of storm sewer assets can be undertaken through a condition assessment program, recommended to be visual inspection through CCTV or zoom camera means. Usage of the zoom camera technology has the risk of insufficient visual detail to make appropriate activity decisions.

Decommissioning activities of the storm sewer assets includes abandonment or replacement of the asset at the end of its useful life. While typically assets are abandoned in place, the removal of the expended asset can provide additional space for new underground assets to be constructed.

7.3.2 STORMWATER PUMPING STATION

The lifecycle activities for the stormwater pumping station will generally include:

7.3.2.1 CONSTRUCTION

The start of an asset lifecycle is its construction. The asset should be constructed to adhere with the applicable standards and codes. The design of the facility should suit the purpose of its construction, including operating capacities and capabilities.

7.3.2.2 MAINTENANCE

Throughout the full lifecycle of an asset, the majority of expected lifecycle activities to be undertaken will be maintenance works. Maintenance activities can be used to improve the level of service of an asset (or component), or to maintain it. Activities that fall under the maintenance category can be varied by response type and scale of maintenance requirements. Activities can be required through routine maintenance works, response to poor condition or performance, or on an emergency basis. In general, the expected types of maintenance activities within the lifecycle of an asset include:

- **Preventative maintenance**
  - Maintenance activity is undertaken to prevent failure or poor performance of a building asset component. Preventative maintenance works can be undertaken according to a maintenance schedule. Manufacturer directives and condition assessments should assist in determining frequency of preventative maintenance activities.
- **Reactive maintenance**
  - Maintenance activity is undertaken in response to an issue or fault in the building or component systems, on an ad-hoc basis. Scale of reactive maintenance works will be variable depending on the system and type of failure or decrease in level of service.
- **Major maintenance (rehabilitation)**
  - Maintenance activity is undertaken in response to a component which is no longer able to provide adequate level of service. Major maintenance (rehabilitation) will be undertaken for one or more components of an asset. Major maintenance works can be preventative (in anticipation of end of service life of a component), or in response to a system failure.

Regular inspection is used as a maintenance activity, from which additional or upcoming lifecycle activities can be identified.

7.3.2.3 RENEWAL/ ENHANCEMENT

Renewal works can be used to expand on an existing facility, or to renovate to suit changes to services provided. Enhancement works can be similar and can be used to update an asset for modernization, to achieve compliance with updated codes and requirements. These works can include:

- Addition of new components to an existing asset
  - New components can be added to an existing asset with the existing asset largely unchanged.
- Updating of existing components
  - Updating of existing components can prolong the expected lifespan of an asset.

7.3.2.4 DECOMMISSIONING/DISPOSAL

Removal from service of an asset or component. Disposal can be through decommissioning or sale. Activities should comply with applicable health, safety, and environmental protocols.

7.3.3 STORM BASINS

The lifecycle activities for storm basin assets will be as follows:

7.3.3.1 CONSTRUCTION

The start of a stormwater pond asset lifecycle is its construction. The asset should be constructed to adhere with the applicable standards and codes. The design of the pond should suit the volume and purpose of its construction.

7.3.3.2 MAINTENANCE

The intention of the maintenance activities is to prolong the useful life of the asset and to maintain safety at the facility. Throughout the lifecycle of the pond asset, the majority of the expected lifecycle activities to be undertaken will be maintenance works. The main maintenance activities to take place will include:

- Assessment of the level of sedimentation on the bottom of the pond relative to the proper function of the facility
- Dredging and clearing of sediment from the pond bottom when required
- Vegetation maintenance, including grass cutting, removal of vegetation as required to allow for continued pond function and safety of the facility
- Maintenance of pond components including inlet and outlet structures, etc.

Perform vegetation maintenance as required.

7.3.3.3 RENEWAL/ ENHANCEMENT

Renewal works can be used to achieve compliance with updated codes and requirements, or to expand on an existing pond. Enhancement works can be similar and can be used to update an asset for modernization. These works can include:

- Addition of new components to an existing asset
    - New components (such as OGIs, etc.) can be added to an existing asset with the existing asset largely unchanged.
- Expansion of the pond facility while largely maintaining the existing footprint

7.3.3.4 DECOMMISSIONING/DISPOSAL

Removal from service of an asset or component. Pond site will be decommissioned, with any equipment or surplus material being disposed of. Activities should comply with applicable health, safety, and environmental protocols.

7.4 ASSET MANAGEMENT STRATEGY

7.4.1 LINEAR STORMWATER ASSETS

The asset management strategy for the linear stormwater assets in the Township will employ the lifecycle activities to maximize the useful life and economy of each asset.

The primary indicator used in the development of a lifecycle strategy is the condition of each asset, however the strategy should also consider other factors, such as:

- Importance of the asset
- Asset risk score
- Condition of adjacent sections
- Replacement requirements for adjacent infrastructure (watermain, storm or roadworks)
- Upstream dependency and expansion/ growth requirements.

As the Township storm assets continue to age and the network is further developed, these factors will continue to change, and each have an impact on the lifecycle of an asset. Consideration of these factors should be given when devising capital project outlooks and budgeting and updating of the asset management plan.

The assets will deteriorate on a non-linear basis, and the various lifecycle activities can be implemented at varying stages within an asset's deterioration. **Figure 7-3** provides a visualization of the theoretical deterioration curve for an asset, and the opportunity windows to conduct lifecycle activities within the expected useful life of an asset.

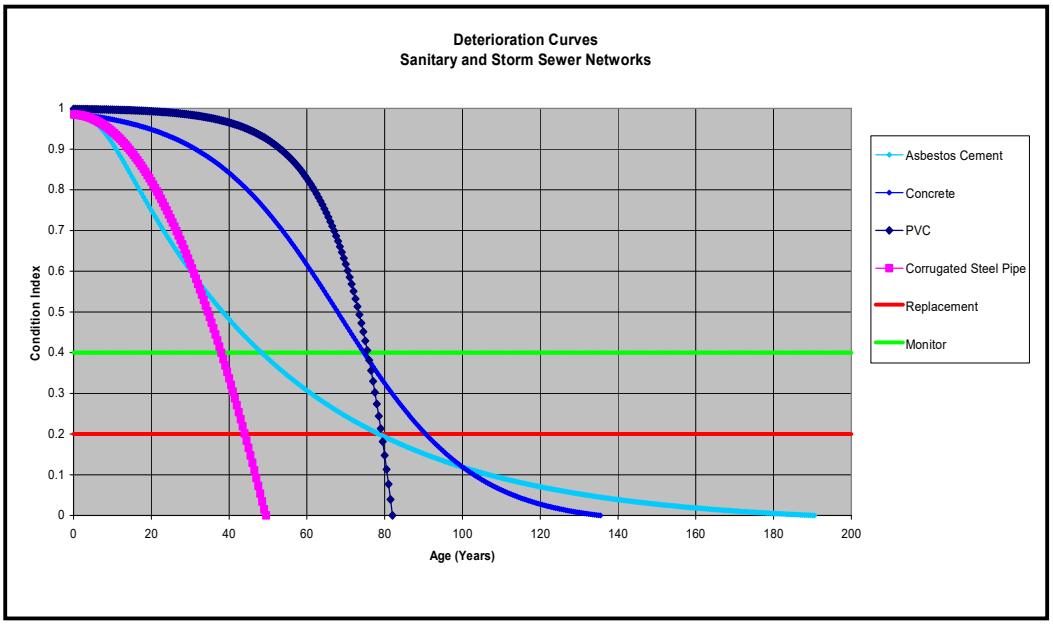

Figure 7-3: Theoretical Deterioration Curves for Sewers

Condition indices were derived from the results of the condition assessment processes described previously. The generation of indices, using consistent and repeatable techniques, is essential to be able to compare assets and identify needs in all linear infrastructure networks.

Where condition assessment is not available or is no longer current, the condition indices can be estimated using deterioration curves within the Townships asset management program (current Cartegraph OMS). The deterioration will utilize the most recent known condition as a starting point and continue to deteriorate the assets for the elapsed time since the most recent condition assessment.

Once all assets have been assigned a condition rating, it becomes possible to determine, based on knowledge of the assets and technical expertise, what average condition index represents the minimal acceptable level of condition that relates to the acceptable Level of Service provided to residents. Any components of infrastructure rated below that minimal rating should be rectified to improve the level of service. That rating is called the "Threshold of Acceptability" of an asset.

Accordingly, the Township should maintain its condition assessment program for the storm sewers. The recommendation is to continue use of visual inspection facilitated by CCTV or Zoom camera inspection. The Township's goal is to assess the sewers via visual inspection every 15 years. If the condition starts to change more rapidly than expected, the frequency or priority of CCTV can be adjusted accordingly.

Throughout the lifecycle of the assets, the Township conducts flushing and cleaning works. These occur on a predefined schedule developed by the Township.

When the condition or performance of the asset has degraded such that, an intervention is required, maintenance can be reviewed as the first opportunity to extend the useful life. This can include flushing and cleaning works, which occur on a predefined schedule developed by the Township (these activities can occur throughout the lifecycle of the assets). Maintenance works can also include localized repair work.

When the condition of the asset has degraded such that maintenance is no longer an adequate activity to address deterioration, the segment can be considered for relining. Structural relining is the preference of the Township, and is an option only where condition or performance dictates, including consideration of the condition of service laterals. Pipe relining will only occur once per lifecycle of an asset.

Where performance and condition have deteriorated to the point where maintenance and relining are not adequate solutions, the asset should be considered for reconstruction. The Township should follow best practices and local design guidelines when designing the reconstruction works. Assets at the end of their useful life should be abandoned in place or removed.

A summary of pipe condition and associated lifecycle activity is provided in **Table 7-8**. Note that condition assessment should be undertaken on a routine basis throughout the lifecycle of the asset, and other factors should be considered when selecting a lifecycle activity.

Table 7-8: Storm Pipe Lifecycle Activities and Condition Ranges

Condition Range	Condition Description	Lifecycle Activity Category	Lifecycle Activity
100-60	Excellent to Good	Maintenance *maintenance works can be done beyond the 100-60 condition range as necessary	Maintenance works (cleaning, flushing) Manhole repairs Small pipe section repairs
60-35	Good to Fair	Rehabilitation	Localized repairs Structural relining (if lateral condition is sufficient)
35-0	Poor to Very Poor	Reconstruction	Pipe replacement or abandonment

Current best practices suggest that that reconstruction and new construction works on the storm pipe (urban) assets will be done using PVC material for pipes that are 400 mm in diameter or less, and concrete material for sizes larger than 400 mm diameter.

When constructing storm culverts (rural) HDPE pipe is used in almost all cases except:

1) If pipe being replaced will have less than 300mm cover
2) If pipe being replaced in greater than 900mm dia.

In determining prioritization of the works to the assets, the Township has developed some direction regarding criticality of the assets. By default, sewer pipes are assumed to have the same criticality, unless they meet the following criteria:

- Storm pipes located in high service areas, are considered more critical than 'rural' pipes. The criticality factor 1.2 included within the OMS is increased by 20% of default.

7.4.1.1 SCENARIO ANALYSIS

7.4.1.1.1 STORM PIPE ASSETS

To understand the needs and projected works on the stormwater assets within a 10-year outlook, replacement activities were reviewed under varying budget scenarios to understand the impact on overall network condition. The budgets analyzed include:

1. **Unlimited** Budget – To determine backlog of works
2. **Maintain** 70 OCI – Budget required to maintain 70 overall network OCI at the end of the timeframe
3. **Target** 60 OCI– Budget required to achieve a network 60 OCI at the end of the timeframe
4. **Actual** Budget – changes in OCI using a $ 2,500,000 total budget across the timeframe (best value)

A ten-year projection scenario was run in Cartegraph for each of the scenarios noted above. The results of the scenarios provided works to be conducted on the linear storm pipe assets over the timeframe according to the scenario budget and the goal of the scenario (target OCI, tec.). The average OCI at the start of all reviewed scenarios is 70. A summary of the analysis is outlined in **Table 7-9** below. The existing LoS target to compare with results is 70.

Table 7-9: Scenario Comparison – Storm Pipe

	Budget Scenario	Scenario Type	Average Annual Investment Over Timeframe	Total Investment Over Timeframe	Assets Included	Average OCI (End of Timeframe)	Difference from LoS OCI Target
1	Unlimited Budget	Unlimited	$2,502,589	$25,025,886	552	77	+7
2	Maintain 70 OCI	OCI Target	$962,279	$9,622,789	155	70	-
3	Target 60 OCI	OCI Target	$ -	$ -	--	60	+10
4	Actual Budget	Budget Limitation	$248,167	$2,481,671	130	65	-5

The **unlimited** scenario can be used as an indicator of existing backlog of works on the storm sewer assets. The initial year of the scenario indicated over $14.2M in outstanding needs on the storm sewers. At the end of the unlimited scenario, the average OCI is 77, an increase of just 7 points over the 10-year timeframe.

Scenario 2 considered the funding required to maintain the current OCI target of 70 across the storm pipe network. As the beginning OCI is 70, this scenario identified works to maintain that value across the timeframe. It included 155 assets, and the annual average cost was just under one million dollars. The expenditure and OCI rating to maintain an OCI target of 70 across the timeframe is shown in **Figure 7-4** below.

Figure 7-4: Scenario 2 (Maintain 70 OCI) Storm Pipe Network Analysis

Scenario 3 considered the funding requirement to achieve an OCI target of 60 by the end of the 10-year timeframe. As the starting OCI is higher than the target of 60, there are no expenditures identified throughout this scenario.

Without expenditures noted within the 10-year timeframe, an additional scenario was run to project longer-term needs on the network, to identify upcoming points in time where a significantly larger investment will be required. The target 60 OCI was projected for 40 years with an unlimited budget. This scenario can be a useful planning tool when the current needs (backlog and annual investment) are low. A summary of the result is shown in **Figure 7-5**.

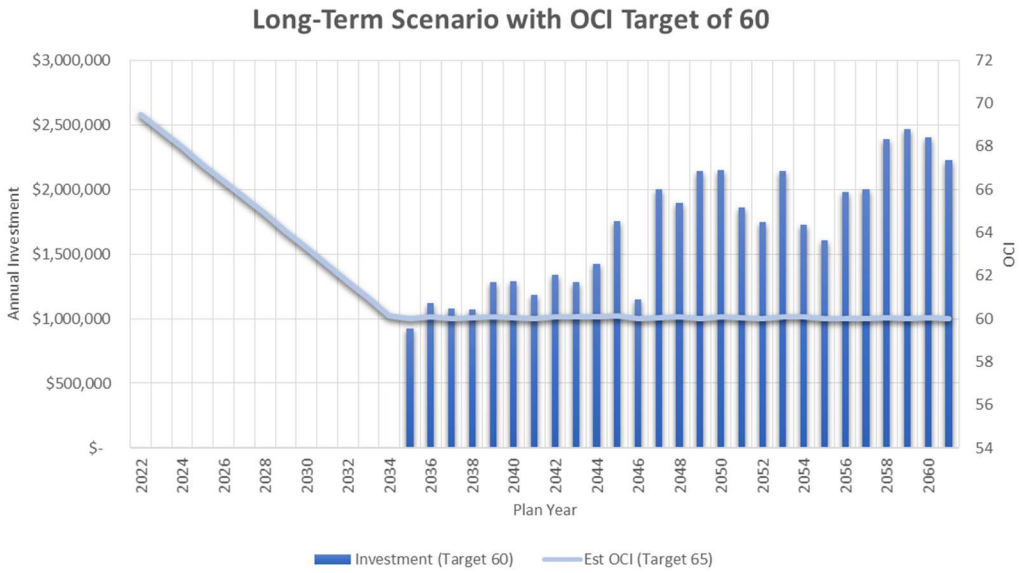

Figure 7-5: "What if" Long-term Scenario with OCI Target of 60 – Storm Pipe

The figure shows that because the starting network OCI is above the target 60, there are no immediate expenditures, and the network is allowed to deteriorate. Once the network deteriorates to the target there are significant annual expenditures, in the range of $1M to just below $2.5M annually. If the Township chooses to 'do nothing' in the upcoming 10+ years, they should allocate funding into reserves, and undertake detailed condition assessment and prioritization in anticipation of the significant expenditure identified for the last 30 years of the scenario.

With the expenditure for Scenario 3 being null across the 10-year timeframe, comparison of these results to the expenditure required to maintain an OCI of 70, highlights the significant difference in annual expenditure with an adjustment of the target OCI. The cost to maintain an OCI of 70 is significantly greater than the cost expected for a target OCI of 60.

Scenario 4 reviewed the impact on the OCI by utilizing the existing budget as the investment limitation, which was $2,500,000 across the analyzed timeframe (or an average of $250,000 per year). Using almost the entirety of this budget over the 10 years, the OCI at the end of the timeframe was reduced to 65. This is a decrease from the starting OCI but remains over LoS targeted OCI 60. A summary of the investment and OCI values for Scenario 4 is shown in **Figure 7-6** below**.**

Scenario 4 is the most likely for consideration at the Township, as it achieves LoS at the current annual budget, while reducing costly expenditures in the future.

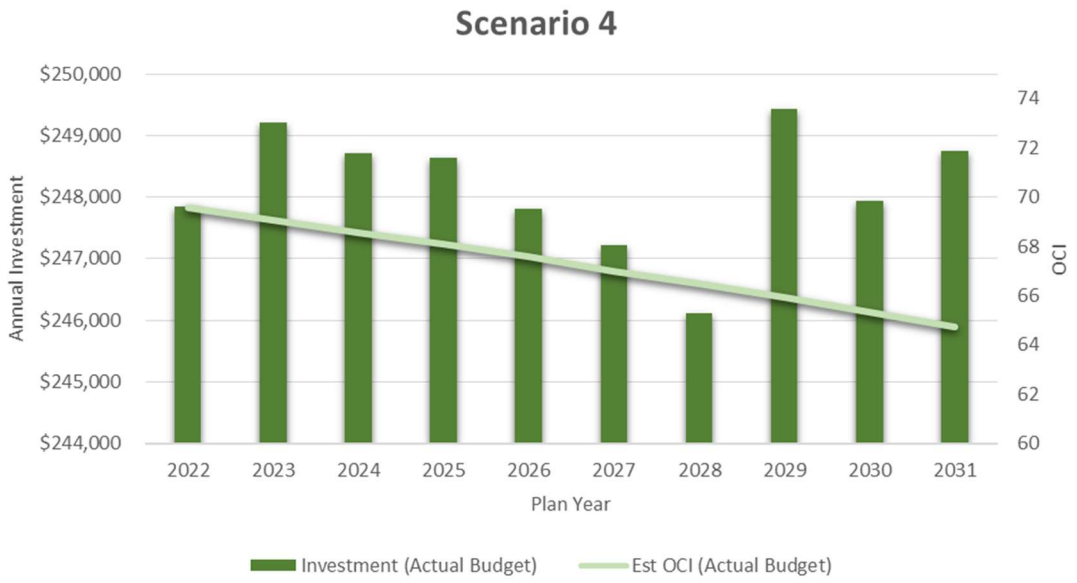

Figure 7-6: Scenario 4 Actual Budget – Storm Pipe Network Analysis

The total investments spent over the full timeframe in Scenarios 2, 3 and 4 are less than the current backlog of works identified within Scenario 1. At the end of these two scenarios, there will still be outstanding backlog of works to be done on the assets, which runs the risk of deteriorating to the point of failure. In addition, more assets will have deteriorated to the point of intervention during the analyzed timeframe. To proceed with either of these scenarios, the Township will need to review the stormwater sewer strategy and consider the following strategy adjustments to address the needs of the network:

- Focus on reconstruction of assets and forego relining activities except on critical assets
- Adjust the thresholds at which the varying lifecycle activities are triggered, perhaps allowing assets to deteriorate to a poorer condition before they are considered for relining or reconstruction (being conscious of the minimum condition required to be eligible for relining)

Scenario 3 provides the most affordable option to the Township, however, carries the highest risk of asset failure due to the low level of investment and reduction of the OCI below the target level. Scenario 2, although still shy of the unlimited budget level of investment, allow the Township to address a more significant portion of the backlog.

It is the recommendation that the current strategy and spending of **Scenario 4 – Actual Budget** continue as a viable option to maintain Levels of Service. Strategies will continue to be reviewed as we better understand the performance of our Storm Pipe assets.

7.4.1.1.2 STORM CULVERTS

To understand the needs and projected works on the storm culvert assets within a 10-year outlook, replacement activities were reviewed under varying budget values to understand the impact on overall asset condition. The budgets analyzed include:

1. **Unlimited** Budget – To determine backlog of works
2. **Target** 60 OCI – Budget required to achieve a network 60 OCI
3. **Actual** Budget – changes in OCI using a $1,000,000 total budget across the timeframe (best value)

A 10-year projection scenario was run in Cartegraph for each of the scenarios noted above. The results of the scenarios provided works to be conducted on the linear storm sewer assets over the timeframe according to the scenario budget and the goal of the scenario (target OCI, etc.). The average OCI at the start of all reviewed scenarios is 67. A summary of the analysis is outlined in **Table 7-10** below.

Table 7-10: Scenario Comparison - Storm Culvert

	Budget Scenario	Scenario Type	Average Annual Investment Over Timeframe	Total Investment over Timeframe	Assets Included	Average OCI (End of Timeframe)	Difference from LoS OCI Target
1	Unlimited Budget	Unlimited	$393,627	$3,936,269	186	68	+8
2	Target 60 OCI	OCI Target	$188,904	$1,889,040	85	60	-
3	Actual Budget	Budget Limitation	$94,402	$944,020	60	57	-3

The **unlimited** scenario can be used as an indicator of existing backlog of works on the storm sewer assets. The initial year of the scenario indicated $1,629,500 in outstanding needs on the storm sewers. At the end of the unlimited scenario, the average OCI is 68, an increase of just 1 point over the 10-year timeframe.

Scenario 2 considered the funding required to meet the current OCI target of 60 across the storm culverts. As the current OCI is higher than the target (currently 67), this scenario allows the OCI to reduce to the maintenance level. The first four years of the scenario have zero expenditures (wherein the average OCI decreases to approximately 60), and investment occurs in years 5-10, with an average of $315,000. The investment scenario is shown in **Figure 7-7** below. At a total expenditure of under $2M, this scenario includes 85 assets.

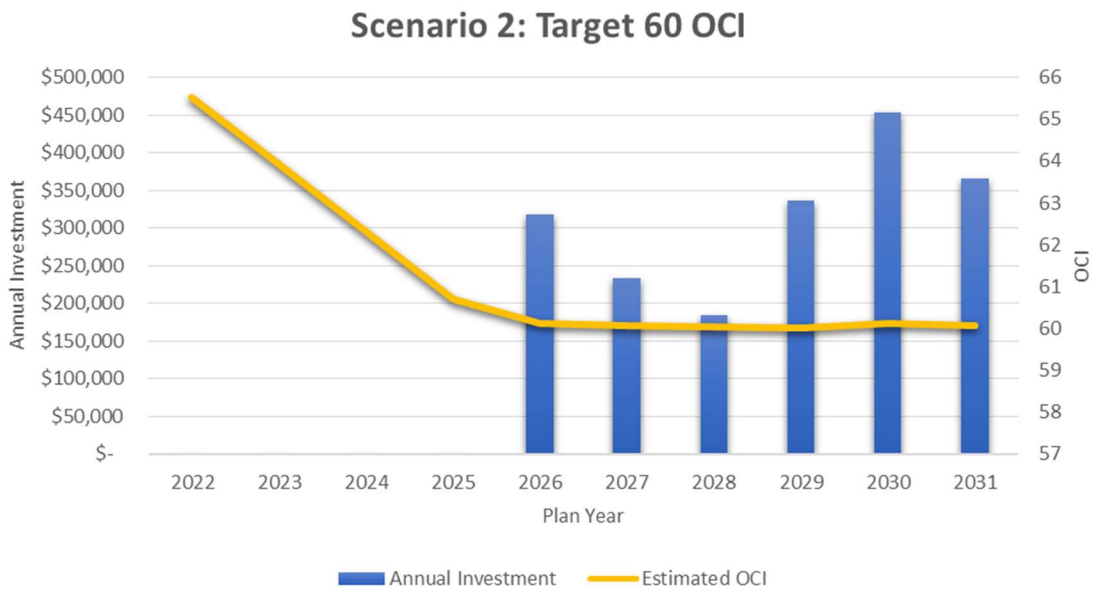

Figure 7-7: Scenario 2: Target 60 OCI - Storm Culvert Network Analysis

The third scenario reviewed the impact on the OCI by utilizing the existing budget limitation, which was $1,000,000 across the analyzed timeframe (or an average of $100,000 per year). Using almost the entirety of this budget over the 10 years, the OCI at the end of the timeframe was reduced to 57. This is a decrease from the current value and is also less than the targeted OCI from the Township LoS definitions. Because this scenario is on an OCI-target basis, the backlog is not addressed in years 1-4 due to the OCI being higher than the target. The Township can consider adjusting the annual investment to move some high-risk asset work to years 1-4.

The total investment over the 10-year timeframe in Scenario 2 is sufficient to address the backlog identified within Scenario 1, however the total investment in Scenario 3 is less than the backlog suggesting that at this investment level, at the end of the analyzed timeframe there may be some assets which may degrade to or near to the point of failure.

It is the recommendation that the current strategy and spending of **Scenario 3 – Actual Budget** continue as a viable option to maintain Levels of Service. Strategies will continue to be reviewed as we better understand the performance of our Storm Culvert assets.

7.4.2 STORMWATER PUMPING STATION & STORM BASIN ASSETS

The asset management strategy for stormwater vertical assets (pumping station and basins) seeks to maximize the useful life and economy of each asset, using the lifecycle activities.

The primary drivers of lifecycle activities for these assets are the condition and service delivery requirements. The Township sewer vertical assets are complex, the componentry for which are

expected to have differing rates of deterioration and expected useful lives. As such, lifecycle activities will be required to be implemented at varied frequency and timelines.

The timing and frequency of lifecycle activities can be established according to the condition and performance of the components. This can be determined theoretically using the expected useful life and age of the assets, or through condition assessment/ inspection of the assets and components. An inspection or assessment can be undertaken at regular intervals for understanding the actual condition, recommended to be at a minimum frequency of every five years, or according to the preferences and schedule established by the Township. Assets with high risk or poor condition/performance components should be prioritized in the condition assessment program.

Routine maintenance schedules are assumed to be in place currently and are recommended to continue assuming that they are currently providing sufficient level of maintenance.

Management of vertical assets should also include climate change considerations in new construction, maintenance, or renewal lifecycle activities. Assessment should be undertaken to understand vulnerability of the stormwater assets to a changing climate, considering increased stormwater demand and utilization of the assets, which will inform lifecycle activity requirements, and potential changes to the way lifecycle activities are undertaken.

Works should also be undertaken as required to maintain the treatment efficiency and capacity to meet regulations and user requirements.

7.4.2.1 SCENARIO ANALYSIS

The pumping station was constructed in 1972 and has an anticipated average useful life of 50 years. Accordingly, the initial approximate date of replacement for this asset would have been 2022. However, in 2019 an assessment was undertaken, and the station was found to be in very good condition (ranking of 4 out of 5). Assuming from this point the station will retain its useful life with LC maintenance and rehab. The Township should expect to reconstruct the station in 2059. Within the 10-year timeframe of this plan, the Township should not require significant capital expenditure.

Given the good condition and relative newness of the Storm Basin assets, it is not expected that capital expenditure will be required within a 10-year timeframe to maintain these assets. Componentry (inlet structures, outlet structures, etc.) will require renewal during the lifecycle of the stormwater pond, however these are anticipated to be completed under maintenance budgets as they are not capital assets. The pond will not need replacement as the pond itself is a passive asset.

7.5 FINANCIAL STRATEGY

The financial strategy for storm sewer assets considers the projected funding requirements identified through analysis and existing funding mechanisms to identify any funding surplus or shortfalls. The Township can utilize these findings to strategize funding and asset management priorities.

Water and sewer plans were initiated in 2007, in guidance with the best practices on integrated asset management published as part to the InfraGuide. In addition, the deliverables had to satisfy the Bill 175 "Sustainable Water and Sewerage System Act" requirements to the extent known at that time.

7.5.1 SOURCES OF FUNDING

Funding comes from a variety of sources including:

- Tax levy
- User Fees
- Debt Financing
- 3rd Party Contribution
- Reserves

7.5.2 FUNDING STRATEGY

The Township currently has one capital and three operational funding budgets through which the stormwater linear assets are maintained. The Township does not have a consistent urban storm pipe annual budget for capital works. A summary of the operational budgets and their purpose is summarized in **Table 7-11**below.

Table 7-11: Stormwater Capital and Operating Budgets

Budget Name	Annual Budget	Lifecycle Activities	Asset	Notes
Capital	$100,000	Replacements	Storm Culverts	---
Operations	$100,000	Repairs and maintenance	Storm Culverts	---
Operations	$150,000	Repairs, maintenance, and cleaning	Storm Pipe – Urban	$28,000 contributed annually to reserve for capital storm pipe projects
Operations	$10,000	Repairs and maintenance	Storm Collection Facilities	---

7.5.2.1 STORM PIPES

To address works for the storm pipes, the Township maintains an operations budget of $150,000 for repairs, maintenance, and cleaning. The Township does not currently have a recurring annual budget associated with capital works (reconstruction, new construction) of storm pipe assets. For modelling purposes, an annual budget level of $250,000 was utilized, based on previous storm budgets to determine the annual expenditure and impact on average OCI.

Based on the analysis in Cartegraph, to maintain an OCI target of 60, the Township does not require any investment over the 10-year timeframe. Although investment is not required under this scenario to maintain the target, it is recommended that the Township continue to utilize the modelling and condition assessment to track, prioritize and address any required interventions on the storm pipes during the timeframe.

As suggested in the longer-term scenario, beginning in 2035 the Township will incur significant costs on the storm pipes on an annual basis. During this timeframe of low investment requirements, the Township could allocate funding to reserves in preparation for the upcoming investment requirements.

7.5.2.2 STORM CULVERTS

The Township budgets to address storm culverts includes a capital and an operations budget, both with an annual value of $100,000. The capital budget was recently decreased to $100,000 from $200,000.

Based on Cartegraph analysis, by continuing to target an average OCI of 60 for the culverts, the Township will require:

- $188,904 annually for capital works
- $1,889,040 over a ten-year timeframe.

With the current allocation of $100,000 annually for culvert assets, this leaves a funding gap of just under $90,000 annually, or $889,040 over the ten-year timeframe.

To address this funding gap, the Township can consider:

- Continue a condition assessment program for the culvert assets to further refine scenario projections based on actual conditions instead of theoretical
- Utilize third-party funding sources such as grants or government funding to increase available budget
- The Township budget allocation for storm culverts was recently decreased to $100,000 from $200,000. Revert budget value to retain the $200,000 level to alleviate funding gap.

7.5.2.3 STORM PUMPING STATION AND STORM BASIN ASSETS

To address works for the storm facilities (pumping station and storm basins), the Township maintains an operations budget of $10,000 for repairs, maintenance, and cleaning. The Township does not currently have a recurring annual budget associated with capital works (reconstruction, new construction) of storm pumping station and storm basin assets. Within the 10-year timeframe of this plan, the Township should not require significant capital expenditure.

Maintenance works, replacements, and allocation into reserves for the pumping station capital works should be identified as part of condition assessment at the pumping station.

8 WASTEWATER ASSETS

8.1 STATE OF INFRASTRUCTURE

The wastewater network includes collection and treatment assets, both linear and vertical. The following table describes the current state of assets.

Category	Class	Condition	Total Length / Count	% Rated	Current Value	Average Age	Avg Years to Re hab/ Replace
Sewer Collection	Force Main	Excellent 	34.51 km	100.00 (BM: 100.00)	$53,623,849.00	19	37
Sewer Collection	Gravity Main	Acceptable 	89.55 km	100.00 (BM: 100.00)	$134,523,249.50	37	29
Sewer Collection	Pump Stations	Excellent 	30	13.33 (BM: 13.33)	$6,880,000.00	21	

Figure 8-1: Excerpt from Infrastructure Report Card (2021) for Wastewater Assets

Current Infrastructure Report Card can be found in **Appendix B.2**.

Additional description of the information presented in the above table are detailed below.

8.1.1 ASSET INVENTORY

8.1.1.1 SANITARY SEWER MAIN ASSETS

The Township owns and operates a total of 124 km of linear sewer main. The pipe network ranges in size from 150 to 600 mm in diameter. The summary of sewer lengths by material type are shown in **Table 8-1**.

Table 8-1: Sanitary Sewer Lengths by Material

Sewer Material	Length (m)
PVC	52,042.89
Asbestos Cement	43,483.93
HDPE	13,642.59
Concrete	9,058.34
PE	3,433.94
Ductile Iron	2,944.85

8.1.1.2 WASTEWATER FACILITIES

The wastewater collection system includes the following facilities:

- 5 main pump stations
- 25 collection pumping stations
    - A new low volume pumping station serving two properties, was commissioned in 2021 and has been included within the inventory in this report.

The wastewater treatment system includes the following facilities:

- Courtright Regional Wastewater Treatment Plant
- Sombra, Brigden and Port Lambton lagoons

The Regional Wastewater Treatment Plant and the Corunna Main PS and Courtright Main PS are currently under operation of Jacobs. It is planned that the Municipality will be taking over these operations in June 2022.

8.1.2 EXPECTED USEFUL LIFE

8.1.2.1 SANITARY SEWER MAIN ASSETS

The expected useful life of the assets is based on the material type and is consistent with TCA data. The expected useful life represents a typical value, and actual useful life of individual assets may vary. Assets will deteriorate on a non-linear basis. For all sanitary sewer pipe materials, the Township expects a useful life of 90 years.

8.1.2.2 WASTEWATER FACILITIES

The componentry of the vertical assets will have individual expected useful lives according to the type of component. Detailed assessment of the vertical assets can identify the individual useful life values. An overall useful life can be estimated for the asset as a whole, by averaging the values from the components.

As part of Tangible Capital Asset (TCA) reporting, the Township has expected useful life for the vertical wastewater assets, as follows:

- Lagoons
    - Lagoon process components: 30 years
    - Fencing: 25 years
    - Buildings: 30 years
    - Lagoons: 50 years
- WWTP: 50 years
- Pumping Stations: 50 years
    - Chamber and valve chamber: 75 years
    - Pumps: 30 years

8.1.3 ASSET VALUE

8.1.3.1 SANITARY SEWER MAIN ASSETS

The asset value is determined based on the current network size and current unit replacement costs. Unit replacement costs for the sanitary main network were estimated using recent tender information from Township projects. The unit prices were developed assuming that all new sanitary linear assets will be constructed of PVC or concrete, dependent on the diameter. A summary of the unit costs is included in **Table 8-2** below.

Table 8-2: Sanitary Sewer Main Unit Replacement Costs (2021)

Asset Size	Unit Cost ($/m)	New pipe material
Up to (and including) 250 mm diameter	$1,450	PVC
251-400 mm diameter	$1,600	PVC
401-600 mm diameter	$1,900	Concrete
Over 600 mm diameter	$2,000	Concrete

The unit replacement costs are on a per meter basis, and include sewer pipe material costs, as well as material to complete trench and restore surface. The cost is further inflated by 10% and 15% to account for engineering and contingency costs.

8.1.3.2 WASTEWATER FACILITIES

An estimation of the value of the wastewater vertical assets (including wastewater treatment plant, lagoons and pumping stations) was done in 2012 by Finance as part of the revised Environmental Sewage Infrastructure Buildings.

For estimation of the asset value in 2021, the prior estimation was inflated by 3% annually. This value was further reviewed by the Township, and a rounded estimated unit price per asset was selected based on the inflated value, and recent tender information.

Most pumping stations were estimated at $200,000, with increasing estimated value up to $750,000 according to pump station size and componentry.

The replacement strategy for lagoons is to replace with WWTPs, which is reflected in the replacement costs.

The value of the wastewater assets indicates the cost that would be required if all existing assets were to be replaced in present day dollars. A comparison of current and past replacement values is shown in **Table 8-3** below. Variation in current assessment value is attributed to changes in the network and valuation methods.

Table 8-3: Wastewater Asset Values				
Infrastructure Network	**Length (km) / Count**	**Estimated Replacement Cost 2021**	**Estimated Replacement Cost 2013**	**Estimated Replacement Cost 2007**
Sanitary Sewer Main	118	$188,147,089	$42,427,492	$30,873,000
WWTP	1	$30,000,000	$28,417,806	---
Lagoons	3	$30,000,000		---
Pumping Stations	30	$6,880,000		---

8.1.3.3 OTHER WASTEWATER ASSETS

In addition to the major assets previously listed, the wastewater network includes the following assets and their estimated replacement costs are shown in **Table 8-4**.

Table 8-4: Other Wastewater Assets		
Asset Type	**Quantity**	**Estimated Replacement Cost (2021)**
Power Sewers	4	$120,000
Standby Generators	5	$300,000
Sewer Pumps	77	$1,640,000
SCADA Control System	1	$4,783,976

Note: While Critical, these Other Assets are included for information only and are not analyzed within this asset management plan. These assets will continue to be maintained, operated, and renewed as required. Consideration will be given for inclusion in future iterations of this AMP.

8.1.4 ASSET CONDITION

8.1.4.1 SANITARY SEWER MAIN ASSETS

The actual inspection condition for sanitary sewer mains can be established through visual inspection (commonly CCTV or other camera inspection) and estimated using theoretical deterioration curves based on asset attributes. The Township typically uses visual inspection for gravity mains, and theoretical deterioration (using age and construction material) for force mains.

The Township continues to undertake CCTV assessment including manhole condition rating and inspection. This work is refreshed on a regular schedule.

Existing sewer conditions are updated with any sewer inspection CCTV work that is completed using the SCT method based on PACP.

The following current SCT condition assessment based on the PACP standard is carried out on current CCTV inspections and recorded accordingly. There is a current backlog of condition capture in OMS due to technological change. This is being addressed, but once captured could significantly change our network condition.

This process is essential to compare infrastructure assets on the same basis and predict performance in the future.

Table 8-5: Wastewater Pipe Condition Indices

PACP Index	PACP Rating	Index	Value	SCT OCI Rating	Description of Defects	Description of Probability	Response / Priority
1	Excellent	100	5	Excellent	Minor defects	Failure unlikely in foreseeable future	None
		90	4.5				
		80	4				
2	Acceptable	70	3.5	Good	Defects that have not begun to deteriorate	Unlikely to fail for at least 20 years	Low
		60	3				
3	Fair	50	2.5	Average	Moderate defects that will continue to deteriorate	May fall in 10 to 20 years	Moderate
		40	2				
4	Poor	30	1.5	Fair	Severe defects that will cause failure within the foreseeable future	Will probably fall in 5 to 10 years	High
		20	1				
5	Failed	10	0.5	Poor	Defects requiring immediate attention	Has failed or will likely fail in next 5 years	Emergency
		0	0	Failed	Asset failure	Failed to provide service	Emergency

Further deterioration of the assets since the time of assessment is modelled within the Cartegraph OMS system. A summary of the current estimated SCT condition of the sewer main network by length and type is shown in **Figure 8-2**.

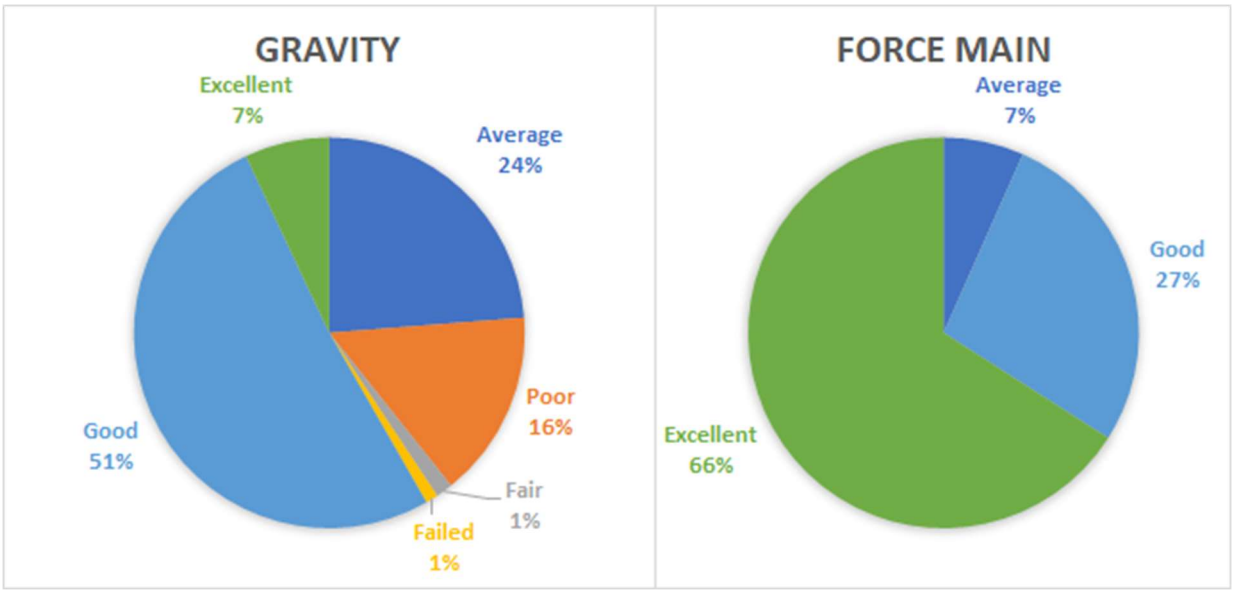

Figure 8-2: Gravity and Force main Sewer Conditions

8.1.4.2 WASTEWATER FACILITIES

Condition assessment for facility assets can be established through visual inspection or estimated using the age and theoretical deterioration of the asset.

The wastewater facilities are complex assets, containing multiple components for proper function of the asset including building, processes, treatment components, etc. The WWTP componentry was evaluated as part of an approved Five-Year Wastewater CIP prepared for the Township of St. Clair by CH2M HILL Canada Limited, dated January 10, 2018.

An additional detailed condition assessment was carried out in 2018 for all pump stations. (**Table 8-6** below) This assessment included a privately owned facility under maintenance contract with the Municipality.

SWF-018	ISLAND VIEW MOORINGS PS	Collection PS	Inspected 2018	3	Good

The Regional WWTP was newly constructed in 2012 and assumed in Excellent Condition.

Lagoons do not have an overall condition assessment. Lagoons are assumed to be in Good Condition based on repair and maintenance history. The 2018 PS assessment also included the Alum Station components which were found to be in Excellent condition.

A summary of the Sewer Facilities and their Condition is in **Table 8-6** below.

Table 8-6: Condition Information for Wastewater Facilities

Sewer Facility\ID	Name	Type	Condition Source	Overall Score	Overall SCT Condition Rating
SWF-001	CLAY CREEK PS	Collection PS	Inspected 2018	3	Good
SWF-002	WHITE LINE PS	Collection PS	Inspected 2018	3	Good
SWF-003	CUNDICK PARK PS	Collection PS	Inspected 2018	3	Good
SWF-004	SOMBRA MAIN PS	Main PS	Inspected 2018	5	Excellent
SWF-005	REGAN PARK PS	Collection PS	Inspected 2018	4	Excellent
SWF-007	HOLT LINE PS	Collection PS	Inspected 2018	3	Good
SWF-008	LAMBTON BAPTIST CHURCH PS	Collection PS	Inspected 2018	3	Good
SWF-009	LEELAND GARDENS PS	Collection PS	Inspected 2018	4	Excellent
SWF-010	CONCESSION 8 NORTH PS	Collection PS	Inspected 2018	3	Good
SWF-011	CONCESSION 8 SOUTH PS	Collection PS	Inspected 2018	3	Good
SWF-012	QUEEN STREET PS	Collection PS	Inspected 2018	2	Average
SWF-013	PORT LAMBTON MAIN PS	Main PS	Inspected 2018	4	Excellent
SWF-014	PORT LAMBTON STORM PS	Storm PS	Inspected 2018	4	Excellent
SWF-016	BRANDER PARK PS	Collection PS	Inspected 2018	3	Good
SWF-017	RIVERSIDE DRIVE PS	Collection PS	Inspected 2018	3	Good
SWF-019	MAPLEWOOD SUBDIVISION PS	Collection PS	Inspected 2018	5	Excellent
SWF-020	INDIAN ROAD PS	Collection PS	Inspected 2018	4	Excellent
SWF-021	BERESFORD STREET PS	Collection PS	Inspected 2018	4	Excellent
SWF-022	TOM STREET PS	Collection PS	Inspected 2018	4	Excellent
SWF-024	INDUSTRIAL PARK PS	Collection PS	Inspected 2018	5	Excellent
SWF-025	BRIGDEN MAIN PS	Main PS	Inspected 2018	3	Good
SWF-026	FROG POINT SOUTH PS	Collection PS	Inspected 2018	3	Good
SWF-027	FROG POINT NORTH PS	Collection PS	Inspected 2018	3	Good
SWF-028	CLAIRWOOD PS	Collection PS	Inspected 2018	4	Excellent
SWF-029	WILKESPORT PS	Collection PS	Inspected 2018	4	Excellent
SWF-030	CURRAN AVE PS	Collection PS	Inspected 2018	4	Excellent
SWF-031	CHURCH STREET PS	Collection PS	Inspected 2018	4	Excellent
SWF-033	CORUNNA MAIN PS	Main PS	*Assumed 2021*		*Excellent*
SWF-034	COURTRIGHT MAIN PS	Main PS	*Assumed 2021*		*Excellent*
SWF-035	ST. CLAIR HEIGHTS PS	Collection PS	*Assumed 2021*		*Excellent*
SWF-036	LINCOLN AVE PS	Collection PS	*Assumed 2021*		*Excellent*
SWF-101	BRIGDEN LAGOON	Lagoon	*Assumed 2021*		Good
SWF-102	PORT LAMBTON LAGOON	Lagoon	*Assumed 2021*		Good
SWF-103	SOMBRA LAGOON	Lagoon	*Assumed 2021*		Good
SWF-106	Courtright REGIONAL WWTP	WWTP	*Assumed 2021*		*Excellent*

8.1.4.3 CONDITION TARGETS

The Township has set wastewater asset condition targets for mains, and pumping stations, however no current target is set for the complex wastewater treatment facilities. A summary of the current condition for the asset types and a comparison to the LoS condition targets is shown in **Table 8-7**.

Table 8-7: Wastewater Main and Pumping Station Condition Targets

Asset Type	Current Condition SCT OCI	LoS Condition Target	Comparison to Target
Sewer Mains	61	60	Higher than target
Pumping Stations	80 (2019)	70	Higher than target

The current estimated condition of Sewer Main, and Pumping Stations are such that they are exceeding the current LoS targets.

8.2 LEVELS OF SERVICE (LOS)

Levels of service (current and proposed), and performance measures are prescribed by O.Reg. 588/17 and defined by the Township. LoS information can be found in **Appendix B.1 LoS Levels of Service**.

8.3 LIFECYCLE ACTIVITIES

The following section describes the lifecycle activities that can be implemented within the asset management strategy for wastewater linear assets. The lifecycle activities include construction, maintenance, renewal, and decommissioning/disposal.

In the lifecycle of a sanitary sewer pipe asset, there are multiple activities that can be taken, depending on the asset attributes. The expected lifecycle activities to be used on the Township assets are as follows:

8.3.1 SANITARY SEWER MAIN ASSETS

8.3.1.1 CONSTRUCTION

Construction of new assets is to be in line with recommendations made through of growth, master plan, or other municipal strategies. The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines and local requirements. New construction of assets will occur where no previous sanitary servicing is available. The risk associated with new construction includes the high cost of brand-new assets relative to ability to recoup costs through user rates or development charges.

Construction can also be the replacement of deteriorated assets. At the end of the useful life of an asset, it can be replaced for continuation of service provision. At the time of replacement, design should be undertaken to ensure design requirements are met, and adequate capacity is provided for current and future requirements.

8.3.1.2 MAINTENANCE

Maintenance activities are undertaken on the assets throughout their useful life to maintain their operating condition and performance. Maintenance works includes routine maintenance (flushing, cleaning), reaming, and minor repairs to assets. There exists the risk that a maintenance activity may be implemented that does not adequately mitigate a performance or condition issue, and additional costs are then required for further repair or replacement. Current maintenance activities typically undertaken on the sanitary sewers include:

- Sanitary flushing (flushing and cleaning) – conducted under maintenance budget
- Reaming – conducted under maintenance budget
- Localized pipe repair - conducted under maintenance budget

Assets are maintained through several preventative maintenance and inspection programs, including sanitary pump station PM inspections, sewer main flushing. All gravity sewer mains are flushed routinely. We currently only have capacity to flush force main 200 diameter or smaller, however there is the potential for this program to expand to larger diameter mains in future.

8.3.1.3 REPLACEMENT/ RENEWAL

The Township may consider using relining activities as part of the sanitary sewer main management strategy. For consideration, estimated relining costs are summarized in **Table 8-8.**

Table 8-8: Sanitary Sewer Main Relining Unit Costs

Asset Size	Unit Cost ($/m)
Under 250 mm	$250
250 mm – 400 mm	$400
Larger than 400 mm	$1,000

Renewal of the sewer main assets can include structural or non-structural lining, with structural lining being the Township preference. A lining can be used to repair cracked or broken pipes that are still structurally sound, and the condition of the service laterals is sufficient. A lining option can be performed once to extend the useful life of an asset and improve performance. Risks associated with lining of a pipe include the improper installation

of the pipe or continued deterioration of the original pipe such that the lining does not perform as expected.

8.3.1.4 OPERATING AND DECOMMISSIONING

Operating activities for the sewer network include those activities that do not directly deal with the physical state of the pipe but work to extend the assets useful life. The operating activities can include non-infrastructure solutions (such as policies, sewer use bylaws), required annual maintenance of commercial grease traps, and monitoring/inspection of the assets. The inspection of sewer assets can be undertaken through a condition assessment program, recommended to be visual inspection through CCTV or zoom camera means. Usage of the zoom camera technology has the risk of insufficient visual detail to make appropriate activity decisions.

Decommissioning activities of the sewer assets includes abandonment or replacement of the asset at the end of its useful life. While typically assets are abandoned in place, the removal of the expended asset can provide additional space for new underground assets to be constructed.

8.3.2 WASTEWATER FACILITIES

The lifecycle activities for the vertical sanitary assets will generally include:

8.3.2.1 CONSTRUCTION

The start of a vertical sanitary asset lifecycle is its construction. The asset should be constructed to adhere with the applicable standards and codes. The design of the facility should suit the purpose of its construction, including operating capacities and capabilities.

8.3.2.2 MAINTENANCE

Throughout the full lifecycle of an asset, the majority of the expected lifecycle activities to be undertaken will be maintenance works. Maintenance activities can be used to improve the level of service of an asset (or component), or to maintain it. Activities that fall under the maintenance category can be varied by response type and scale of maintenance requirements. Activities can be required through routine maintenance works, response to poor condition or performance, or on an emergency basis. In general, the expected types of maintenance activities within the lifecycle of a vertical sanitary asset include:

- Preventative maintenance
    - Maintenance activity is undertaken to prevent failure or poor performance of a building asset component. Preventative maintenance works can be undertaken according to a maintenance schedule. Manufacturer directives and condition assessments should assist in determining frequency of preventative maintenance activities.

- Reactive maintenance
    - Maintenance activity is undertaken in response to an issue or fault in the building or component systems, on an ad-hoc basis. Scale of reactive maintenance works will be variable depending on the system and type of failure or decrease in level of service.
- Major maintenance (replacement)
    - Maintenance activity is undertaken in response to a component which is no longer able to provide adequate level of service. Major maintenance (replacement) will be undertaken for one or more components of a building asset. Major maintenance works can be preventative (in anticipation of end of service life of a component), or in response to a system failure.

8.3.2.3 RENEWAL/ ENHANCEMENT

Renewal works can be used to expand on an existing facility, or to renovate to suit changes to services provided. Enhancement works can be similar and can be used to update an asset for modernization, to achieve compliance with updated codes and requirements. These works can include:

- Addition of new components to an existing asset
    - New components can be added to an existing asset with the existing asset largely unchanged.
- Updating of existing components
    - Updating of existing components can prolong the expected lifespan of an asset.

8.3.2.4 DECOMMISSIONING/DISPOSAL

Removal from service of an asset or component. Disposal can be through decommissioning or sale. Activities should comply with applicable health, safety, and environmental protocols.

As the wastewater vertical assets are specialized for treatment and collection services, there are additional factors that must be considered:

- Wastewater treatment and collection facilities are highly regulated. Any and all lifecycle activities undertaken must be done in compliance with codes and regulations.
- Expansion of existing facilities may be required for additional wastewater treatment and collection capacity as a result of growth. Expansion activities may encompass multiple lifecycle stages, such as construction for additional infrastructure required, and renewal for expansion of existing infrastructure such as the treatment facility.

8.4 ASSET MANAGEMENT STRATEGY

8.4.1 SANITARY SEWER MAIN ASSETS

The asset management strategy for the linear sewer assets in the Township will employ the lifecycle activities to maximize the useful life and economy of each asset.

The primary indicator used in the development of a lifecycle strategy is the condition of each asset, however the strategy should also consider other factors, such as:

- Importance of the asset (criticality factor)
- Asset risk score
- Condition of adjacent sections
- Replacement requirements for adjacent infrastructure (watermain, storm or roadworks)
- Upstream dependency and expansion/ growth requirements.

As the Township wastewater assets continue to age and the network is further developed, these factors will continue to change, and each have an impact on the lifecycle of an asset. Consideration of these factors should be given when devising capital project outlooks and budgeting and updating of the asset management plan.

The assets will deteriorate on a non-linear basis, and the various lifecycle activities can be implemented at varying stages within an asset's deterioration. **Figure 8-3**provides a visualization of the theoretical deterioration curve for an asset, and the opportunity windows to conduct lifecycle activities within the expected useful life of an asset.

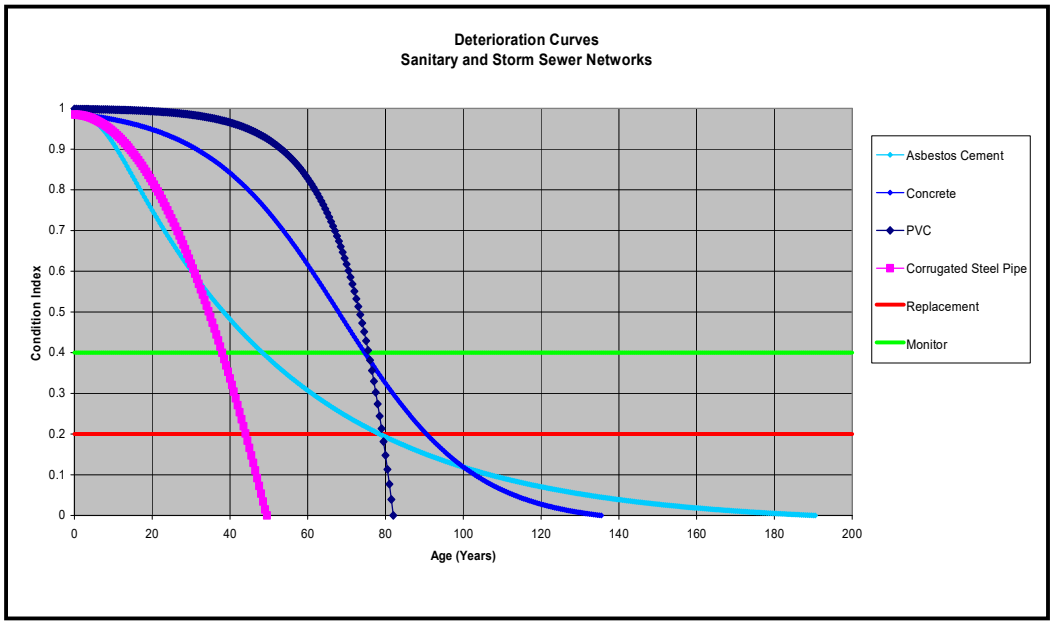

Figure 8-3: Theoretical Deterioration Curves for Sewers

Condition indices were derived from the results of the condition assessment processes described previously in the report. The generation of indices, using consistent and repeatable techniques, is essential to be able to compare assets and identify needs in all linear infrastructure networks. Once all assets have been assigned a condition rating, it becomes possible to determine, based on knowledge of the assets and technical expertise, what rating represents the minimal acceptable level of condition that relates to the acceptable Level of Service provided to residents. Any components of infrastructure rated below that minimal rating should be rectified to improve the level of service. That rating is called the "Threshold of Acceptability" of an asset.

Accordingly, the Township should maintain its condition assessment program for the gravity sanitary sewers. The recommendation is to continue use visual inspection facilitated by CCTV or Zoom camera inspection. The Township's goal is to assess the gravity sewers via visual inspection every 15 years. If the condition starts to change more rapidly than expected, the frequency or priority of CCTV can be adjusted accordingly.

When the condition of the asset has degraded such that, an intervention is required, it is recommended that maintenance be reviewed as the first opportunity to extend the useful life. Maintenance works can include increased frequency of maintenance activities, localized repair work. The Township currently has a schedule for undertaking flushing and cleaning works on the sewer mains.

When the condition of the asset has degraded such that maintenance is no longer adequate or feasible to address deterioration, the segment can be considered for relining. Structural relining is the preference of the Township, and is an activity option only where condition or performance dictates, including consideration of the condition of service laterals. Pipe relining will only occur once per lifecycle of an asset.

Where performance and condition have deteriorated to the point where maintenance and relining are not adequate solutions, the asset should be considered for reconstruction. Relining should be evaluated as an activity prior to opting for reconstruction. The Township should follow best practices and local design guidelines when designing the reconstruction works. Assets at the end of their useful life should be abandoned in place or removed.

Operating activities and some maintenance activities can be implemented throughout the lifecycle of the asset. The Township has an established annual flushing program for the sewers. Maintaining this program will be useful in maintaining the performance of the assets. The Township can continue to flush and clean sewers according to the existing schedule. As required, the program can be updated to reflect changing conditions in the sewers, such as requirements for more frequent flushing.

A summary of the pipe condition and associated lifecycle activity is provided in **Table 8-9** below. Note that condition assessment should be undertaken on a routine basis throughout the lifecycle of the asset, and other factors should be considered when selecting a lifecycle activity.

Table 8-9: Sanitary Sewer Lifecycle Activities and Condition Ranges			
Condition Range	**Condition Description**	**Lifecycle Activity Category**	**Lifecycle Activity**
100-60	Excellent to Good	Maintenance *Can be done beyond the 100-60 condition range as necessary	Maintenance works (cleaning, flushing) Small pipe section repairs
60-35	Good to Fair	Rehabilitation	Localized repairs Structural relining (if lateral condition is sufficient)
35-0	Poor to Very Poor	Reconstruction	Pipe replacement or abandonment

Current best practices suggest that that reconstruction and new construction works on the assets will be done using PVC material for pipes that are 400 mm in diameter or less, and concrete material for sizes larger than 400 mm diameter.

In determining prioritization of the works to the assets, the Township has developed some direction regarding criticality of the assets. By default, sewer main assets are assumed to have the same criticality, unless they meet the following criteria:

- Force mains are considered more critical than gravity mains. The criticality factor 1.5 included within the model is increased by 50% of default.
- Sewer pipes greater than 400 mm in diameter are considered more critical than smaller pipes, due to the assumed upstream dependency. The criticality factor 1.2 included within the model is increased by 20% of the default.

8.4.1.1 SCENARIO ANALYSIS

To understand the needs and projected works on the sanitary sewer main assets within a 10-year outlook, replacement activities were reviewed under varying budget values to understand the impact on overall asset condition. The budgets analyzed include:

1. **Unlimited** Budget – To determine backlog of works
2. **Maintain** 66 OCI – Budget required to maintain a 66 overall OCI throughout the timeframe
3. **Target** 60 OCI – Budget required to achieve a network 60 OCI at the end of the timeframe
4. **Actual** Budget – changes in OCI using a $ 1,500,000 total budget across the timeframe (best value)

A ten-year projection scenario was run in Cartegraph for each of the scenarios noted above. The results of the scenarios provided works to be conducted on the linear sanitary sewer assets over the timeframe according to the scenario budget and the goal of the scenario (target

OCI, etc.). The average OCI at the start of all reviewed scenarios is 66. A summary of the analysis is outlined in **Table 8-10** below.

Table 8-10: Sanitary Sewer Main Scenario Comparison

	Budget Scenario	Scenario Type	Average Annual Investment Over Timeframe	Total Investment over Timeframe	Assets Included	Average OCI (End of Timeframe)	Difference from LoS OCI Target
1	Unlimited Budget	Unlimited	$3,190,829	$31,908,289	532	75	+15
2	Maintain 66 OCI	OCI Target	$1,982,517	$19,825,171	177	66	+6
3	Target 60 OCI	OCI Target	$627,556	$6,275,559	81	60	--
4	Actual Budget	Budget Limitation	$148,504	$1,485,043	51	57	-3

The **unlimited** scenario can be used as an indicator of existing backlog of works on the wastewater sewer assets. The initial year of the scenario indicated over $30.6M in outstanding needs on the sanitary sewers. At the end of the unlimited scenario, the average OCI is 75, an increase of 10 points over the 10-year timeframe.

Scenario 2 considered the funding required to maintain the current OCI of 66 across the sanitary sewer assets. This scenario included 177 assets across the timeframe, and the annual average cost was just under two million dollars.

Scenario 3 considers the overall OCI target of 60. As the starting OCI is higher than the target of 60, there are no expenditures identified within the first 6 years of the plan as the OCI is allowed to deteriorate to approximately 60, wherein works are then restarted, which occurs in 2027. The annual expenditure for the last 3 years of the scenario are in the range of $2 million. This scenario includes 81 assets across the timeframe, and the total cost is just over $6 million.

Scenario 4 reviewed the impact on the OCI by utilizing the existing budget as the investment limitation, which was $1,500,000 across the analyzed timeframe (or an average of $150,000 per year). Using almost the entirety of this budget over the 10 years, the OCI at the end of the timeframe was reduced to 57. This scenario included only 51 assets.

Scenarios 3 and 4 are the most likely for consideration at the Township, as they utilize the target OCI established by the Township, and the current annual budget. A summary of the investment and OCI values for Scenarios 3 and 4 are shown in **Figure 8-4** below**.**

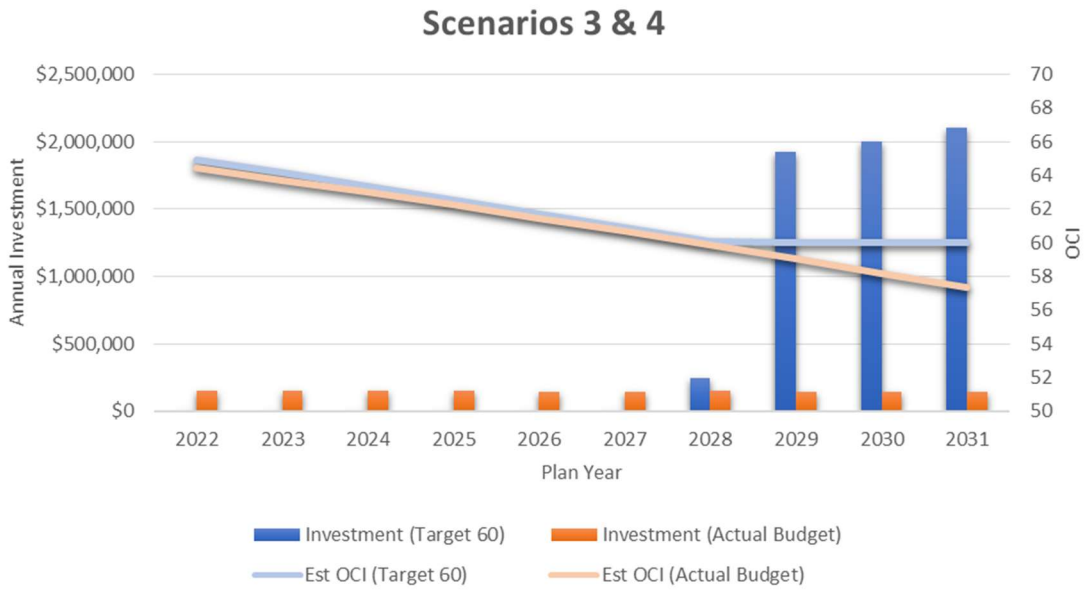

Figure 8-4: Scenarios 3 and 4 Comparison - Sewer Main Network Analysis

The total investments spent over the full timeframe in Scenarios 3 and 4 are less than the current backlog of works identified within Scenario 1. At the end of these two scenarios, there will still be an outstanding backlog of works to be done on the assets, which runs the risk of deteriorating to the point of failure. In addition, additional assets will have deteriorated to the point of intervention during the analyzed timeframe. To proceed with either of these scenarios, the Township will need to review the sanitary sewer strategy and consider the following strategy adjustments to address the needs of the network:

- Focused condition assessment program, identifying and prioritizing assets in poorest condition, to understand rate of deterioration and more accurately target the optimal time for intervention
- Establish an LoS target below the current level of 66 to allow further deterioration of the assets without intervention
- Adjust the thresholds at which the varying lifecycle activities are triggered, perhaps allowing assets to deteriorate to a poorer condition before they are considered for relining or reconstruction (being conscious of the minimum condition required to be eligible for relining)

Scenario 3 provides the most affordable option to the Township, however, carries the highest risk of asset failure due to the low level of investment and reduction of the OCI. Scenario 2, although still shy of the unlimited budget level of investment, allows the Township to address a more significant portion of the backlog.

8.4.2 WASTEWATER FACILITIES

The asset management strategy for sanitary sewer facilities seeks to maximize the useful life and economy of each asset, using the lifecycle activities.

The primary drivers of lifecycle activities for these assets are the condition and service delivery requirements. The Township sanitary sewer facilities are complex assets, the componentry for which are expected to have differing rates of deterioration and expected useful lives. As such, lifecycle activities will be required to be implemented at varied frequency and timelines.

The timing and frequency of lifecycle activities can be established according to the condition and performance of the components. This can be determined theoretically using the expected useful life and age of the assets, or through condition assessment/ inspection of the assets and components. An inspection or assessment can be undertaken at regular intervals for understanding the actual condition, recommended to be at a minimum frequency of every five years, or according to the preferences and schedule established by the Township. Assets with high risk or poor condition/performance components should be prioritized in the condition assessment program.

Lifecycle activities should be selected according to the results of inspection or condition estimation. The timing of the works should be identified according to the funding available, risk, and criticality of the asset (and other factors as required).

Routine maintenance schedules are assumed to be in place currently and are recommended to continue assuming that they are currently providing sufficient level of maintenance.

The Township, based on condition, risk, and performance, compiled a listing of works projects to be conducted on the wastewater facilities. These projects were further assessed, including cost estimates, criticality, and financial viability (and others), the results of which were compiled into a ten-year wastewater capital plan. The plan provides project details and financial forecasts for years 2021-2030. Maintenance and works to be done on the wastewater facility assets should be done according to the capital plan.

Management of sanitary sewer facilities should also include climate change considerations in new construction, maintenance, or renewal lifecycle activities. Assessment should be undertaken to understand vulnerability of these assets to a changing climate, considering increased volumetric demand and utilization of the assets, which will inform lifecycle activity requirements, and potential changes to the way lifecycle activities are undertaken.

Works should also be undertaken as required to maintain the treatment efficiency and capacity to meet regulations and user requirements.

8.4.2.1 SCENARIO ANALYSIS

The Township's 10-year capital plan prioritizes identified wastewater facility projects. The initial year of the plan (2021) has an estimated expenditure of $700,000, suggesting a backlog of works on the wastewater facility assets. The two following years have total cost estimates of $350,000 and $600,000 respectively, while the remaining years are in the range of $100,000 to $300,000. The annual investment allocations have been determined through an assessment of priority, and therefore it is expected that completing the works as suggested in the plan will be important for continued operation of the wastewater facilities assets.

8.5 FINANCIAL STRATEGY

The financial strategy for sanitary sewer assets considers the projected funding requirements identified through analysis and existing funding mechanisms to identify any funding surplus or shortfalls. The Township can utilize these findings to strategize funding and asset management priorities.

Water and sewer plans were initiated in 2007, in guidance with the best practices on integrated asset management published as part to the InfraGuide. In addition, the deliverables had to satisfy the Bill 175 "Sustainable Water and Sewerage System Act" requirements to the extent known at that time.

8.5.1 SOURCES OF FUNDING

Funding comes from a variety of sources including:

- Property taxes
- User Fees
- Debt Financing
- 3rd Party Contribution
- Reserves

8.5.2 FUNDING STRATEGY

The Township currently uses multiple capital and operations budgets through which the sanitary assets are maintained. The Township does not have a consistent sanitary sewer annual budget for capital works. A summary of the operational budgets and their purpose is summarized in **Table 8-11** below.

Table 8-11: Sewer Main & Facility Capital and Operating Budgets

Budget Name	Annual Budget	Lifecycle Activities	Asset	Notes
Operations	$100,000	Ream & Grout/ Spot Liners/ MH Repairs	Sewer Mains – Linear Gravity	---
Operations	$50,000	Full length liner	Sewer Mains – Linear Gravity	Not currently done yearly, targeting more frequent applications
Operations	$50,000	Maintenance and Cleaning	Sewer Collection System	Annual flushing program
Capital	$60,000	---	Sewer Collection Facilities	Every other year pumps and panel replacements. Pump station replacements are funded by WW reserves based on condition assessment.
Operations	$50,000	Maintenance and Cleaning	Sewer Collection Facilities	Semi Annual Pump Station Wash Down, Annual Pump PM Program
Capital	---	---	Sewer Treatment Facilities – WWTP/ Lagoons	10-year WW plan identifies planned projects. Funded by WW reserves
Operations	$85,000	Repairs	Sewer Treatment Facilities – WWTP	---
Operations	$60,500	Maintenance	Sewer Treatment Facilities – WWTP	---
Operations	$35,000	Maintenance/ Repairs	Sewer Treatment Facilities – Lagoons	---

8.5.2.1 SANITARY SEWER MAIN ASSETS

To address operational works on the sanitary sewers, the Township maintains three budgets totaling $150,000 for lining, repairs, maintenance, and cleaning. The Township does currently have a recurring annual budget associated with capital works (reconstruction, new construction) or sanitary pipe assets. For modelling purposes, an annual budget of $150,000 was utilized, based on previous sanitary budgets to determine the annual expenditure and impact on average OCI.

Based on the analysis of Cartegraph, investing approximately $150,000 annually, the Township will require:

- $148,504 annually for capital works (average across all years of the timeframe)
- $1,485,043 over a ten-year timeframe.

Should the Township choose to increase the annual investment level to maintain the target OCI and address some of the identified backlog, the Township will require:

- $627,556 annually for capital works (average across all years of the timeframe)
- $6,275,559 over a ten-year timeframe.
- Noting that the annual value is an average of the plan years. Modelling suggests that over the first six years of the scenario there is $0 of investment, and in the range of $2million for the last 3 years. The Township can consider contributing to reserves over the first six years of the plan in preparation for large expenditure during the final three or prioritizing the works in the last 3 years such that they can be moved forward in time within the plan to 'smooth out' the funding requirements across the timeframe.

Both funding scenarios currently have a gap in funding, due to the undefined annual capital budget.

Due to the considerable volume of backlog, the Township should prioritize completion of condition assessments surveys as required to focus the investment and maximize impact. Additional funding should be sought to maximize the scope of feasible reconstruction works to address the backlog and minimize risk of failure.

8.5.2.2 WASTEWATER FACILITIES

To address operational and capital works for vertical sanitary assets, the Township maintains six different budgets, each attributed to a type of lifecycle activity. Across sewer treatment facilities, the Township has a total annual spend of $180,500 for operations activities, and across sewer collection facilities, the Township has a total annual spend of $110,000 for operations and capital activities.

In November 2020, the Township had developed a ten-year capital plan for wastewater assets, in **Appendix C.4 Wastewater Capital Plan**. The capital plan used a defined list of important projects (identified by the Township) and used a variety of prioritization criteria to develop a ten-year capital plan and financial forecast.

The plan was more recently updated based on an Odour assessment completed as part of the WWTP Odour Control Project follow-up. The assessment allowed the Township to refine the projected works to be done at the plant, removing two of the previously identified projects.

The total expenditure across each of the years of the plan is shown in **Figure 8-5** below.

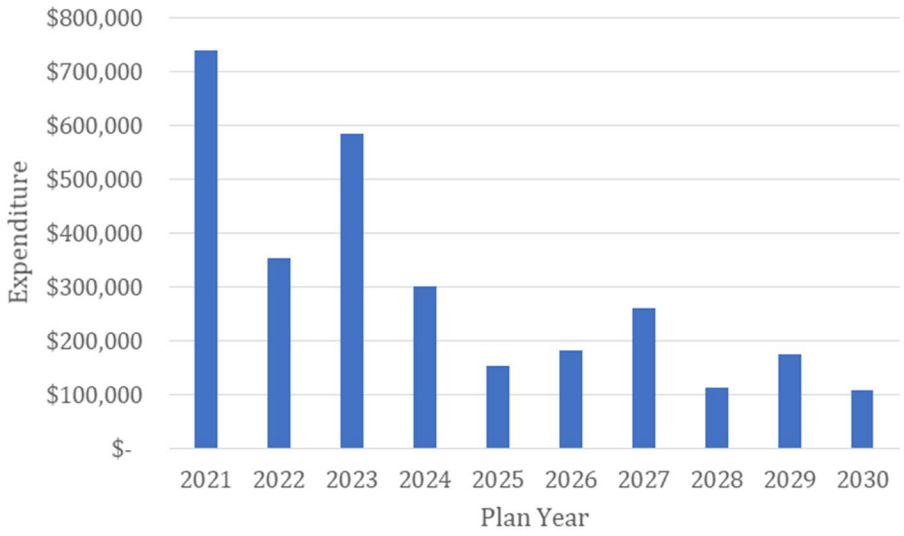

Figure 8-5: Wastewater Facility Annual Expenditure (Ten Year Plan)

The plan includes 41 individual projects, ranging in expected cost from $8,000 to $525,000.

It is noted within the report that the accuracy of the costing is variable, and therefore this is subject to change depending on any changes to scope of the project, and available pricing at the time each project is undertaken.

Years 1 and 3 of the plan have the most significant expenditure, totaling just over $700,000 in 2021 and just under $600,000 in 2023. The total cost across the remaining years ranges from $110,000 to just over $350,000, with an average of $183,191. (The average across all plan years is $297,372).

A recurring capital budget of $60,000 annually is used to address pump and panel replacements at pumping stations, and the remainder of the annual investment is expected to be funded through wastewater reserves.

Throughout each of the plan years, it is expected that reserve funds will be utilized to cover the plan costs. It is expected that the Township could seek additional sources of funding to supplement the reserve balances. This can include third party funding such as governmental grants, etc. A detailed review of the current and future reserve funding amounts can identify further gaps where third party funding could be required.