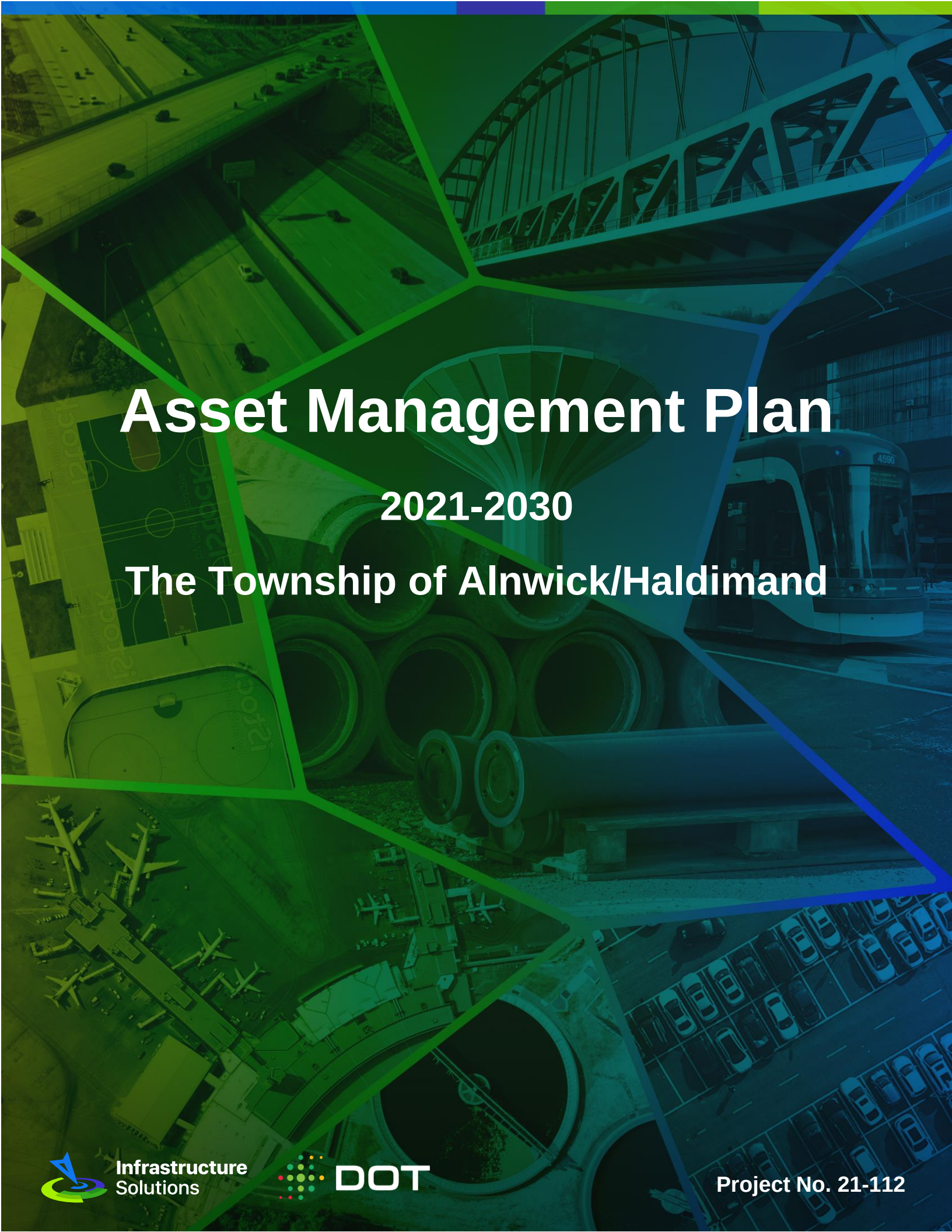

Asset Management Plan

2021-2030

The Township of Alnwick/Haldimand

Infrastructure Solutions

DOT

Project No. 21-112

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1 EXECUTIVE SUMMARY

The Township of Alnwick/Haldimand is undertaking a detailed evaluation of all its existing infrastructure in order to update their long-term Asset Management Plan, put the municipality in a position to receive the Federal Canada Community-Building Fund (formerly Gas Tax Fund) and other grants, and build a fully implementable program for its residents which aims to further strengthen municipal asset management practices.

Infrastructure Solutions Inc. was well supported by the Township's CAO to accumulate the geometric and condition assessment data, where available. We based the Asset Management Plan on all asset types and their current replacement costs. Asset lifespans, condition and project requirements were determined by engineering assessments and degradation curves. Where condition assessments were unavailable, ISI applied an age-based analysis. Our objective was to build a practical asset management plan based on optimizing the capital spend and taking corrective action to address the Township's infrastructure deficit.

The Municipality's infrastructure deficit is defined as the added investment that would be required to maintain a Municipality's infrastructure at appropriate service levels and in a good state of repair today. Based on our calculations, Alnwick/Haldimand's infrastructure deficit is calculated to be $27.2 million dollars. The Township's infrastructure deficit is quite significant and eliminating it within a 10-year period will be challenging with the Township's current financial capability. We have analyzed the Township's assets in detail with the objective of optimizing how capital is expended.

We have reviewed the Township's current/projected capital contributions in relation to its current/projected needs. For the primarily tax funded assets, excluding the water system, the Township is currently contributing $1,416,057 per annum to its capital program with a contribution requirement of $2,904,170 per annum. Therefore, the Township does not have sufficient funds available to fund capital projects and to eliminate its deficit within the 10-year plan period.

The water system has been analyzed separately in the 2019 Alnwick Haldimand Water Rate Study with a 50-year plan period, and the Township has adopted its recommendations to achieve self-sustainability of the water system.

As highlighted in the SOTI Report within this document, the Township's most valuable assets by replacement cost are the Roads (72.9%), the Structures, including Bridges and Structural Culverts (8.8%), Buildings (7.5%) and Water (7.2%). Overall, the Roads are in Poor condition, Structures and Buildings are in Fair condition, while the Water assets are in Good condition. All the other asset types are in Fair or Good condition. Only the Ball Field Diamonds and Wells are in Poor condition overall, based on an age-based analysis, and need attention. A Well replacement has already been scheduled. To improve the accuracy of the capital planning, it is recommended to establish periodic condition assessments for the key assets.

2 ONTARIO ASSET MANAGEMENT REGULATION

2.1 HISTORICAL OVERVIEW

Municipal infrastructure is the foundation that the daily life of Canadians is built upon. The strength of this foundation enables our communities and local businesses to grow and it ensures that Canadians have a high quality of life. Municipalities own the core infrastructure assets that are critical to the quality of life of Canadians and the competitiveness of our country. Almost 60% of Canada's core public infrastructure is owned and maintained by municipal governments. According to survey results, the total value of core municipal infrastructure assets is estimated at $1.1 trillion dollars or about $80,000 per household.

The Township of Alnwick/Haldimand is not alone in dealing with an infrastructure deficit. According to the Canadian Infrastructure Report Card (CIRC), one-third of our Canadian municipal infrastructure is in fair, poor or very poor condition, increasing the risk of service disruption. Assets in fair, poor and very poor conditions represent a call for action. Survey results demonstrate that roads, municipal buildings, sport and recreation facilities and public transit are the asset classes most in need of attention. Figure 1 provides a summary of the physical condition ratings for all municipal asset categories across the country.

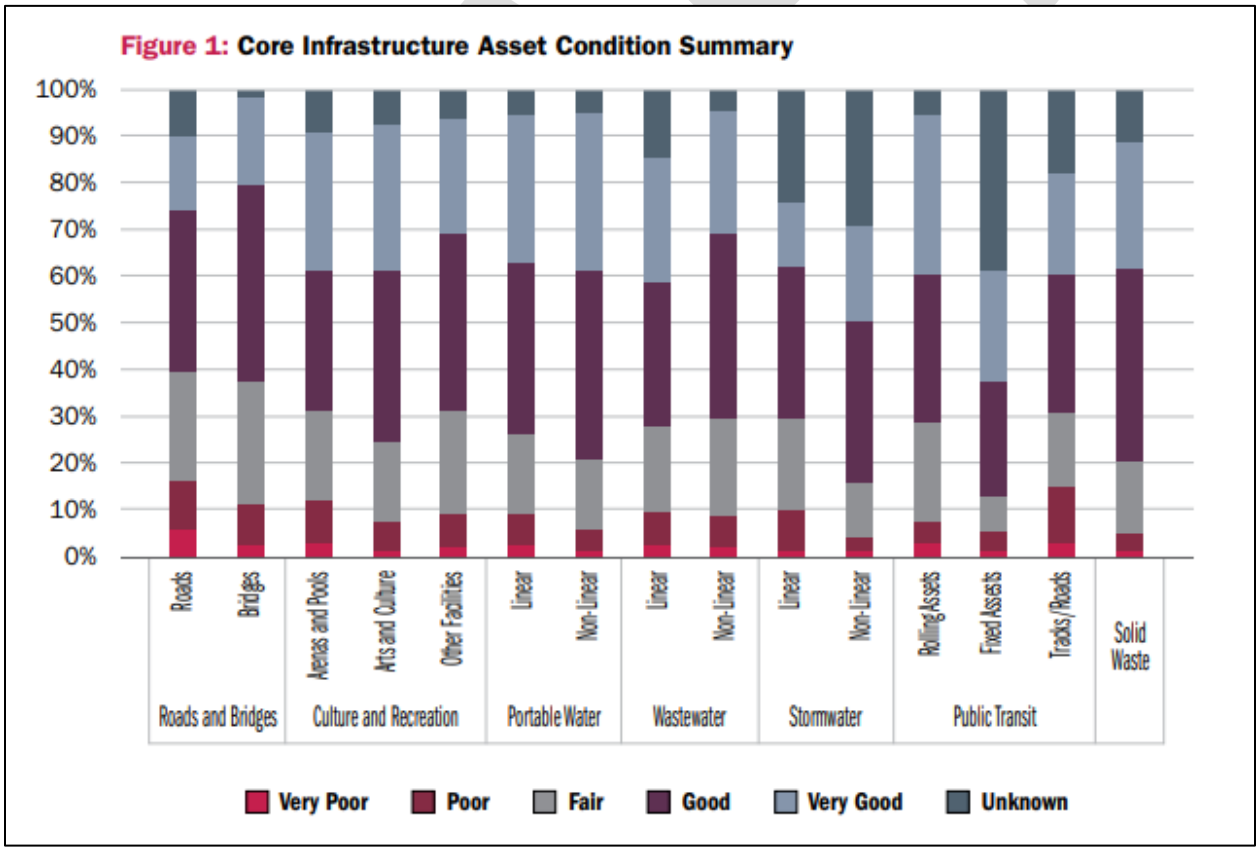


Figure 1: Physical Condition Ratings by Asset Category
Source: 2019 Canada Infrastructure Report Card

Increasing reinvestment rates will stop the deterioration of municipal infrastructure. The 2019 CIRC report found that rates of reinvestment are lower than targets recommended by asset

management practitioners. The rate can vary based on factors such as the age of the infrastructure, the level of service and risk tolerance. The values provided are based on the experience of municipal asset management practitioners and are intended to be informative in nature. Roads and sidewalks, storm water, and sport and recreation infrastructure presented the largest gaps in terms of current and target rates of reinvestment. Figure 2 demonstrate the gap between current and target reinvestment levels. Continuing down this path will result in a gradual decline of physical condition levels that will impact municipal services. When contrasted with target reinvestment rates it becomes clear that current levels of reinvestment in municipal infrastructure are inadequate.

Target Reinvestment Rates vs Current Reinvestment Rate

Infrastructure	Lower Target Reinvestment Rate	Upper Target Reinvestment Rate	Current Reinvestment Rate
Potable Water (linear)	1.0%	1.5%	0.9%
Potable Water non-linear)	1.7%	2.5%	1.1%
Wastewater (linear)	1.0%	1.3%	0.7%
Wastewater (non-linear)	1.7%	2.5%	1.4%
Stormwater (linear)	1.0%	1.3%	0.3%
Stormwater (non-linear)	1.7%	2.0%	1.3%
Roads and Sidewalks	2.0%	3.0%	1.1%
Buildings	1.7%	2.5%	1.7%
Sport and Recreation	1.7%	2.5%	1.3%

Figure 2: Target Reinvestment Rates vs Current Reinvestment Rate

Under the Ontario MIII program in 2013, for the first time Ontario municipalities were required to develop an Asset Management Plan in order to qualify for certain grants and to receive federal Canada Community-Building Fund (formerly Gas Tax Fund) revenue. This first round of Asset Management Planning focused primarily on the core assets, and to assemble inventory data, identify the condition state, quantify the infrastructure deficit, and determine the required capital expenditures based on expected service life.

2.2 REQUIREMENTS OF ONTARIO REGULATION 588/17

As part of the *Infrastructure for Jobs and Prosperity Act, 2015*, the Ontario government introduced Regulation 588/17 - Asset Management Planning for Municipal Infrastructure (O. Reg 588/17. Along with creating better performing organizations, more liveable and sustainable communities, the mandated regulation is a key driver of asset management planning and reporting. It places substantial emphasis on current and proposed levels of service and the lifecycle costs incurred in delivering them.

The Requirements of O.Reg.588/17 will progressively come into effect in three phases until July 1, 2025. This comprehensive Asset Management Plan addresses the requirements of all three phases. The regulation requirements are summarized as follows:

1. **General**
   - The municipality shall prepare an asset management plan in respect of its core municipal infrastructure assets by July 1, 2022 (Phase 1), and in respect of all of its

other municipal infrastructure assets by July 1, 2024 (Phase 2). The municipality shall prepare a revised asset management plan for July 1, 2025 (Phase 3, to include proposed levels of service, financial strategy, and asset lifecycle management strategy). Please note that the implementation deadlines of the 3 phases shown have been adjusted to reflect that they each have been moved forward by one year due to Covid 19.

- The municipality must post its current strategic asset management policy by July 1, 2019 and asset management plan on a website that is available to the public, and shall provide a copy of the policy and Plan Governance plan to any person who requests it.
- The municipality shall review and update its asset management plan at least five years after the year in which the plan is completed and at least every five years thereafter.
- Every asset management plan prepared or updated, must be endorsed by the executive lead of the municipality, and Plan Governance, and must be approved by a resolution passed by the municipal council.
- Every municipal council shall conduct an annual review of its asset management progress on or before July 1 in each year, starting the year after the municipality's asset management plan is completed.
- The annual review must address the municipality's progress in implementing its asset management plan, any factors impeding the municipality's ability to implement its asset management plan; and Plan Governance, and a strategy to address the factors impeding municipalities' ability to implement its asset management plan.

2. Level of Service

- Current Level of Service is required for Phase 1 for core assets, Phase 2 for non-core assets: For each asset category, the current levels of service being provided, determined in accordance with qualitative descriptions and technical metrics, based on data within the past two calendar years; With respect to core municipal infrastructure assets, the qualitative descriptions and the technical metrics set out in the Regulation; With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality. The current performance of each asset category, determined in accordance with the performance measures established by the municipality, based on data within the past two calendar years.
- Proposed Level of Service Is required for Phase 3: For each asset category, the levels of service that the municipality proposes to provide for each of the 10 years following, is included in the asset management plan, determined in accordance with the following qualitative descriptions and technical metrics: With respect to core municipal infrastructure assets, the qualitative descriptions and the technical metrics set out in the Regulation; With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.
- A discussion of the proposed versus current Level of Service is required for Phase3: An explanation of why the proposed levels of service are appropriate for the

municipality, based on an assessment of the following: The options for the proposed levels of service and the risks associated with those options to the long-term sustainability of the municipality; How the proposed levels of service differ from the current levels of service; Whether the proposed levels of service are achievable; The municipality's ability to afford the proposed levels of service.

- Required for Phase 3): The proposed performance of each asset category for each year of the 10-year period, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency.

3. **State of local infrastructure**
   - Required for Phase 1 for core assets, Phase 2 for non-core assets: For each asset category: A summary of the assets in each category; The replacement costs of the assets in the category; The average age of the assets in the category; The information available on the condition of the assets in the category; A description of the municipality's approach to assessing the condition of the assets in the Category.

4. **Asset Lifecycle Management Strategy**
   - Required for Phase 3: For each asset category, the lifecycle activities that would need to be undertaken to maintain the current levels of service for the next 10 years and the costs of providing those activities based on an assessment of the following: The full lifecycle of the assets; The options for which lifecycle activities could potentially be undertaken to maintain the current levels of service; The risks associated with the options for lifecycle activities; The lifecycle activities defend that can be undertaken for the lowest cost to maintain the current levels of service.

5. **Financial Strategy**
   - Required for Phase 3: For each of the 10 years following the year for which the current levels of service are determined, the estimated capital expenditures and significant operating costs related to the lifecycle activities required to maintain the current levels of service in order to accommodate projected increases in demand caused by growth, including estimated capital expenditures and significant operating costs related to new construction or to upgrading of existing municipal infrastructure assets.
   - Required for Phase 3: An identification of the annual funding projected to be Financial Strategy available to undertake lifecycle activities and an explanation of the options examined by Cambridge Appendices to maximize the funding projected to be available.
   - Required for Phase 3: If, based on the funding projected to be available, the municipality identifies a funding shortfall for the lifecycle activities; An identification of the lifecycle activities that the municipality will undertake, and if applicable, an explanation of how the municipality will manage the risks associated with not undertaking any of the lifecycle activities.

3 SCOPE AND METHODOLOGY

The scope of this project is to undertake a detailed evaluation of all the Township's existing infrastructure in order to update a long-term Asset Management Plan, give the municipality continued eligibility to receive the Federal Canada Community-Building Fund (formerly Gas Tax Fund) and other grants, and build a fully implementable program for its residents which aims to further strengthen municipal asset management practices.

Asset management planning requires that the most cost effective and realistic decisions are made regarding the building, operating, maintaining, renewing, replacing and disposing of infrastructure assets. The prime goal of the Asset Management Plan is to maximize benefits, manage risk, and offer satisfactory, safe and sustainable service levels to the public. Asset management planning requires that the Township of Alnwick/Haldimand has an in-depth understanding of the characteristics and condition of infrastructure assets, as well as the service levels they are expected to meet. Asset management planning also involves strategic prioritization and optimization to obtain the best decision-making concerning the timing and utilization of investments, which includes a comprehensive and achievable financial strategy.

ISI and the Township are using the DOT™ (Decision Optimization Technology) software), a leading-edge asset management and investment planning software to assist in establishing that the most cost-effective and realistic decisions are made regarding the replacement, maintenance, rehabilitation, and reconstruction of the Town's assets. DOT™ will give you a plan that is flexible, easy to update, credible, defensible, and implementable.

Using any software to build an Asset Management or Capital Plan is complex. Effective planning requires a balancing act which contemplates fluctuating annual budgets, shifting strategic priorities, service levels objectives and public expectations, risk and safety considerations, cross-departmental co-operation, and due consideration to political objectives. DOT™ helps with the analytical process, best utilizing your current budget to best meet your financial and socioeconomic objectives. It determines what your budget needs to be to manage your infrastructure deficit and reach your levels of service objectives. It provides concrete recommendations and an actionable plan to put your community on a solid path forward. It generates a plan that well exceeds ISI 55000 standards and meets all Provincial and Federal regulations.

DOT™ is unique in the industry. Firstly, for the plan to be right, the civil engineering must be right. We have spent years in R&D working out degradation curves, lifecycle expectations, and factors like the impact of preventive maintenance. Secondly, prioritization and cost-benefit analysis methodologies do not have the analytical capability to manage a SAMP or Capital plan's complexity. Instead, DOT™ utilizes state-of-the-art, multiyear, multi-constraint optimization algorithms to create a range of scenarios to attain the best plan forward. Our flexible and comprehensive analytical processes give you the opportunity to attain your unique objectives for levels of service, socio-economic factors, and safety considerations. Finally, the plan you generate is only as good as your ability to gain support from your Council and community. DOT™ uses highly visual reports, presentation, and report ready, to simplify your communication task.

With DOT™ our objective is simple. We believe that the best plans are generated by local administrators and their public works department (and external engineering companies when necessary), and interfacing with the community and Council to establish their political and level

of service objectives. We will continue to expand the functionality of DOT™ as a world class Municipal planning tool, built for Canadian governments by a Canadian company.

4 STATE OF THE INFRASTRUCTURE

4.1 ASSET INVENTORY

The Asset Repositories for all asset types have been assembled, using as much information as the Municipality had available. The following procedure was used to assemble the Asset Inventories for this plan:

a) All asset types, location and quantities;
b) Segmenting of linear assets into manageable sections;
c) Unique Asset ID's for each asset type;
d) Geometrics of the asset (dimensions and physical properties)
e) Current year financial accounting valuation using historical costs and depreciation assumptions and replacement cost calculation accounting for expected inflation, changes in technology and other factors;
f) Asset age distribution and asset age as proportion of expected useful life;
g) Identified needs for all asset types
    i. identify deficiencies
    ii. identify treatments and life cycle interventions currently used to address deficiencies, including maintenance
    iii. determine cost of treatments and interventions
    iv. develop list of all asset needs with a multi-year listing (10-year) projects assuming unlimited funding; and a year-by-year (10-year) listing of total costs and capital requirements.

This section will also be supported by:

a) An inventory database of infrastructure covered by the plan, which includes basic asset information.
b) Records of all assumptions.
c) A data verification policy and a condition assessment policy, consistent with provincial requirements, setting out when and how asset information will be verified and when and how assets will be assessed to determine their condition.

4.2 REPLACEMENT COST

Replacement Costs are calculated for each asset. The following hierarchy is used in calculating Replacement Costs, depending on data availability:

1. Replacement Costs provided by client, inflated to 2020
2. Reconstruction unit costs where available, inflated to 2020
3. Initial Cost, inflated to 2020

The Municipality's Replacements costs by Asset Category is shown here:

Module	Replacement Cost	Percentage
Transportation	$292,521,583	72.9%
Structures	$35,470,146	8.8%
Water	$29,044,951	7.2%
Facilities	$29,885,431	7.5%
Fleet	$8,639,543	2.2%
Parks	$400,112	0.1%
Equipment	$5,094,792	1.3%
TOTAL	**$401,056,558**	**100.0%**

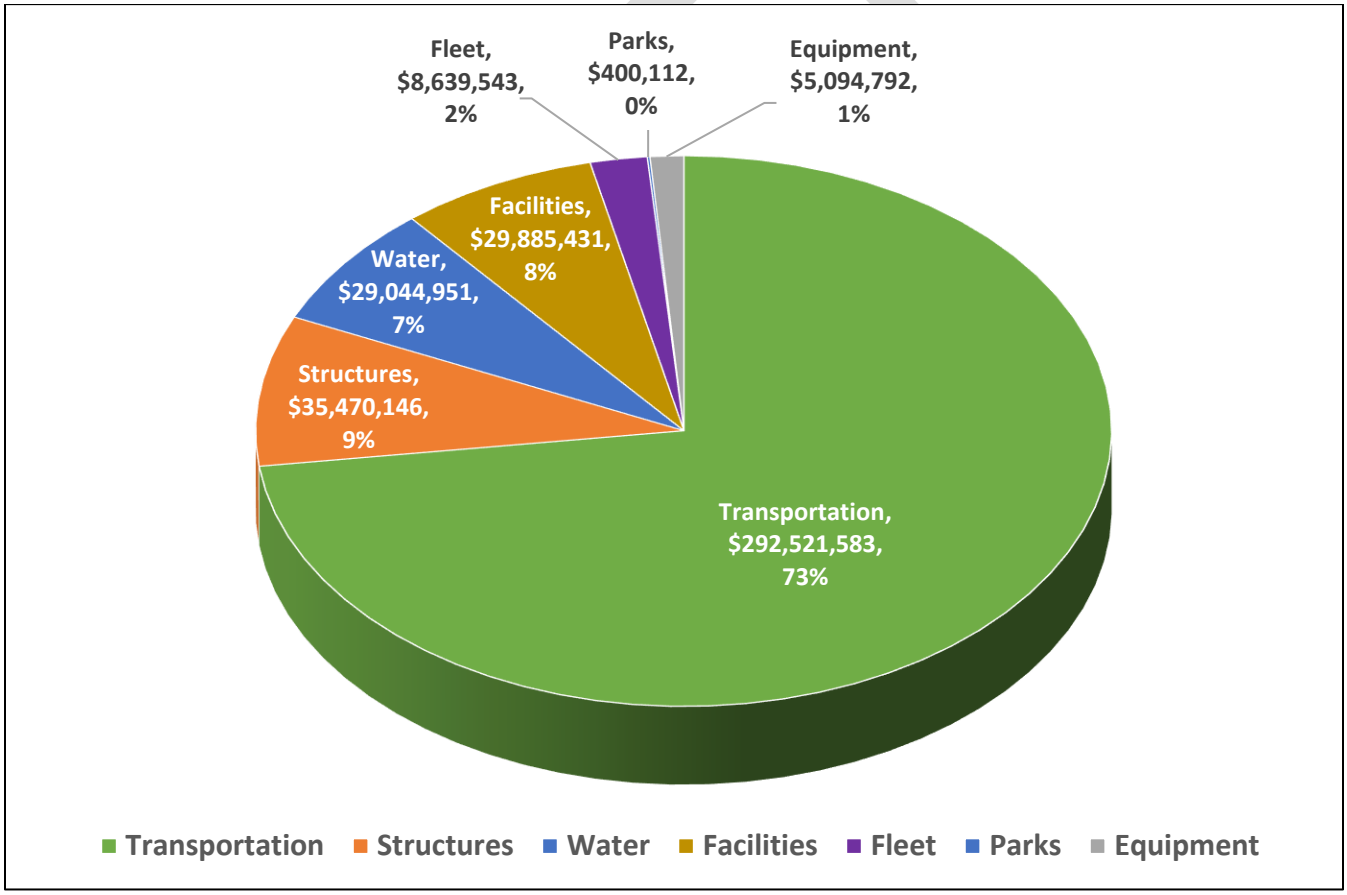


Figure 3: Asset Replacement Cost by Category

4.3 CONDITION ASSESSMENT APPROACH

Wherever condition assessments are available, they were utilized to determine asset conditions. When no condition data were available, an age-based condition rating of %RSL (% Remaining Service Life) was calculated based on predicted service life for a given asset. The condition assessment approach used is stated for each Asset Type in Section 5.

4.4 LEVELS OF SERVICE

The plan will define potential Levels of Service (LOS) for community consideration through performance measures, targets, and timeframes to achieve them. This section provides an overview of the Level of Service methodology used and is supported by specifications for each asset type in Section 4, of which performance measures are associated with a given asset type, current performance and expected performance over the planning period, as well as any assumptions. We made recommendations, but significant input was provided by the Township to define their desired levels of service, and these targets will be refined further with time.

4.4.1 OVERVIEW

Levels of Service (LOS) are statements of service performance delivery. LOS is established based on Council direction, the needs or wants of the community as well as legislative and regulatory requirements. This report includes Operating Performance Indicators (OPI's) for current levels of service. Through the ongoing Asset Management process, LOS will be further defined for the Municipality, the Municipality's assets, and the community. They all are interconnected.

There is likely further effort required by the Municipality to address and formally define levels of service from a customer perspective. Asset management, at its root, is really about balancing the full life cycle costs of various services and the levels of service being provided. It is about knowing what levels of service customers expect and what they are willing to pay. The level of service is a reflection of the quality, function, and capacity of the services being provided. As a Municipality, you might consider:

- The level of service you are currently providing to users
- The annual cost to continue to provide the current level of service
- How the level of service is expected to change in the future given current funding levels
- If you are meeting the level of service expectations of your users given the costs to provide current and desired levels of service

As a rough generalization, the higher the level of service provided, the higher the life cycle costs of providing that service. Levels of service drive the expected treatments in the management of infrastructure. Customer levels of service outline the overall quality, function, capacity, and safety of the service being provided. Technical levels of service outline the operating, maintenance, rehabilitation, renewal and upgrade activities expected to occur within the Municipality. When practicing asset management, it is important to first document the current level of service being provided. As asset management becomes more established within your Municipality, levels of service may be set through consultation with the community. However, it is critical that prior to consulting with the public, the current levels of service along with associated life cycle costs are understood.

It is also important to discuss how various levels of service may have different risks associated with them. These risks may play an important role in determining if certain levels of service are acceptable. As with all economic analysis, a sensitivity analysis should be carried out on those parameters which are more likely to be beyond the control of the organization, such as market forces affecting the opportunity cost of capital, community expectations/perception on risk and factors in the long-term, health and safety effects, community economic effects, environmental and social effects, feasibility including public support and the Municipality's readiness.

4.4.2 LEVEL OF SERVICE APPROACH

The implementation of a formal Maintenance Management System (MMS), among many other items, measures the response time, lag time, total time to resolution, resources involved, and communication logs for all issues identified internally and by customers. Going forward, this type of information not only provides the basis for resource and program management decisions but is key information that will provide council and the public with the service level information in relation to the cost of service. Historically a significant portion of activities has been provided at a 'best we can do with what we have' basis. Through a review of design guidelines, and metrics being captured by the MMS, the Township of Alnwick/Haldimand can re-orientate service delivery that is driven by service level expectations that incorporate Level of Service factors. To assist in better establishing Levels of Service, the Township should also consider collecting technical performance measures needed to provide information on:

- the types of failure
- the number of customers affected
- the duration of the failure
- the severity of the failure

This kind of technical performance measurement and monitoring is undertaken to support decision-making by the asset managers within an organization. It addresses issues for consideration in the effective management of the assets, such as:

- Assessing the effectiveness of the operational, maintenance and capital works program
- Review and refinement of maintenance and rehabilitation strategies and standards
- Assistance in strategic decision-making through the definition of remaining life, based on the measure being assessed, e.g. capacity of a pipe versus demand.

Benchmarking and other comparison management techniques are used both internally and for external regulation and monitoring, to assess the performance of infrastructure groups and asset owners. Each Municipality needs to consider developing rating systems to judge the assets from both a Municipality's perspective with the values that it brings to the organization, and also from a user's or regulator's perspective, in terms of the functionality, suitability, cost and service performance of the asset.

4.4.3 LEVELS OF SERVICE PROCESS

Some Levels of Service (LOS) for the Municipality can be attained through documents developed in the industry and by internally focusing on technical requirements that meet generally expected levels of operation and safety:

- Provincial Minimum Maintenance Standards (MMS) for roads, street lighting, water and drainage
- Drinking Water Quality Management System (DWQMS)
- Engineering Standards Manuals

Operating Performance Indicators – These are the main activities within each operating budget cost center. These activities (OPI's) link directly to the level of service provided by the Municipality. The OPI's also include maintenance tasks that help extend asset life. A good balance between asset replacement through capital funding and ongoing maintenance provides the best cost efficiency and service productivity.

4.4.4 OPERATING PERFORMANCE INDICATOR EXAMPLE

ROADS				
Service	Operating Performance Indicators (OPI)	Current Performance	Target Performance	Timeframe
Examples for Roads below:				
Road Maintenance & Repairs	Complete approximately X work orders per year for service requests including pothole repair, minor asphalt patching, sightline improvement, MVA clean-up.	1500	500	3 Years
Brushing and Roadside Mowing	Complete approximately X km's of brushing on roadsides annually.	N/A	50 km	2 Years
	Complete roadside mowing X times annually	2	3	3 years
Boulevard Maintenance	Twice per year cut every boulevard in the Municipality.	2	3	3 Years
	Annual weeding, cleaning, and caulking of X km of sidewalk and curb.	7	7	
	Maintain sight lines at intersections for vehicle and pedestrian safety.	14 Days	14 Days	Timeline Achieved
	Roads Recapped ____km's - Annual Average	8	30	2 Years
	Gravel Roads Surface Treated ___km's - Annual Average	3.5	20	2 Years
Curbing/Shoulders	Annual repair, by August, of all curbing damage in previous winter.	September	July	1 Year
Sidewalks & Walkways	Completed Inspections _____times per year	1	1	Timeline Achieved
	Sidewalks / Walkways swept _____ times per year	1	1	Timeline Achieved
Vandalism	Within X hours of notification, remove graffiti.	48	24	1 Year
Street Lighting	Service requests for street light repair completed within X hours.	5 days	48 hours	1 Year
Signs	Annual inspection and maintenance of all X stop signs.	1225	1225	Timeline Achieved
	Annual inspection of crosswalk, pedestrian,	September	July	1 Year

	school and playground signs and beacons.			
	Annual Upgrade of X signs to diamond grade	12	25	1 Year
Snow and Ice Control	Major roads including emergency routes during winter events.	16 Hours	16 Hours	Timeline Achieved
	Residential areas – through roads first then cul-de-sacs and dead ends.	16 Hours	16 Hours	Timeline Achieved
	Residential areas will be plowed and maintained within 96 hours unless snow and icy conditions return crews back to major roads.	16 Hours	16 Hours	Timeline Achieved
VEHICLES – FLEET				
Service	Operating Performance Indicators (OPI)	Current Performance	Target Performance	Timeframe
Fleet Maintenance	Undertake preventative maintenance and repairs to meet industry standards for safety and operation.	Daily	Daily	Timeline Achieved
	Maintain fleet availability at X%.	80	100	3 Years
Small Equipment	Inventory, maintain and repair X pieces of small equipment for use by all departments.	40	40	Timeline Achieved
Preventative Maintenance Services	X units inspected every X months to maintain safety and fleet efficiency.	32 Units every 250 Hours	32 Units every 250 Hours	Timeline Achieved
WATER				
Service	Operating Performance Indicators (OPI)	Current Performance	Target Performance	Timeframe
Valves & Air Valves	Exercise all line valves X per year with monthly/quarterly/yearly reporting	1	1	Present
Water Main Breaks	Upon notification emergency response and water shut down within X minutes.	60	60	Present
	Repair completed and water service re-instated within X hours.	12	12	Present

	Currently experiencing X breaks per year on average	0	>2	Present
Service Connection Renewals	X renewals completed each year on average.	0		
	Service connections associated with Road Rehab Program and capital projects are checked and replaced as necessary.	at that time	at that time	Present
Pump Stations	Annual painting	no	yes	Present
	Annual vegetation control	yes	yes	Present
	X year cycle – rebuild control valves.	as necessary	10 years	Present
	X year cycle – rebuild or replace pumps.	as necessary	15 years	Present
	Weekly trouble shooting and repairs	yes	yes	Present
	X weekly visual inspections	7	7	Present
Stations	Maintain all pressure reducing stations to operate without failure.	as necessary	every 5 years	Present
	X year cycle - complete replacement of each station	as necessary	as necessary	Present
	X year cycle - complete rebuild of the system.	as necessary	every 10 years	Present
	Annual painting and vegetation control.	n/a	n/a	n/a
Water Testing	100% of water samples contain no bacteriological contaminants.	100%	100%	Present
	Monthly reporting	no	no	Present
WPC Chlorination	Disinfects X% of Municipality supply.	100%	100%	Present
	Daily data acquisition and inspection	yes	yes	Present
	Daily water testing	yes	yes	Present
	Monthly chlorine cylinder replacement.	n/a	n/a	n/a
	Semi-annual chlorination equipment replacement and repairs	n/a	n/a	n/a
	Annual painting and vegetation removal	n/a	n/a	n/a
	X year cycle - replacement of small piping and control valves.	as necessary	every 10 years	Present

Reservoir Chlorination	Disinfects X% of Municipality supply	n/a	n/a	n/a
Water Main Flushing	Annually flush all supply lines.	annual	annual	Present
Service Call-outs	Provide 24/7 on call coverage for emergency response.	yes	yes	Present

4.4.5 CURRENT LEVEL OF SERVICE

The Level of Service for each asset is defined either by its condition rating, or by an age-based rating, e.g., Percent of Remaining Service Life (%RSL). Generally, condition ratings are preferred to age-based ratings, and are used wherever they are available. Different condition rating Indices are used for different assets, for example PCI, PQI or PASER, etc. for roads, NCAP for pipes, BCI for bridges, etc. Municipalities are encouraged to have conditions assessed for as many assets as possible.

The overall Level of Service Rating is weighed in the most appropriate way, depending on the asset. For example, linear assets like roads and utility pipes are usually weighed be length, assets of similar cost like hydrants, park benches, etc. are weighed by Quantity or Count, and Equipment or Fleet assets with large cost variations would typically weighed by Replacement Costs.

Alnwick/Haldimand's Network Condition Report Card is shown here:

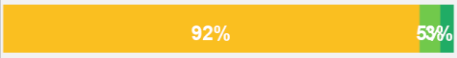
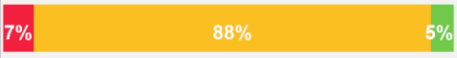
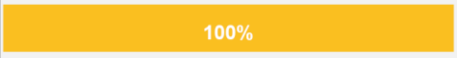
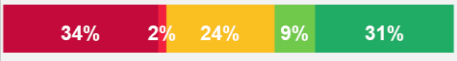
Asset Type	Network Size	No. of Assets	Network Condition	Condition State	Condition Distribution
Roads	635 Km	808	36.4	Poor	
Street Lights	$146,272	224	75	Good	
Bridge	$21,352,335	20	71.58	Fair	
Culverts (Structural)	$12,715,037	26	68.82	Fair	
Sidewalks	2 Km	12	53	Good	
Traffic Signs	3010 ea.	1584	67	Good	
Waterlines	19 Km	195	67	Good	
Treatment Plants (Water)	$5,253,406	38	47	Fair	
Valves (Water)	$944,398	224	70	Good	
Hydrants	$947,955	118	48	Fair	
Water Meters	$307,528	3	73	Excellent	
Vehicles	$8,488,341	41	51	Fair	
Playgrounds	4 ea.	4	82	Excellent	
Ball Fields-Diamonds	4 ea.	4	0	Very Poor	
Equipment	$4,370,958	83	41	Fair	
Land Improvements	3 ea.	3	63	Good	
Wells	2,979,533	3	18	Poor	
Buildings	$18,645,197	39	49	Fair	

Figure 4: State of the Infrastructure Report Card

4.4.6 LIFE CYCLE CONSIDERATION

The Life Cycle of an asset is the time span from when an asset is first put into service to when it is replaced or discarded. Various intervention options are available during the life on an asset. These are divided into Early-Life interventions, (preventive maintenance), Mid-Life interventions (minor rehabilitation) and End-of-Life interventions (major rehabilitation, reconstruction, replacement). In addition, there are operation or routine maintenance interventions. For each asset type the suitable life cycle interventions available to the municipality are identified with the corresponding costs. The DOT™ software, during its optimization analysis, will determine the best possible intervention strategy, applying the right treatment at the right time, to maximize the life cycle of each asset at minimum cost and ensuring the maximizing the asset performance

throughout the asset's lifecycle, while satisfying the Level of Service, risk tolerance and budget constraints at the same time.

4.4.7 RISK METHODOLGY

The Concept of Risk

In an ideal case, Risk can be determined using the formula below based on the Probability of Failure and the Consequence of Failure in monetary terms. Formulations can be more complex using concepts such as risk mitigation and vulnerability.

Risk = Pf × Cf
Pf = probability of failure
Cf = consequence of failure in monetary terms

Quantification of Pf and Cf, however, is not an easy task and requires major research and development in addition to data collection by experts at municipalities. In practice, a variation of the above formula is used to determine a Risk Index based on the combination of **Criticality** (instead of the monetized consequence of failure) and **Likelihood of Failure** (instead of detailed probability functions and values). Criticality is typically determined based on the properties of various assets. Physical attributes or Community Impact factors can contribute to the criticality level. As an example, a large size sewer pipe with potential environmental impact has a higher criticality as compared to a small residential pipe. Likelihood of failure is determined based on the condition assessment protocol and determination models. In the software, you can create various functional relationships between condition index and LoF as part of your CI settings.

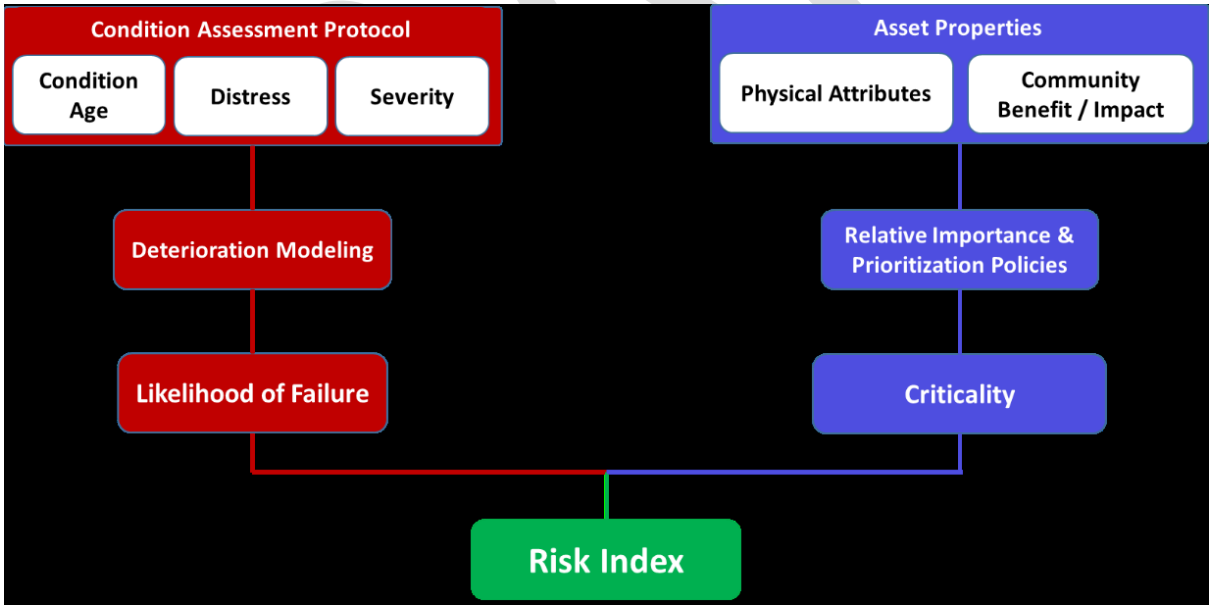


Figure 5: Concept of Risk

Risk Matrix Settings

Likelihood of Failure is calculated from the Level of Service for each asset. A typical relation of Asset Condition and Likelihood of Failure for a specific asset type is shown in Figure 6:

Figure 6: Likelihood of Failure Setting

Consequence of Failure is calculated from the Criticality value calculated for each asset. A typical relation of Criticality and Consequence of Failure is shown in Figure 7:

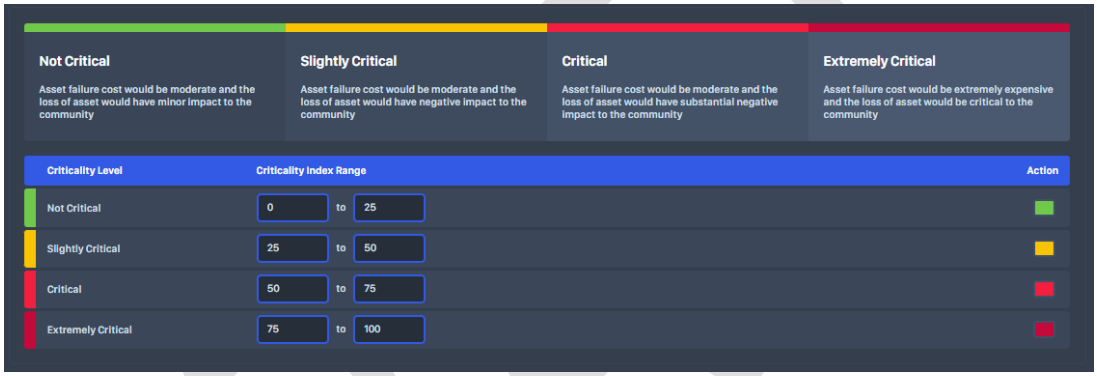


Figure 7: Consequence of Failure Setting

The combination of Criticality and Likelihood of Failure represents different risk levels. This combination is usually presented using a Risk Exposure Matrix and shown below.

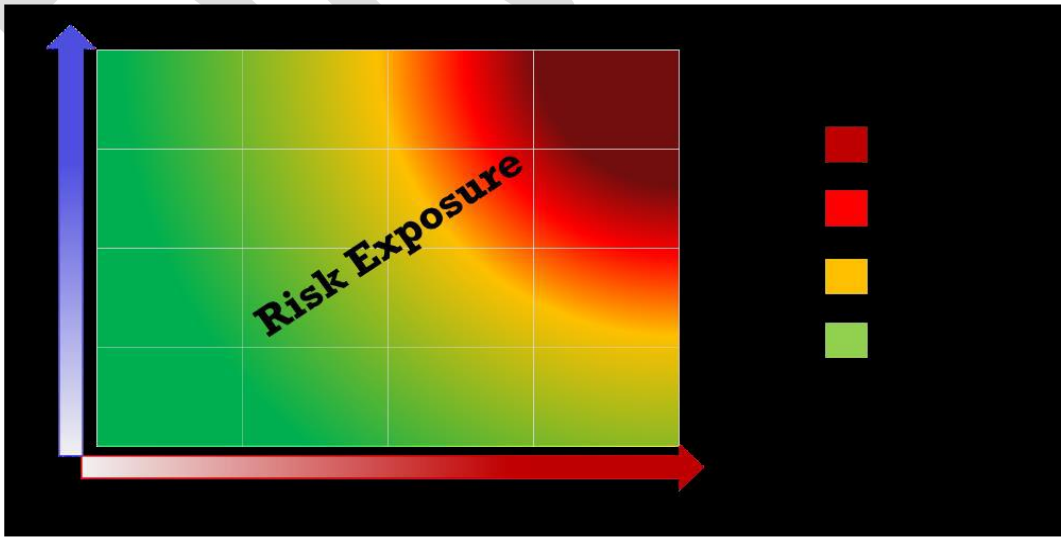


Figure 8: Risk Exposure Matrix

The DOT™ software utilizes your criticality and LoF settings to automatically calculate and produce Risk Matrix results to identify assets at different risk levels. Each point on the Risk Matrix below represents one asset such as a road segment or sewer pipe.

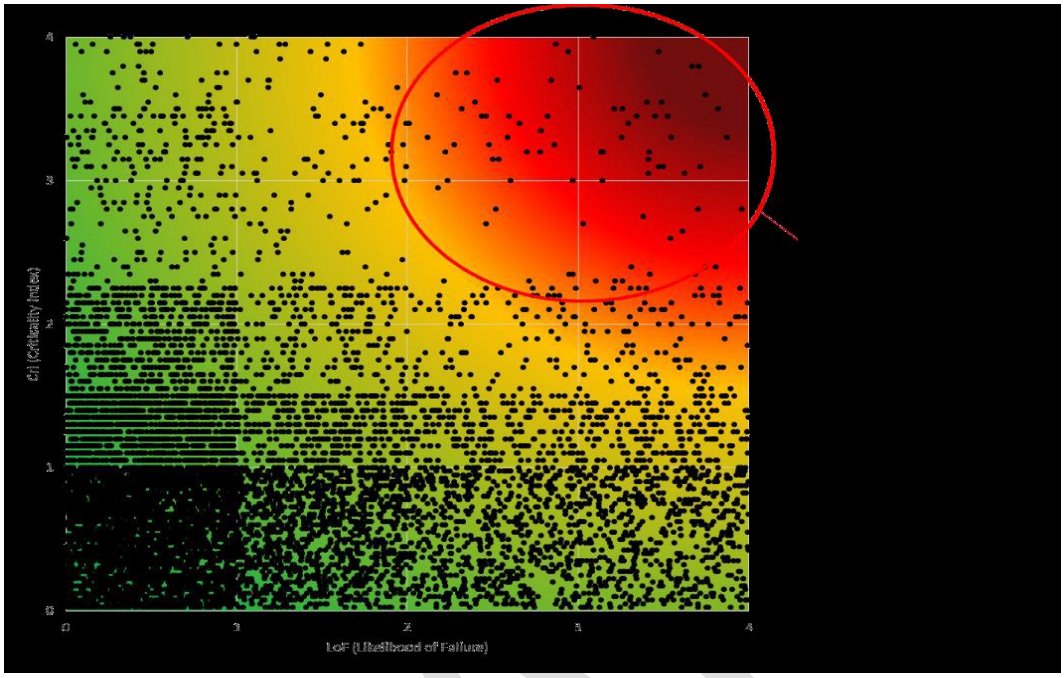


Figure 9: Risk Exposure Matrix of Assets

Risk matrix and risk level ranges can be set on the settings page of the software.

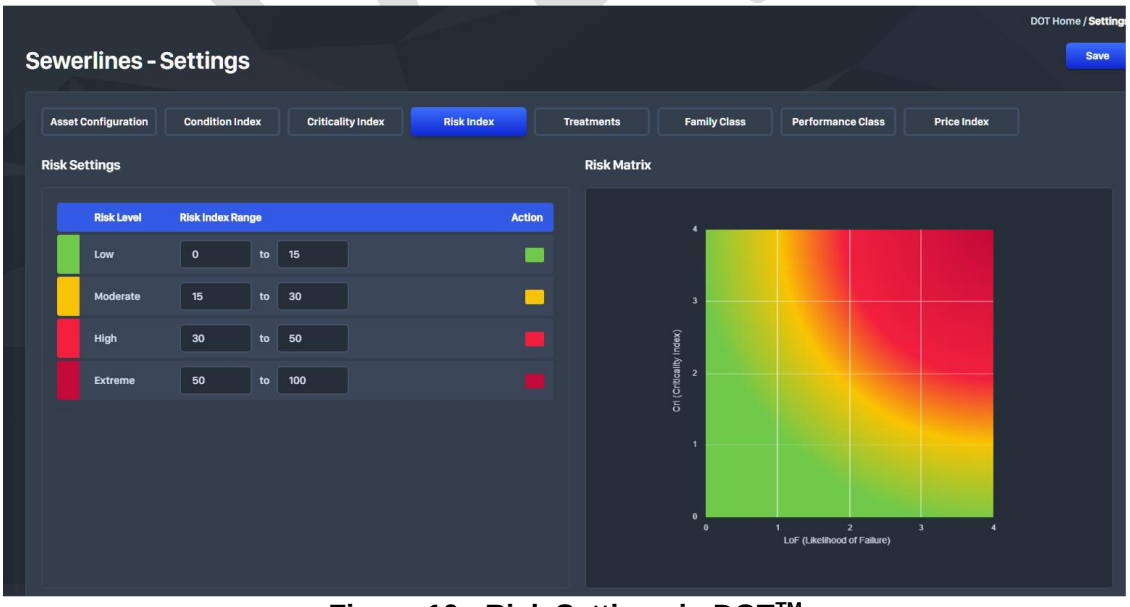


Figure 10: Risk Settings in DOT™

Risk Tolerance

As part of LoS settings, Risk Tolerance can be set to determine allowable risk thresholds for various Performance Classes and asset types. The following example shows a risked-based

optimization scenario with the objective of maintaining the network risk level at low and moderate levels. In other words, the optimization process allocates available funding to eliminate all events exhibiting high and extreme risk levels over the planning horizon.

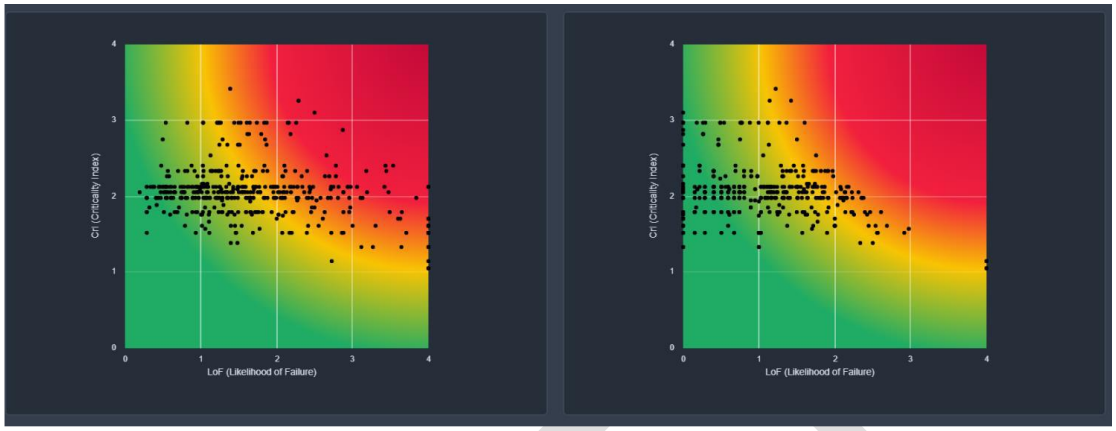


Figure 11: Risk-based Analysis Before/After Results in DOT™

4.5 CLIMATE CHANGE AND ADAPTION MEASURES

Municipalities are encouraged to address climate change, both by adopting measures to mitigate the effects and risks of climate change to the municipality, and by looking for ways to reduce the carbon footprint. Municipalities have the ability to force change through by-laws and zoning.

Carbon Footprint

Municipalities can have a positive impact on reducing the carbon footprint. These include improving the energy efficiency of municipal facilities, buildings and fleet. Municipalities can also work with utility providers to facilitate the installation of public and private electric vehicle charging stations, wind generators, etc. through by-laws, zoning or even by just making public land available for installations. For new construction, the use of sustainable energy can be mandated, for example through photovoltaic installation on roofs, as well as requiring provisions for EV charging, for example.

The municipality should engage in the development of a Climate Change Action Plan (CCAP). The objectives of the Plan are to:

1. Understand and address climate change at the municipal level (infrastructure, operations, service delivery) using Infrastructure Canada's two Climate Lens assessment frameworks for greenhouse gas (GHG) mitigation and climate resilience.
2. Provide a municipality-wide baseline and forecast of greenhouse gas (GHG) emissions using the Broader Public Sector: Energy Reporting and Conservation and Demand Management Plan required under Ontario Regulation 507/18.
3. Complete a climate change risk assessment for critical municipal infrastructure that is in accordance with Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure.
4. Establish specific targets for reducing GHG emissions using a scenario planning approach. These benchmarks should align with the federal GHG reduction target of 40-45 percent below 2005 levels by 2030 under the Canadian Net-Zero Emissions Accountability Act and outlined in Canada's Climate Actions for a Healthy Environment and a Healthy Economy.
5. Compliance (see PCP compliant plans) with FCM's Partners for Climate Protection (PCP) program's Milestones One, Two, and Three requirements.

6. Compliance with ICLEI Building Adaptive & Resilient Communities (BARC) Milestones One, Two, and Three requirements.

Mitigation:
Climate change, also referred to as global warming, results in more extreme and more frequent severe weather events. This includes strong winds, tornados and hurricanes, heat waves and intense rain or snow falls. The municipality should assess its infrastructure to minimize the risk of damage/loss to life and property, and to be prepared to deal with these extreme weather events.

Examples of climate change mitigation include upgrading infrastructure to minimize flooding, for example improving storm water run-off into waterways, doing a flood plain analysis and minimize development in low lying areas with higher flood risk, LID's (Low Impact Developments) like rain gardens, bioswales, infiltration trenches, permeable pavement or rainwater harvesting, and minimizing storm water from entering the wastewater system to prevent the release of untreated wastewater into the environment.

Measures to mitigate draught include minimizing the run-off of rainwater into the storm system, for example by disconnecting roof drains from the storm system and discharging downpipes into permeable landscape, permeable pavement driveways, minimizing water consumption through metering and rate structures, and to ensure sufficient water supply. Another aspect is to deal with the increased likelihood of fires, in particular wildfires, by strictly enforcing seasonal fire bans and other activities that could start a fire, and providing sufficient water reservoirs for firefighting.

Mitigation measures also include an effective early warning system and having clearly defined emergency procedures and periodic training in place.

5 COMPREHENSIVE ANALYSIS BY ASSET TYPE

Our DOT (Decision Optimization Technology)™ Transportation capital planning tool provides a robust decision-making process, identifies the best possible course of action, and considers both the short-term needs and the long-term goals of a municipality. It includes an advanced decision-making process called optimization or prescriptive modeling, which is the most powerful and effective way of finding the best possible solution to a decision-making problem. A capital planning tool with optimization capability can maximize the overall performance of a network in terms of physical condition (or any other criteria) over a multi-year analysis horizon and provides municipalities with the best possible course of action in terms of timing and selection of different maintenance, rehabilitation, or reconstruction treatments considering all municipal goals and constraints. The improvements achieved through an optimized solution, which inevitably highlights the critical importance of preventive maintenance, can be translated into substantial savings and increased socio-economic benefit (Figure 12).

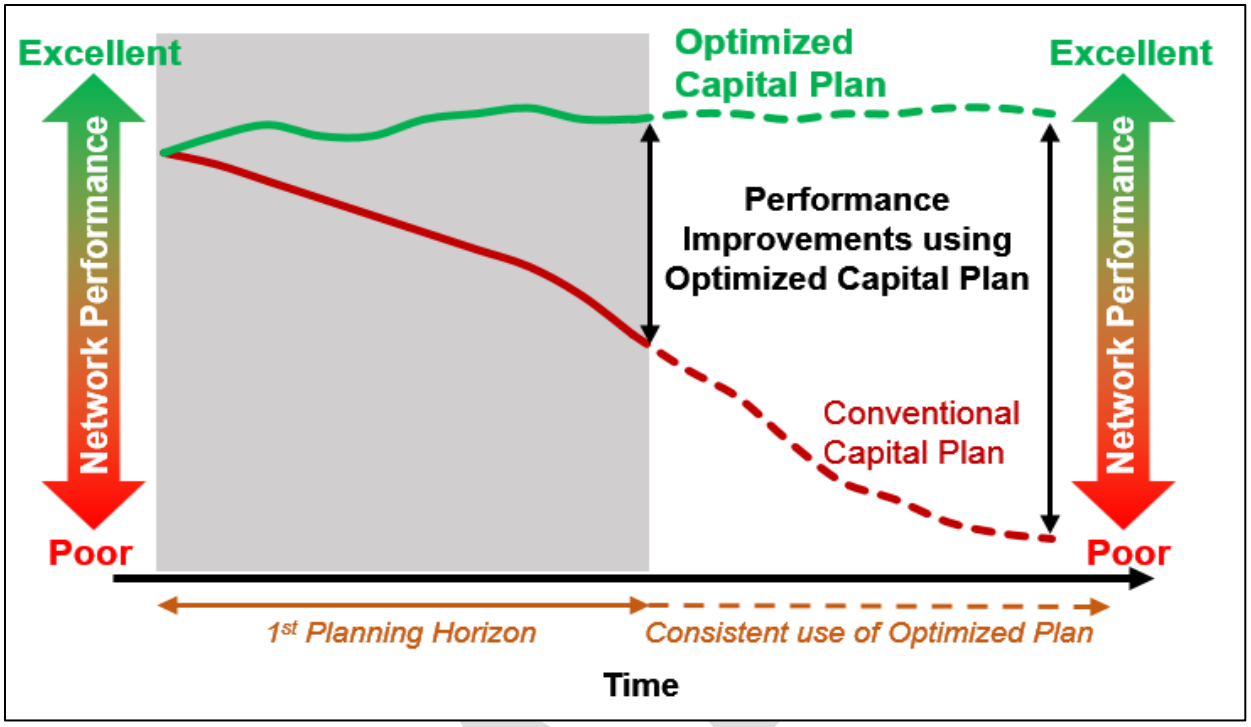


Figure 12: Optimized vs. Conventional Capital Planning

Combining advanced optimization capabilities with robust engineering models and socio-economic consideration provides municipalities with a fully implementable and defensible road network capital plan. The analytical models used in the system are flexible, able to adjust to regional variances and reflect the behavior of assets verified through a rigorous analysis.

5.1 ROAD NETWORK

The Township of Alnwick/Haldimand has a total of 477.9 km of roads in total in the form of Earth, Gravel, Surface Treated (Chip Seal) and Paved (Hot Mix Asphalt) roads.

5.1.1 ROAD GEOMETRICS AND ATTRIBUTES

The following summarizes the road surface types within the Municipality:

Surface Type	Length (km)	Percentage
Hot Mix Asphalt	17.8	3.7%
Surface Treated	300.0	62.8%
Gravel	126.9	26.6%
Earth	33.2	6.9%

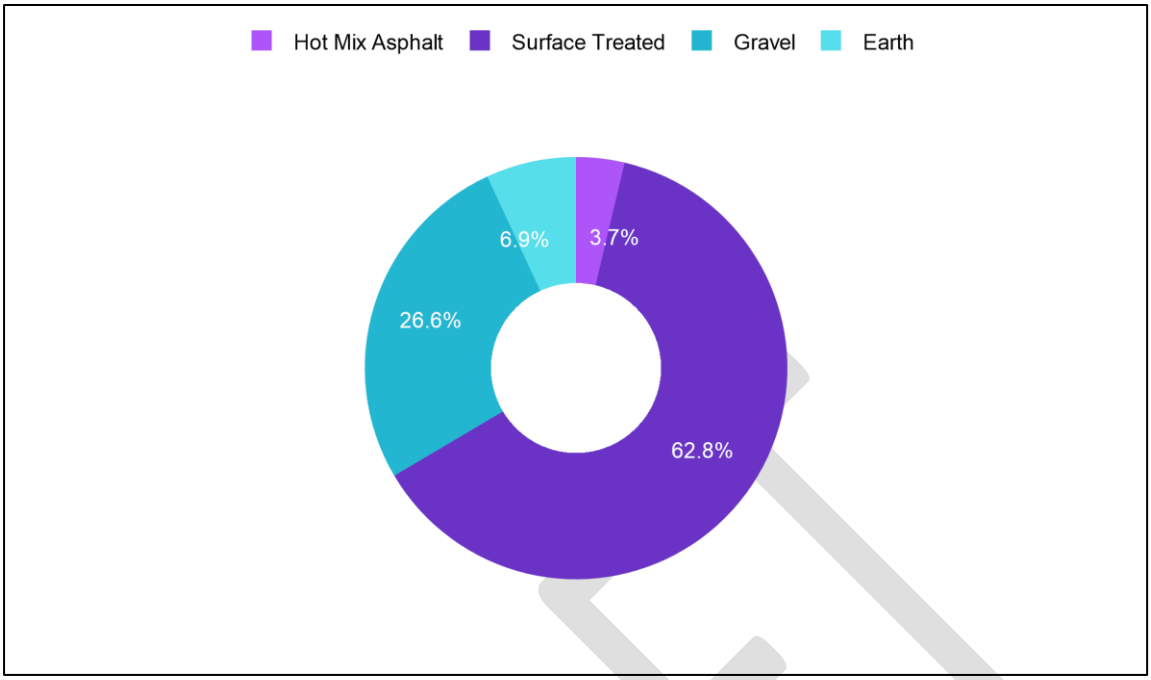


Figure 13: Road Surface Types by Section Length

5.1.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for roads is determined through a condition based analysis. The five (5) Condition States are defined as follows:

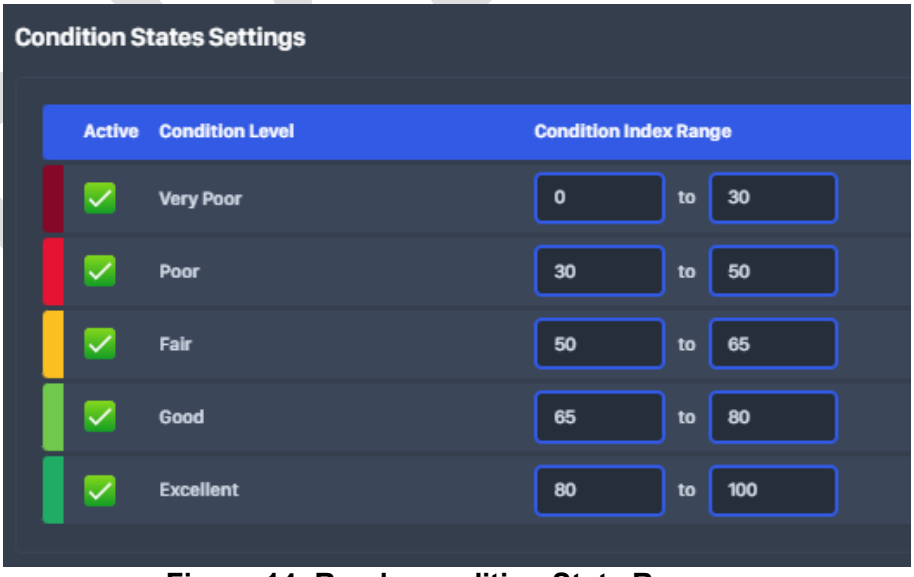


Figure 14: Roads condition State Ranges

The most recent Roads PCI condition assessment was done in 2016 by J.D. Jewell Engineering Inc, and DOT™ was used to calculate estimated 2021 PCI condition ratings by applying all road maintenance projects since the 2016 assessment, and built-in degradation curves. Because the

maintenance history of gravel roads was not available, only Paved roads (Hot Mix Asphalt and Surface Treated) are included in this process. Based on this methodology, the current estimated 2020 Network Condition (PCI) of the paved roads is 42.0, which is a slight increase over the 2016 Network Condition of 41.5. This represents an overall "Poor" condition state.

Title	Condition (PCI)	Condition State
Network Overall Condition 2016	41.5	Poor
Current Estimated Condition 2020	42.0	Poor

The following summarizes the estimated 2020 Network Pavement Condition Index (PCI), weighted by section length:

Condition-EST 2021	Length (km)	Percentage
Very Poor	317.2	72.5%
Poor	44.8	10.2%
Fair	20.4	4.7%
Good	14.4	3.3%
Excellent	40.7	9.3%

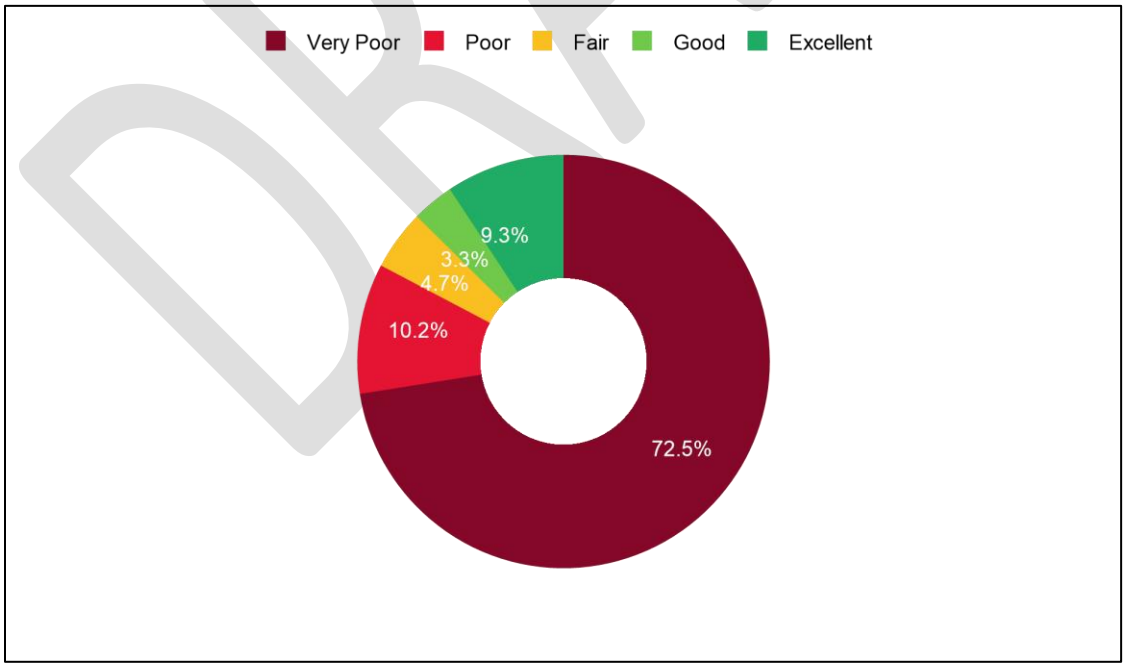


Figure 15: Road Network Condition

The condition state by Surface Type is shown in Figure 16:

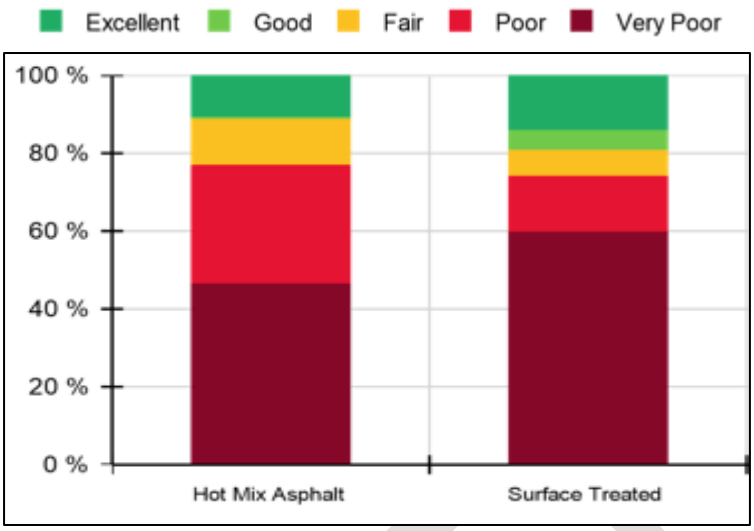


Figure 16: Est. 2021 Road Network Condition by Surface Type

The Map view of the condition state is shown in Figure 17.

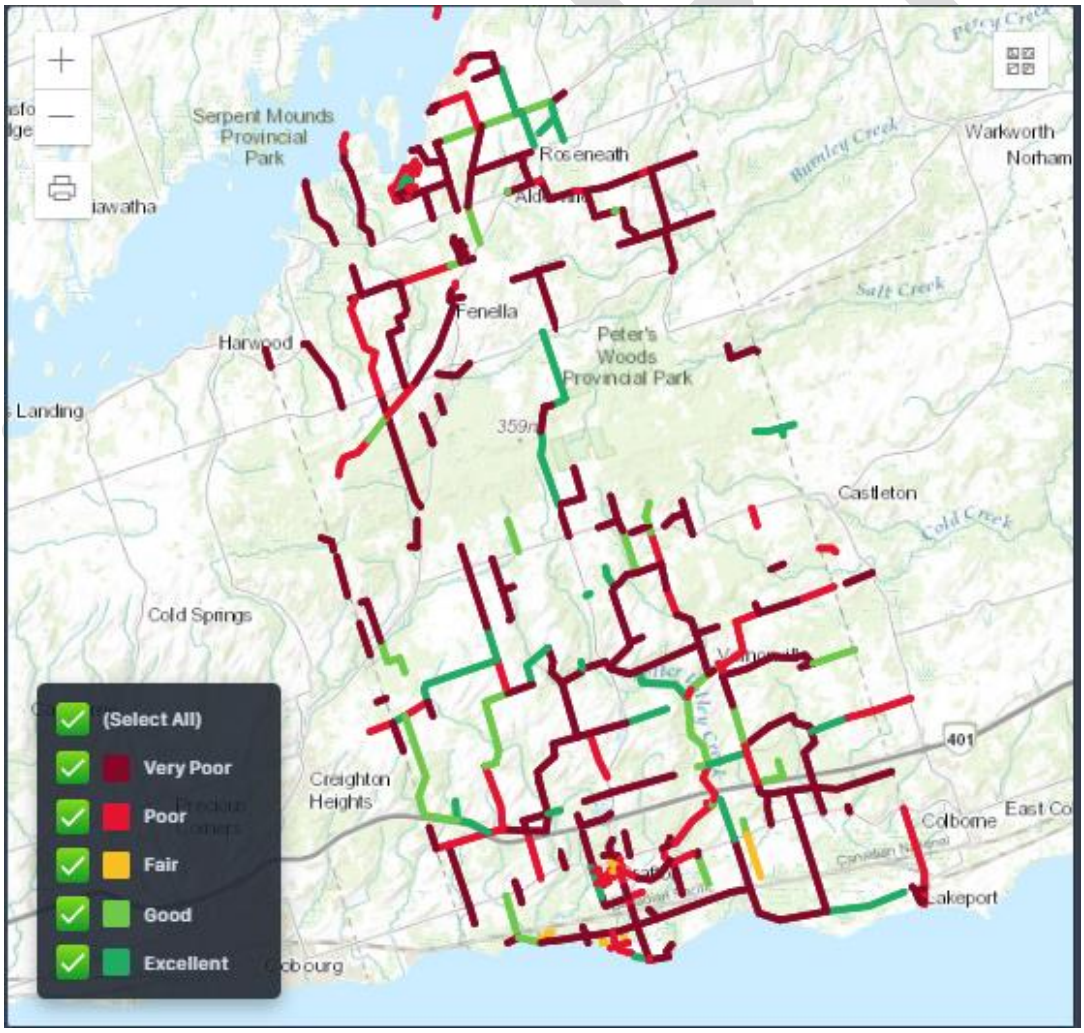


Figure 17: Est. 2021 Road Network Condition Map

5.1.3 CRITICALITY AND RISK CRITERIA

Criticality

Based on the Data Attributes available, the Criticality settings were applied based on Minimum Maintenance Standard Classification and Surface Type. Socio-economic factors were not included at this time.

Criticality Settings	
Minimum Maintenance Standards	**10**
1	0
2	0
3	0
4	100
5	50
6	10
Surface Type	**5**
Composite	0
Concrete	0
Earth	0
Gravel	10
Hot Mix Asphalt	100
Surface Treated	60

Criticality Ranges are in the software as follows:

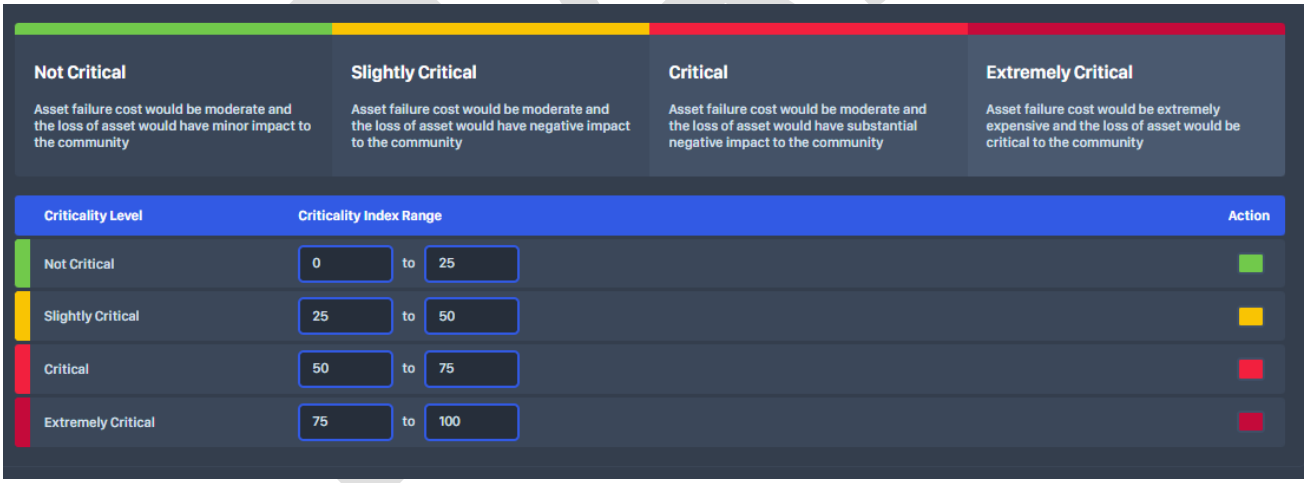


Figure 18: Criticality Ranges

The map (Fig 19) view shows the criticality states of the various road sections:

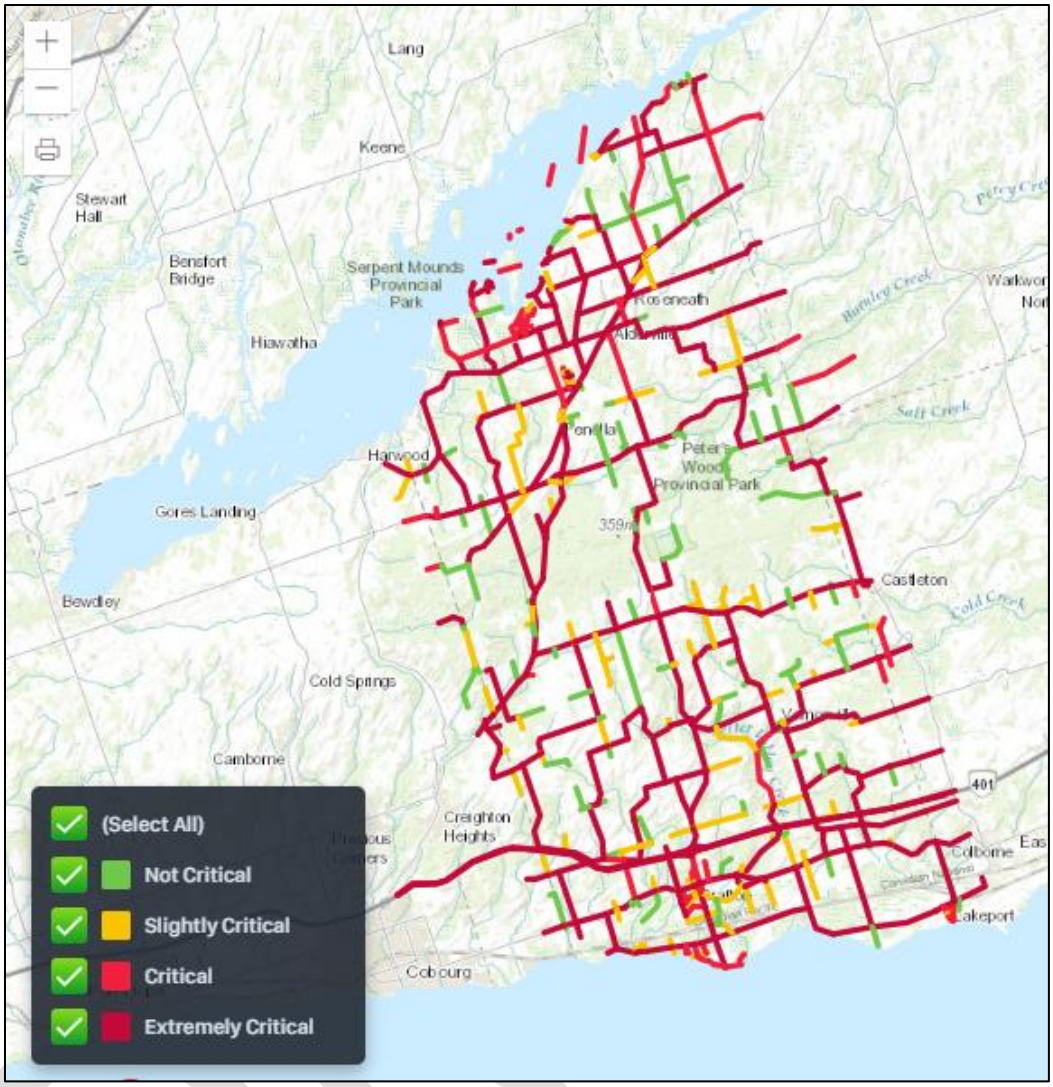


Figure 19: Road Network Criticality Map

Risk

The Risk is based on the Likelihood of Failure which is derived from the PCI condition ratings as shown here:

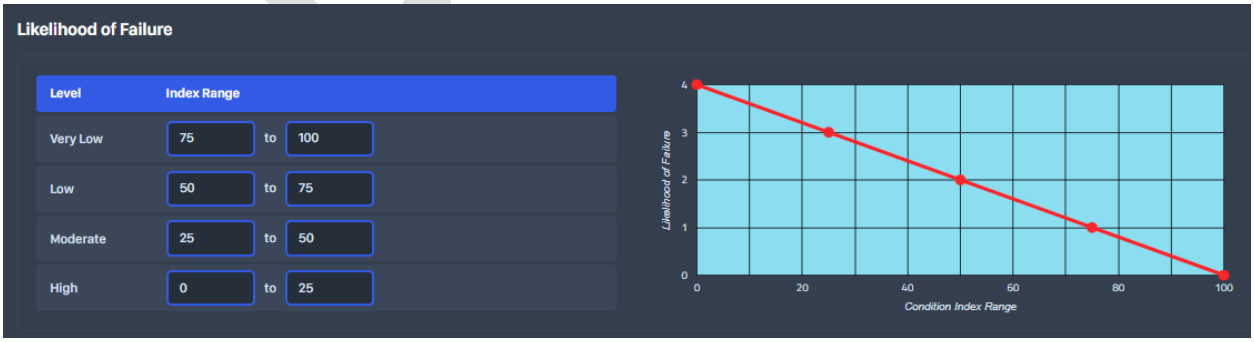


Figure 20: Likelihood of failure settings

Risk is then calculated based on the Likelihood of Failure settings based on condition, and the Consequence of Failure settings based on Criticality.

The default Risk settings are used for Roads, as described in section 4.

This map (Fig 21) view shows the Risk levels of the road system:

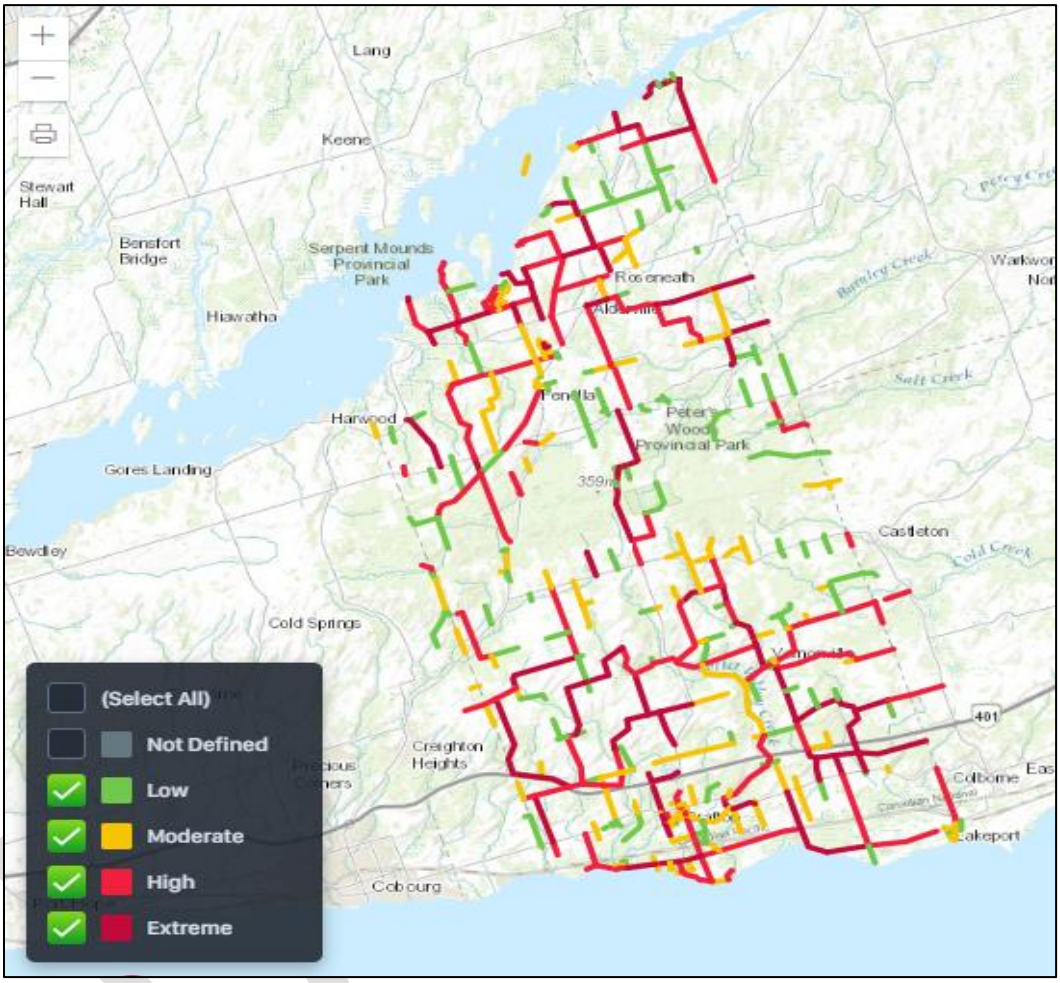


Figure 21: Map view of Risk levels

Due to the nature of the Roads assets, there are no risk targets set in the planning.

5.1.4 LEVEL OF SERVICE REQUIREMENTS

The Township targets an improvement of the Network condition for paved roads from the current Network PCI of 42 to achieve a Network PCI of 50 which is the threshold from Poor to Fair condition, by the end of the 10-year plan period. No other Level of Service targets are set. The Township has a large number of roads in very poor condition, and by maintaining their good roads first it will have more funds available to tackle these very poor roads as time goes by.

The Level of Service Settings are as follow:

LOS Constraints

Target Performance

Name	Perf. Class	Perf. Attribute	Constraint	Violation	Penalty
Target Performance	Network	PCI	>= 50 by 2030	Soft	Normal

5.1.5 LIFECYCLE MANAGEMENT STRATEGY

A number of treatment options is available for Hot Mix Asphalt (HMA) and Surface Treated (ST) roads, including Routine Maintenance, Preventive Maintenance, Minor and Major Rehabilitation and Reconstruction treatments. The treatment options and their unit costs are summarized here:

Treatment	Description	Unit Cost
ST-Slurry	Slurry Seal	3.50 $/m²
ST-SST	Single Surface Treatment (Chip Seal)	4.00 $/m²
ST-DST	Double Surface Treatment (Chip Seal)	6.50 $/m²
ST-DST SAMI	Double Surface Treatment (Chip Seal) & SAMI	8.50 $/m²
ST-EnhSurf	Enhanced Thin Surfacings (Microsurfacing, Thin HMA Overlay)	4.00 $/m²
ST-Enh2Surf	Enhanced Double Thin Surfacings (Double Microsurfacing, Cape Seal)	6.50 $/m²
ST-FDR & DST	Full Depth Reclamation (FDR) + Double Surface Treatment	10.00 $/m²
ST-FDR & DST & SAMI	Full Depth Reclamation (FDR) + Double Surface Treatment + SAMI	12.00 $/m²
HMA-Crack Seal	Crack Sealing	0.25 $/m²
HMA-Slurry	Slurry Seal	3.50 $/m²
HMA-ST	Single Surface Treatment (Chip Seal)	4.00 $/m²
HMA-DST	Double Surface Treatment (Chip Seal)	6.50 $/m²
HMA-DST SAMI	Double Surface Treatment with SAMI	8.50 $/m²
HMA-EnhSurf	Enhanced Thin Surfacings (Microsurfacing, Thin HMA Overlay)	4.00 $/m²
HMA-Enh2Surf	Enhanced Double Thin Surfacings (Cape Seal, Double Microsurfacing)	6.50 $/m²
HMA-Ovly	One Lift Overlay / Mill and One Lift Overlay	24.00 $/m²
HMA-2Ovly	Two Lift Overlay / Mill and Two Lift Overlay	48.00 $/m²
HMA-FDR & 2Ovly	Full Depth Reclamation (FDR) + Two Lift Overlay	51.50 $/m²
HMA-FDARR & 2Ovly	Full depth asphalt removal and replacement (Two Lifts HMA)	53.00 $/m²
HMA-FDARR & 3Ovly	Full depth asphalt removal and replacement (Three Lifts HMA)	77.00 $/m²
HMA-Recon 90HMA	Full Depth Reconstruction (350 Gran B, 150 Gran A, 90 HMA)	198.20 $/m²
HMA-Recon 140HMA	Full Depth Reconstruction (350 Gran B, 150 Gran A, 140 HMA)	222.20 $/m²

Utilization of Preventive Maintenance Treatments

In 2018 Infrastructure Solutions Inc. conducted the most comprehensive Canadian survey of municipal road maintenance practices ever undertaken. The 171 survey participants represented 45,000 km of paved road, 15% of Canada's population, and a wide range of municipalities by region and population. The survey was designed to identify the extent to which municipalities apply preventive maintenance treatments, to attain practical observations about treatment options and lifecycle gains and clarify user perceptions about what constitutes best road maintenance practices. The results are truly disturbing.

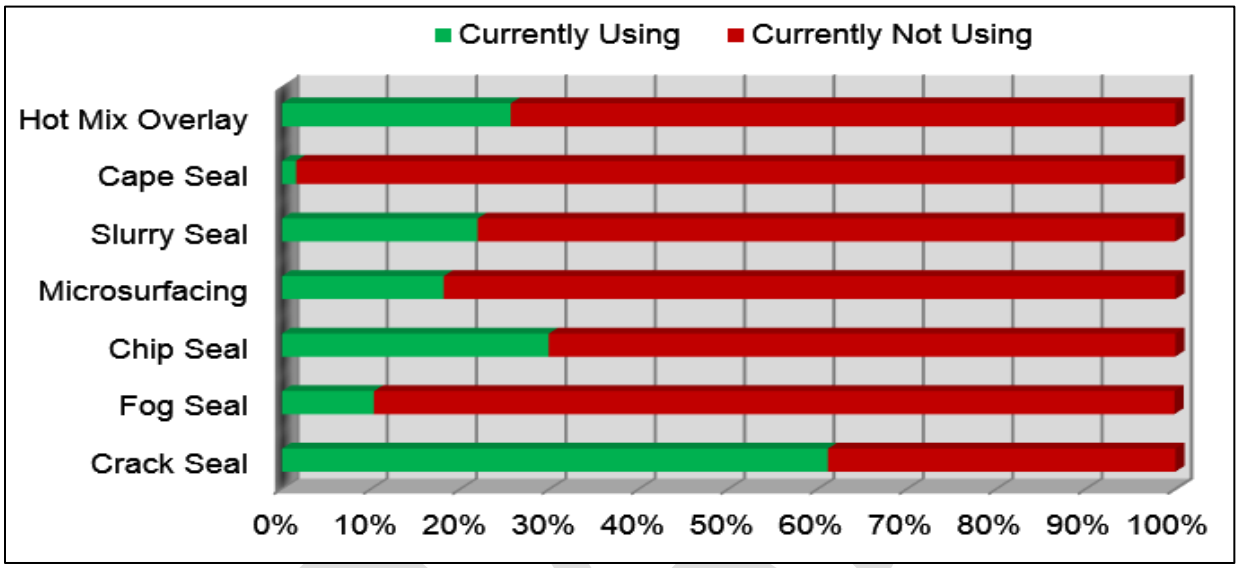


Figure 22: Current Application of Preventive Maintenance Across Canadian Municipalities

The survey established that 98% of respondents perceive preventive maintenance as an important and cost-effective approach to extend the service life of their pavements and to save the municipality significant capital investment in the long run. The survey further establishes that a majority of the municipalities do not apply preventive maintenance treatments (Figure 3) and have a widely-varied understanding of when these treatments should be applied.

Respondents were asked what percentage of their municipality they believe is currently being maintained according to best practices. Figure 4 shows the survey's cumulative response on the application of chip seal, micro-surfacing, and slurry seal to paved roads. For every major surface treatment type, less than 20% of municipal road networks are maintained in accordance with what respondents believe to be best practice.

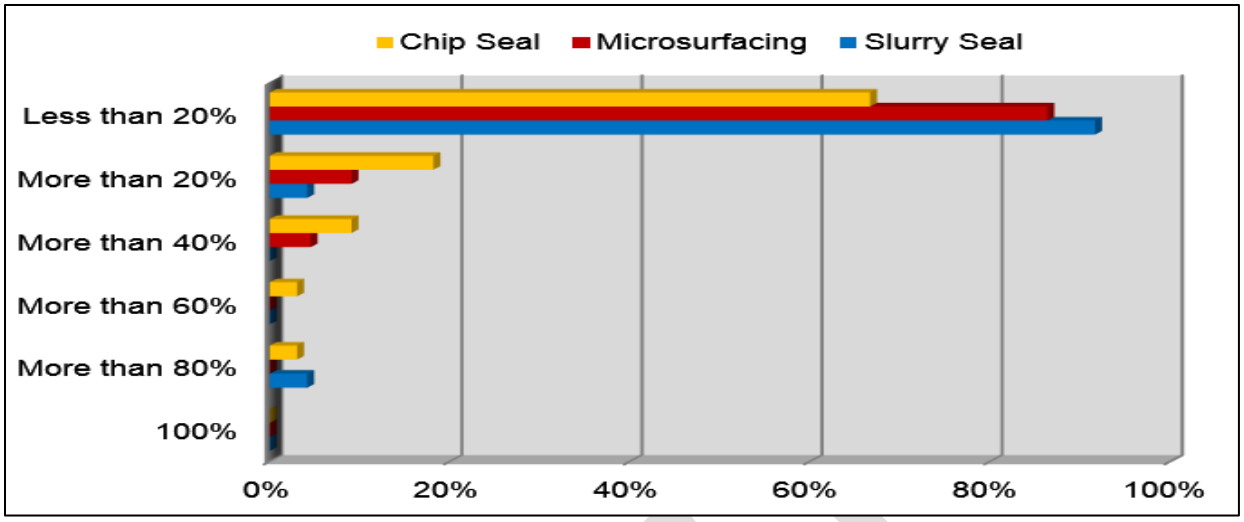


Figure 23: Application of Preventive Treatments According to Best Practices

This contradiction between the clearly appreciated benefits of preventive maintenance and the inadequate application of preventive treatments in practice has deep roots. Municipalities may be overly reactive to community requests. Councils surely follow the advice of Roads Needs Studies, where engineering companies recommend repairing worst roads first for safety and other reasons, assuming an unlimited municipal budget. Deteriorated water or wastewater lines might necessitate road reconstruction for line replacement and take precedence over maintenance. Smaller municipalities often use Excel or simplistic pavement management programs which typically recommend projects based on a simple ranking process. Finally, many municipalities still operate on an ad hoc basis, arbitrarily selecting roads which need rehabilitation or reconstruction work without undertaking any analytical process whatsoever. Whatever the circumstance, tax dollars are being poured into potholes unnecessarily.

5.1.6 BUDGET CONSTRAINTS

A Target Scenario was run to establish required funding levels to achieve a PCI of 50 by the end of the 10-year plan. An annual Capital budget of $1.15 million and a Routine Maintenance Budget of $45,000 is required to achieve this goal.

Total Capital Budget					
Name	**Subset**	**Settings**	**From**	**To**	**AGF**
Total Capital Budget	NA	<= $1,150,000	2021	2030	0.0%
Total Routine Maintenance Budget					
Name	**Subset**	**Settings**	**From**	**To**	**AGF**
Routine Maintenance Budget	NA	<= $45,000	2021	2030	0.0%

5.1.7 OPTIMIZED CAPITAL PLANNING RESULTS

This section provides an overall summary of the optimized capital planning results for the paved road network of the Township of Alnwick/Haldimand. The analysis is only focused on the paved road network with a total length of 317.8 km (Asphalt and Surface Treated).

The Optimization Analysis Settings are as follows:

Scenario

Name:	AMP - Budget $1.15mil Paved
Description:	Target Performance 50, RM $45k
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Optimization analysis has been performed to produce a workable capital plan considering municipal constraints and objectives, while maximizing network overall performance to achieve the highest possible investment efficiency.

Figure 24 shows the overall network performance throughout the plan period:

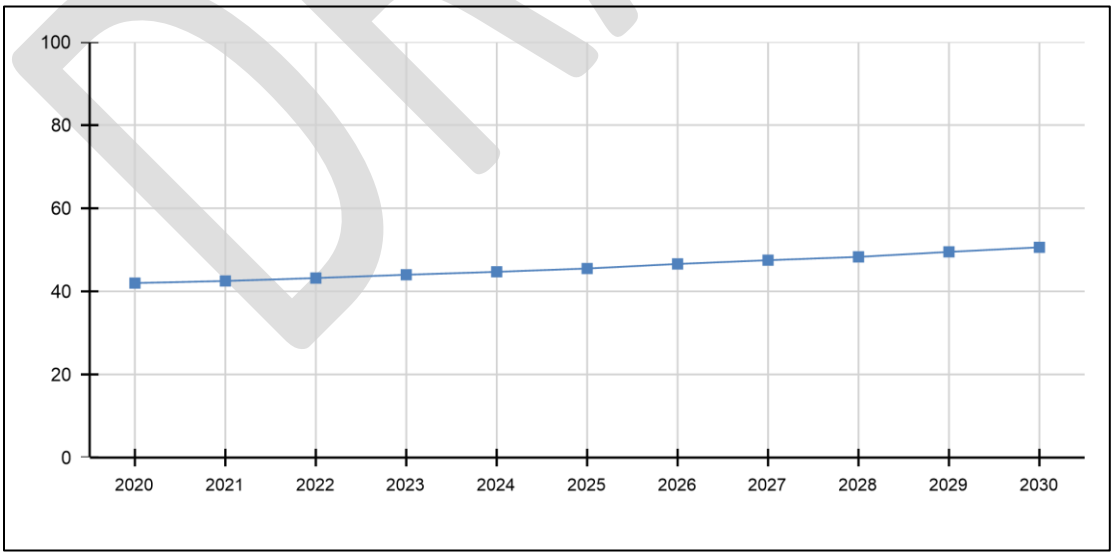


Figure 24: Scenario Comparison - Overall Network Performance

Over the next 10 years, the performance of the Road network is improved from the 2020 current PCI condition of 42.0 to a PCI condition of 50.8 by 2030.

Figure 25 shows the overall network risk throughout the plan period:

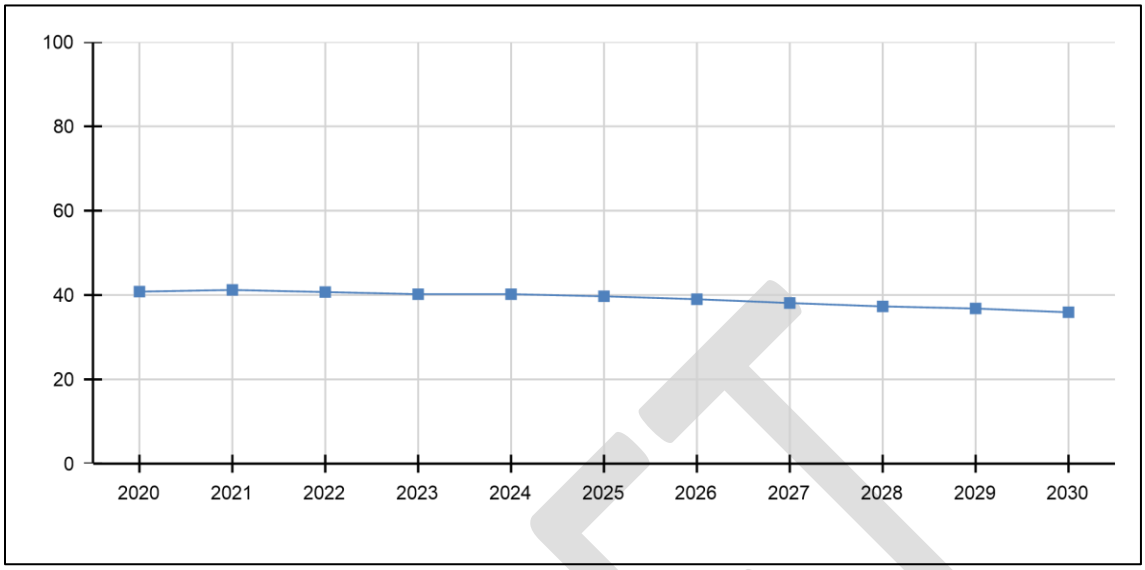


Figure 25: Overall Network Risk

Figure 26 shows the condition status of the network at each year of the plan period:

Figure 26: Annual Network Condition Status

In comparison with ranking or prioritization solutions, depending on the utilized ranking method, the optimization shows 15% to 30% added performance on average. The current overall performance of the network has been determined at 42.0, with 57% of the sections performing in a very poor, 17% in a poor, 1% in a fair, 11% in a good, and 14% in an excellent condition state. Using the recommended budgeting strategy, over the next 10 years the performance of the network improves to an end of plan PCI of 50.8 overall, with 33% of the network in very poor, 12% in poor, 14% in fair, 16% in good, and 25% in excellent condition. in good condition in the beginning of the plan, a significant improvement.

The paved road infrastructure deficit is estimated at $18,175,148 at the beginning of the plan, decreasing by 35.3% to $11,756,496 at the end of the plan period, a significant improvement.

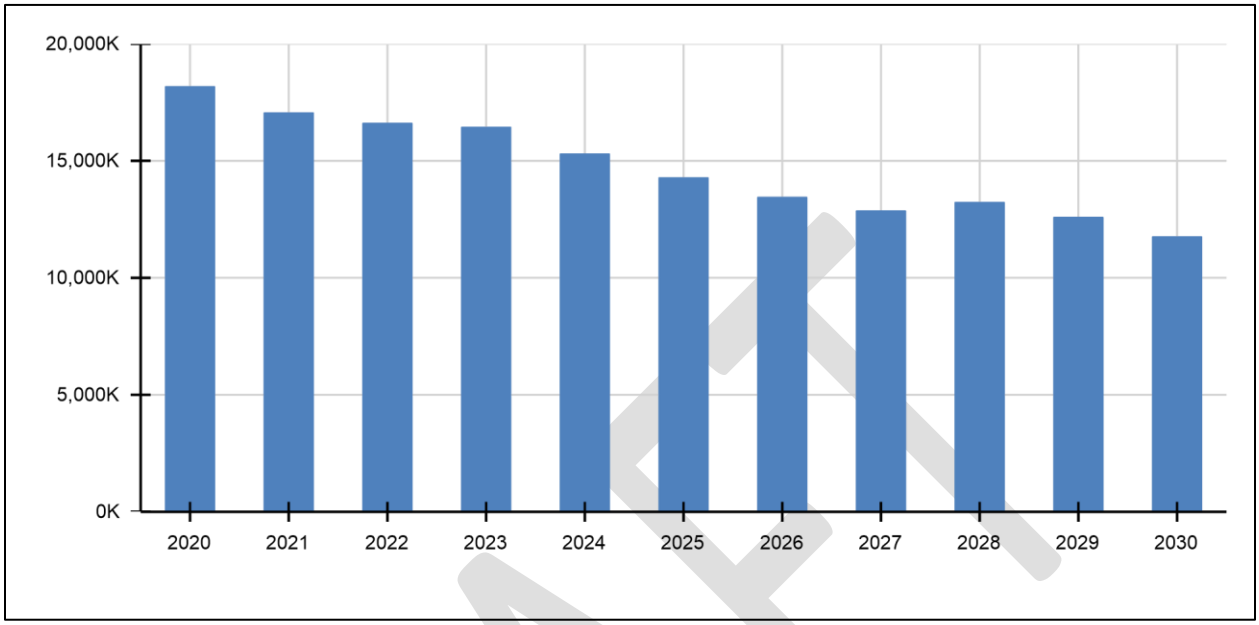


Figure 27: Road Infrastructure Deficit Projection

5.1.8 RECOMMENDED PROJECTS

An overview of the annual capital projects is shown in Figure 28. The road treatment costs are based on contractor costs for the region and cost data provided by the Municipality.

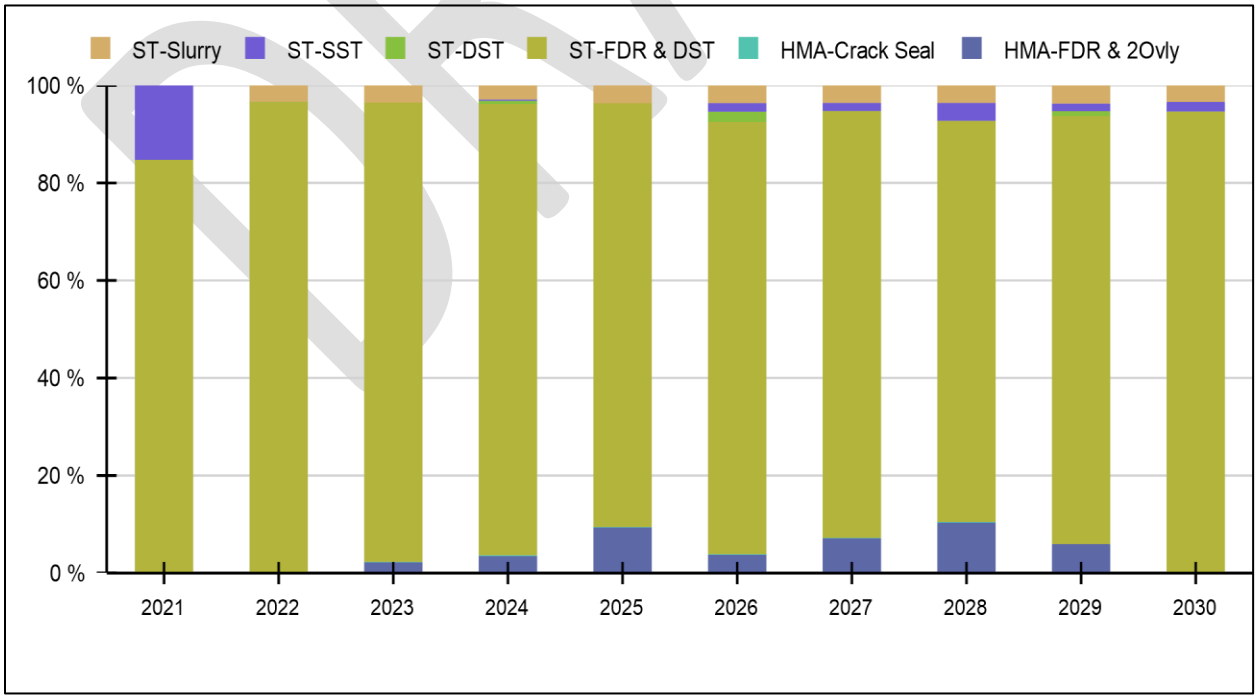


Figure 28: Roads Capital Project Overview

Treatment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
ST-Slurry	$0	$39,937	$42,278	$34,125	$43,378	$43,121	$42,730	$42,606	$44,496	$40,496	**$373,167**
ST-SST	$175,473	$0	$0	$3,150	$0	$20,925	$19,479	$43,728	$18,570	$22,947	**$304,272**
ST-DST	$0	$892	$0	$7,917	$0	$25,335	$0	$0	$12,188	$0	**$46,332**
ST-FDR & DST	$973,800	$1,149,008	$1,120,740	$1,096,762	$1,035,008	$1,057,515	$1,045,260	$982,680	$1,047,938	$1,126,838	**$10,635,549**
HMA-Crack Seal	$0	$0	$1,232	$1,865	$1,232	$1,865	$1,232	$1,995	$202	$672	**$10,295**
HMA-FDR & 2Ovly	$0	$0	$26,690	$41,715	$111,665	$44,805	$85,130	$123,561	$71,070	$0	**$504,636**
Total	**$1,149,273**	**$1,189,837**	**$1,190,940**	**$1,185,534**	**$1,191,283**	**$1,193,566**	**$1,193,831**	**$1,194,570**	**$1,194,464**	**$1,190,953**	**$11,874,251**

The detailed capital Investment plan specifying which road section is scheduled for which suggested treatment, in which year, and at what budgeted cost is presented in Appendix A, the Capital Investment Plan the Municipality.

5.1.9 GRAVEL ROADS

The gravel road expenses are treated as operating expenses and are not included in the Capital Plan. However, the DOT™ Transportation software being provided to the Municipality includes an GRMS (Gravel Road Management System). The Gravel Road Management System is fully integrated into the DOT™ Roads module The GRMS was designed to meet the following criteria:

- manage inventory, condition data, and maintenance history of the gravel roads in conjunction with the paved roads;
- establish refined priority policies using network-wide priority settings based on various physical attributes, such as traffic, functional class, roadside environment, in addition to socio-economic factors for individual road segments;
- specify detailed routine maintenance polices based on local knowledge or pre-set schedules;
- identify when gravel roads should be upgraded to a hard surface;
- compare the longer-term impacts of multiple scenarios with different policy and budget settings; and
- generate a 10-year capital plan with road lists, budgeted costs, annual schedules, and map visualizations.

Decision to Upgrade to Surface Treatment

A key component of the analysis module of a GRMS is to determine if surface treating (i.e., chip sealing, oiling or similar) a gravel road is a sensible option. A financial analysis (i.e., discounted cash flow analysis) can be performed based on the initial cost of upgrading and the cost of subsequent maintenance activities in both cases. Figure 15 shows an example of a financial analysis on two gravel road segments. First segment is 476 m long with AADT of 250 and the other segment is 973 m long with AADT of 50. The analysis uses an inflation rate of 1.5% and a nominal discount rate of 3%. In the first case (AADT of 250), the cost of maintenance as a gravel road (i.e., the cost of re-gravelling, drainage maintenance, grading, and dust control) over the next 20 years in today's dollars is estimated at about $69,000. By surface treating this segment the 20-year maintenance costs are reduced to about $37,000 (i.e., the initial cost of a double chip seal with subsequent slurry seals and single chip seal treatments). It is, therefore, more cost effective to chip seal this segment. In the second case (AADT of 50), however, the cost of maintaining the segment with a gravel surface is around $22,000 less compared to surface treatment.

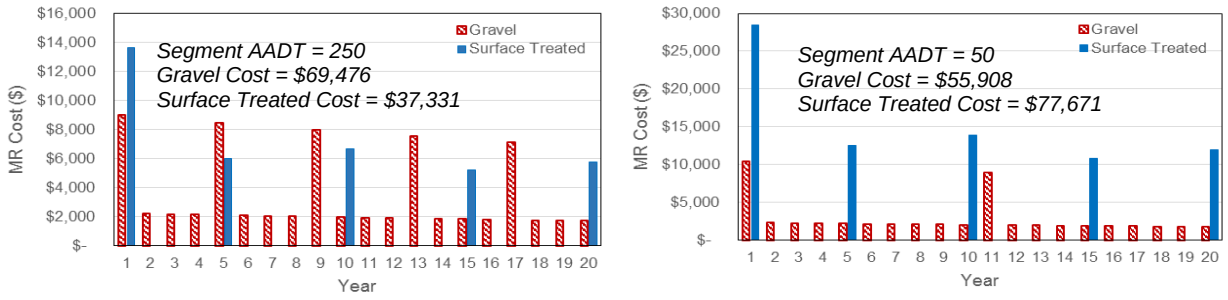


Figure 29: Financial analysis of upgrading gravel roads to surface treated

Performing financial analysis indicates that traffic is a major determinant of the time of upgrade for a gravel road. In addition to financial analysis, other considerations that should factor in the decision are described below:

- **Structural Capacity**: When a gravel road is upgraded, the surface treatment acts as a sealant and reduces moisture penetration. It also prevents surface gravel loss, eliminates dust generation, and increases user satisfaction by providing a smoother ride and better appearance. A surface treatment, however, does not improve the structural capacity of a gravel road. A gravel road with structural or subgrade defects, needs to be structurally enhanced or rehabilitated before upgrading to surface treatment. The cost of rehabilitation and stabilization should be added to the initial cost of surface treatment as part of the financial analysis. Upgrading a gravel road with structural defects can significantly reduce the service life of the surface treatment and result in poor performance.
- **Drainage**: Similar to structural capacity, adequate drainage provision of a surface treated road is imperative to achieving satisfactory long-term performance. Surface treated roads are less forgiving to frost damage than gravel surfaces. Poor drainage conditions will reduce the useful life of a surface treatment and make it expensive to maintain.
- **Traffic Characteristics**: Types of traffic can significantly affect the performance of surface treated roads. In some cases, a gravel road can be an agricultural or mining access road that experiences heavy or overloaded trucks on a regular basis. In general, if a gravel road serves heavy traffic, upgrading to surface treated can become an expensive decision since heavy trucks are more damaging to a surface treated road and the cost of rehabilitation is higher. In this case, it may be better to retain the gravel surface and upgrade to a superior load-bearing hot mix asphalt pavement when sufficient funds are available.
- **Road Geometry**: When a gravel road is upgraded to surface treated, it encourages drivers to drive faster and therefore operational speed increases. It may also increase traffic volumes as more motorists decide to use it. Substandard geometric features such as horizontal and vertical alignments, sight distances, lane widths, shoulder widths, superelevations, in addition to lack of signage, can result in safety hazards and a higher risk of accidents. It might be necessary to improve the geometric features of a road before upgrading to surface treatment and the cost of these improvements should be taken into account as part of a financial analysis.
- **Opinions of Local Residents**: While it is usually assumed that local residents will support an upgrade to surface treatment, this is not always the case. Local users may prefer to retain a gravel road rather than encouraging more traffic, higher speeds and greater use of the route by commuters. It should also be noted that from a context sensitivity

perspective, gravel surfacing may be more compatible with the road environment and community setting.

Because there is little or no repair history available for gravel roads, an accurate gravel road maintenance plan could not be established. It is recommended that the gravel road maintenance history is entered into the DOT software, or that a condition assessment is completed. This is an example of a Gravel Road maintenance program created by DOT™:

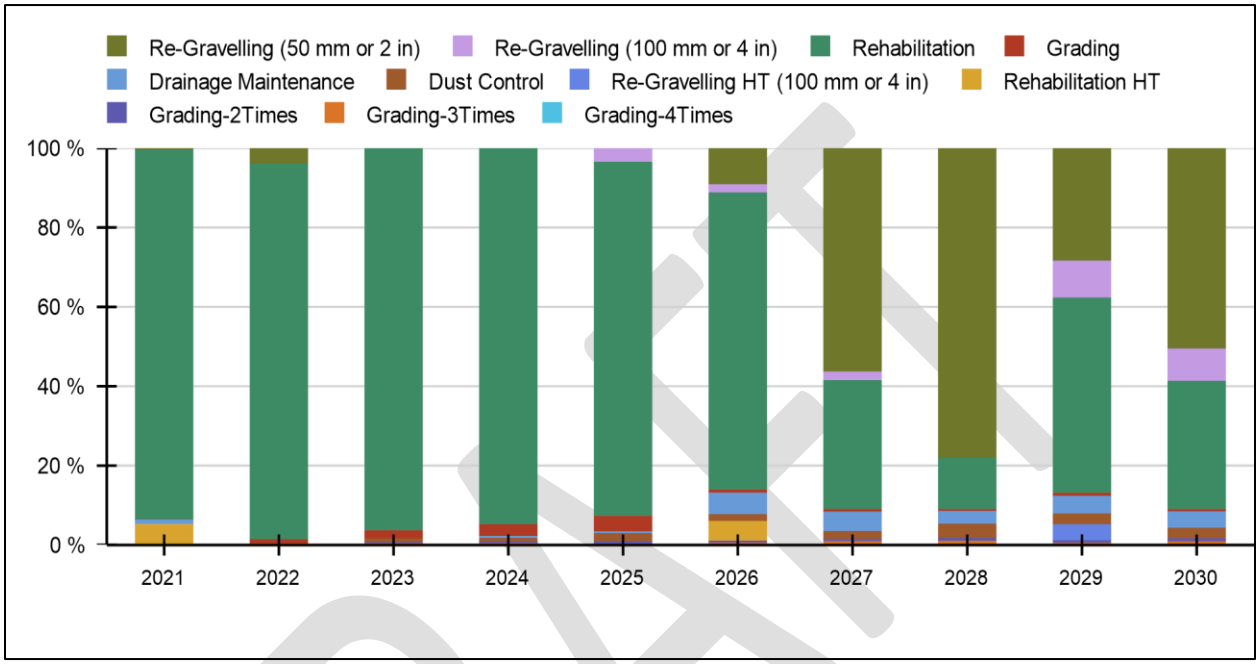


Figure 30: Example Gravel Roads Maintenance Program Overview

Treatment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Re-Gravelling (50 mm or 2 in)	$752	$7,809	$0	$0	$0	$20,004	$123,733	$171,117	$62,000	$111,016	**$496,431**
Re-Gravelling (100 mm or 4 in)	$0	$0	$0	$0	$7,380	$4,530	$4,798	$0	$20,256	$17,882	**$54,846**
Rehabilitation	$188,268	$192,173	$199,758	$199,600	$192,377	$164,561	$71,433	$28,425	$107,863	$71,000	**$1,415,458**
Grading	$216	$2,126	$4,290	$6,312	$8,514	$1,703	$1,504	$1,150	$1,638	$1,255	**$28,708**
Drainage Maintenance	$2,160	$0	$0	$1,080	$1,059	$11,925	$10,653	$7,074	$9,663	$9,137	**$52,751**
Dust Control	$0	$0	$1,978	$1,782	$4,359	$3,855	$4,405	$7,835	$6,013	$5,810	**$36,037**
Re-Gravelling HT (100 mm or 4 in)	$0	$0	$0	$0	$0	$0	$0	$0	$8,842	$0	**$8,842**
Rehabilitation HT	$10,783	$0	$0	$0	$0	$10,783	$0	$0	$0	$0	**$21,566**
Grading-2Times	$0	$79	$523	$883	$1,270	$1,040	$1,244	$1,538	$1,314	$1,801	**$9,692**
Grading-3Times	$0	$324	$523	$1,109	$785	$1,475	$1,674	$1,885	$1,371	$1,475	**$10,621**
Grading-4Times	$0	$518	$518	$0	$0	$0	$518	$518	$0	$518	**$2,590**
Total	**$202,179**	**$203,029**	**$207,590**	**$210,766**	**$215,744**	**$219,876**	**$219,962**	**$219,542**	**$218,960**	**$219,894**	**$2,137,542**

5.2 SIDEWALKS

The Township of Alnwick/Haldimand has a total of 2.4 km of Sidewalk Assets.

5.2.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Sidewalks is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 31: Sidewalk Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Sidewalk Assets, weighed by replacement cost, is 53. This represents an overall "Poor" condition state.

Title	Condition	Condition State
Network Overall Condition	53	Good

The following summarizes the 2020 Network Condition States:

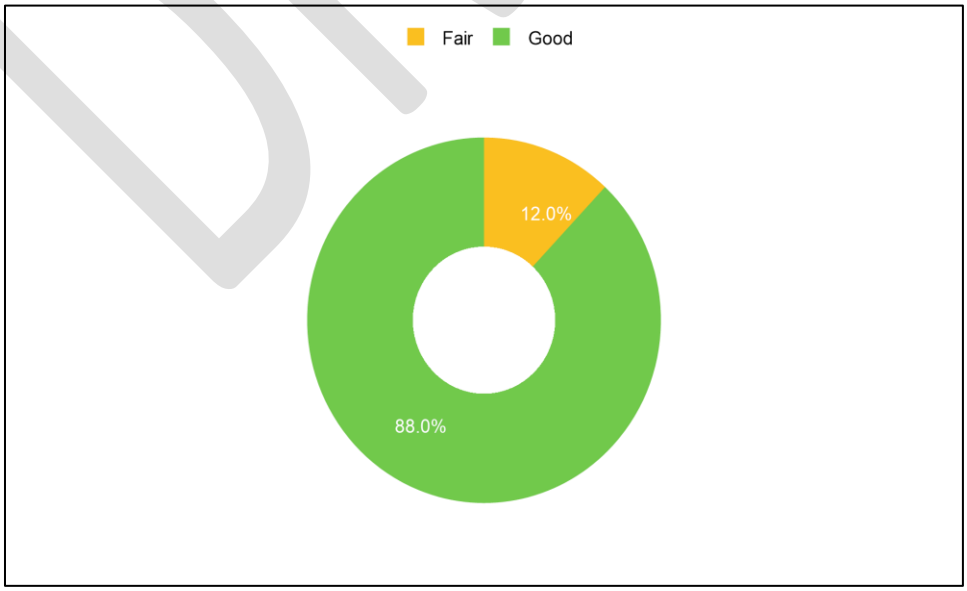


Figure 32: Sidewalk Network Condition Status

5.2.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Sidewalks Assets are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.2.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Sidewalks Assets before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.2.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Sidewalks Assets, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement Treatment		100.00 %	0.0%	2021

5.2.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Sidewalks, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of Life Replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 33 shows the Sidewalks Assets overall network performance throughout the plan period:

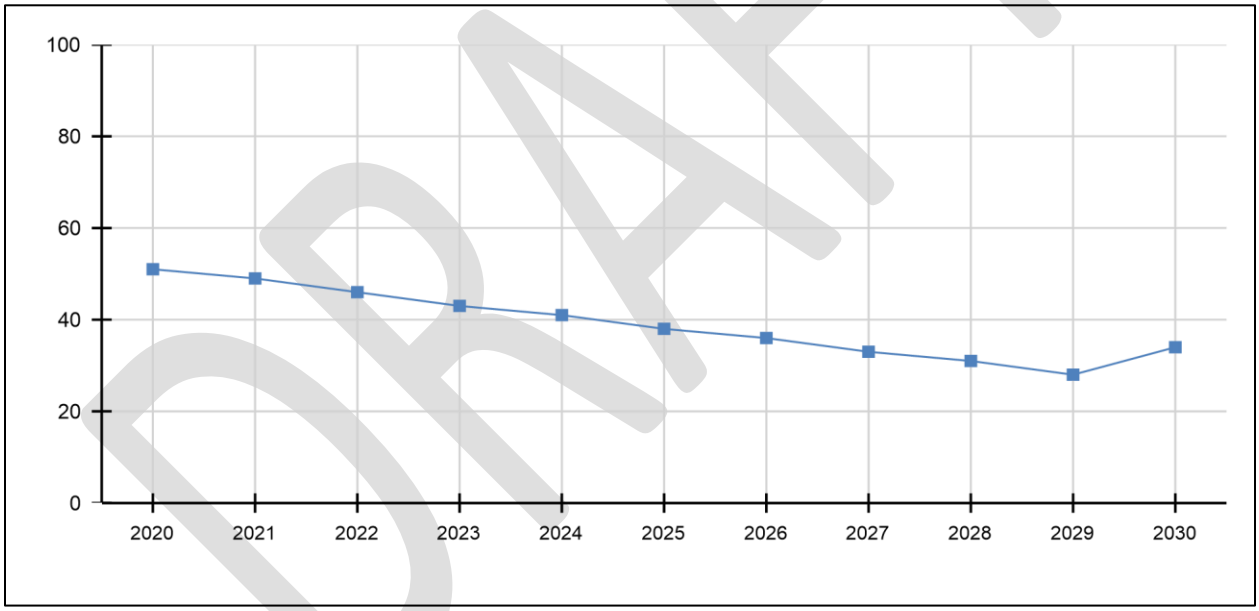


Figure 33: Sidewalks Network Performance

Over the next 10 years, the performance of the Sidewalks Assets network decline from 51 to 34 at the end of plan.

Figure 34 shows the condition status distribution of the Sidewalks Assets network at each year of the plan:

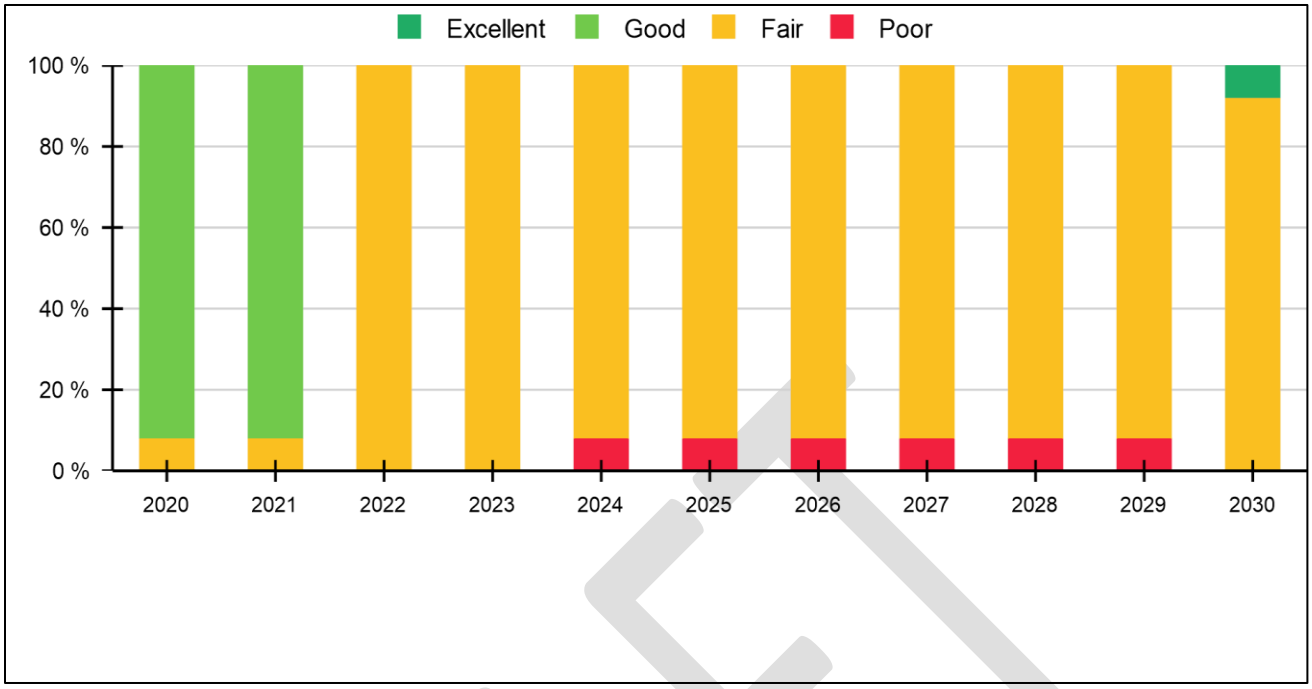


Figure 34: Sidewalks Annual Network Condition Status

As shown in this figure, at the beginning of the plan 92% in in good, and 8% in fair condition. At the end of the 10-year plan 8% will be in excellent, and 92% will be in fair condition.

The scheduled capital expenditures are shown in Figure 35:

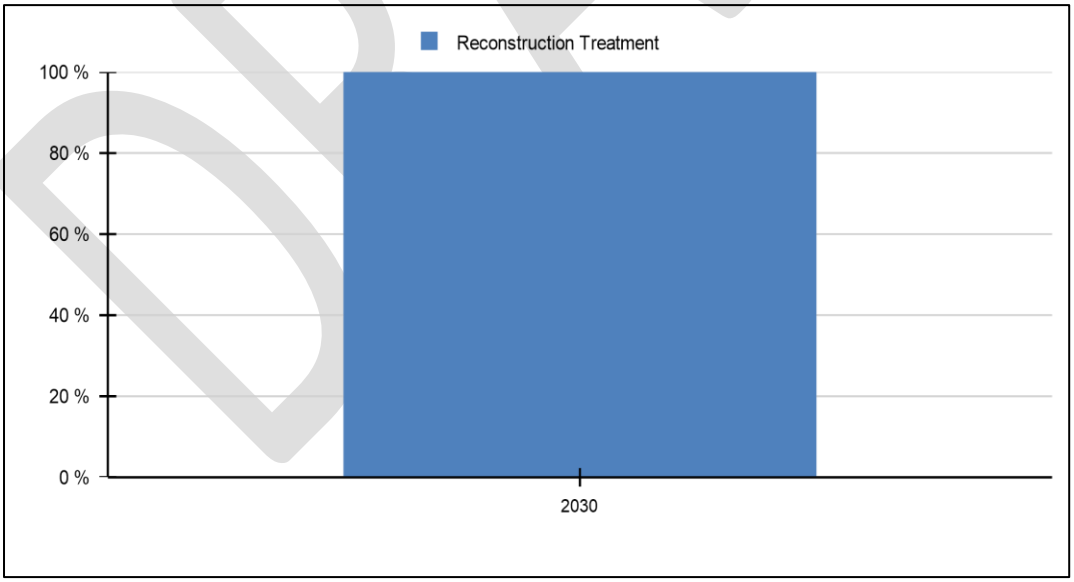


Figure 35: Sidewalks Capital Expenditures

None of the Sidewalk's sections are in a deficit position throughout the plan period.

5.3 STREETLIGHTS

The Township of Alnwick/Haldimand has a total of 224 Street Lights Assets.

5.3.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Streetlights assets is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 36: Streetlights Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Streetlights is 75. This represents an overall "Good" condition state.

Title	Condition	Condition State
Network Overall Condition	75	Good

The following summarizes the 2020 Network Condition States:

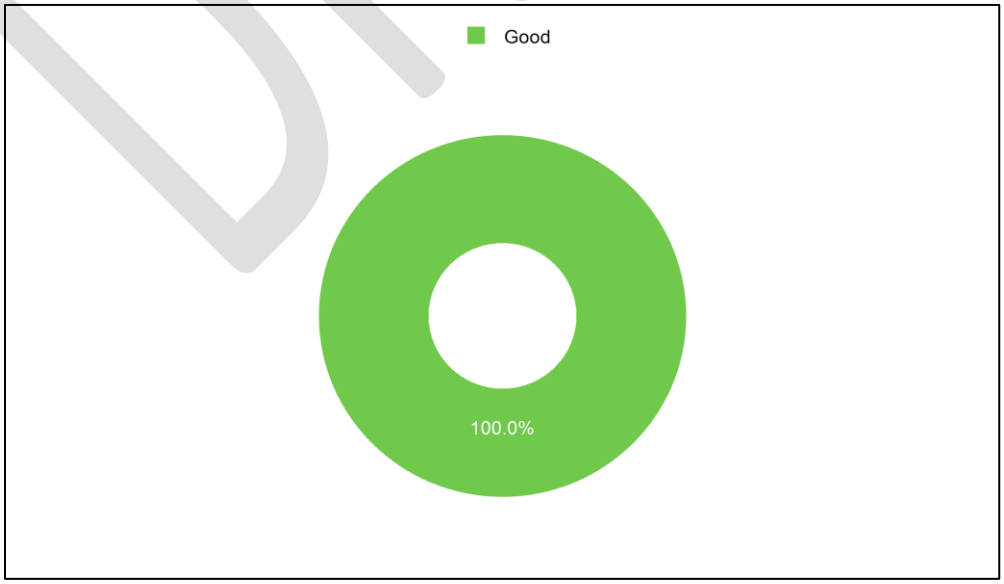


Figure 37: Streetlights Current Network Condition Map

5.3.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Department. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	50
Removed	0
Unassumed	0

Risk
The Risk settings for Streetlights Assets are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.3.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Streetlights before the end of their service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.3.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Streetlight assets, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.3.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Streetlights, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 38 shows the Streetlights Assets overall network performance throughout the plan period:

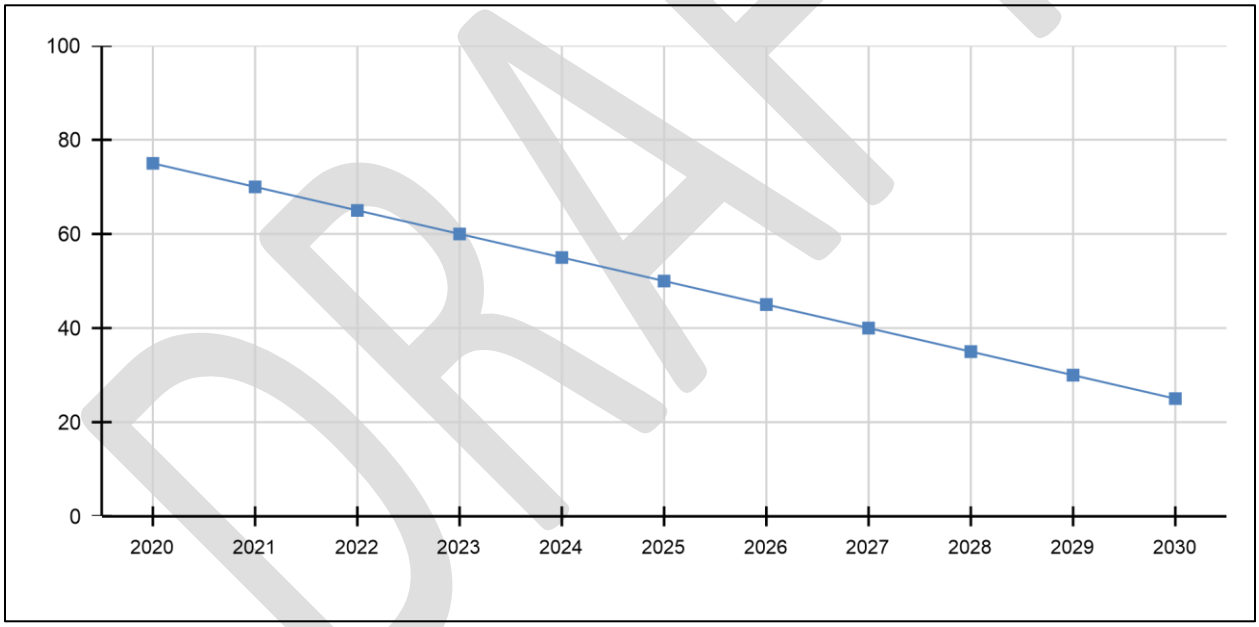


Figure 38: Street lights Network Performance

Over the next 10 years, the performance of the Streetlights network declines from 75 to 25 at the end of plan.

Figure 39 shows the condition status distribution of the Streetlights Assets network at each year of the plan:

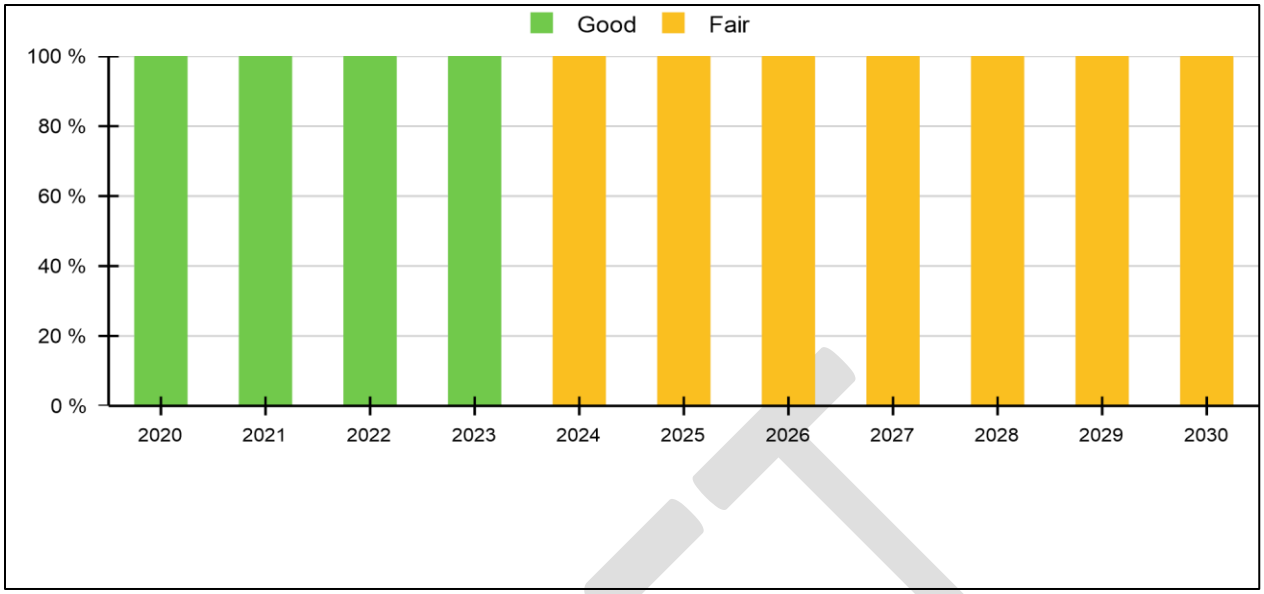


Figure 39: Streetlights annual Network Condition Status

As shown in this figure, at the beginning of the plan all Streetlights are in good condition, and at the end of the 10-year plan all Street Lights will be in fair condition.

None of the Streetlights are in a deficit position throughout the plan period, and no replacements are scheduled.

5.4 TRAFFIC SIGNS

The Township of Alnwick/Haldimand has a total of 1,576 Traffic Signs in its inventory. A 2020 sign inspection was done by Mesh Advantage Data Collection. The inspection report identified 1,492 Traffic Signs within the Municipality, of which 1,434 Signs were inspected, and 58 signs were not inspected because they were missing, removed or non-reflective. The overall Condition Rating was used for the Analysis, and the ratings were converted to a scale from 0 to 100.

5.4.1 TRAFFIC SIGN GEOMETRICS AND ATTRIBUTES

The Traffic Signs are classified as Priority, Regulatory and Warning signs. The distribution by classification is shown here:

Sign Type	Count	Percentage
Priority	326	20.7%
Regulatory	258	16.4%
Warning	984	62.4%
Other	8	0.5%

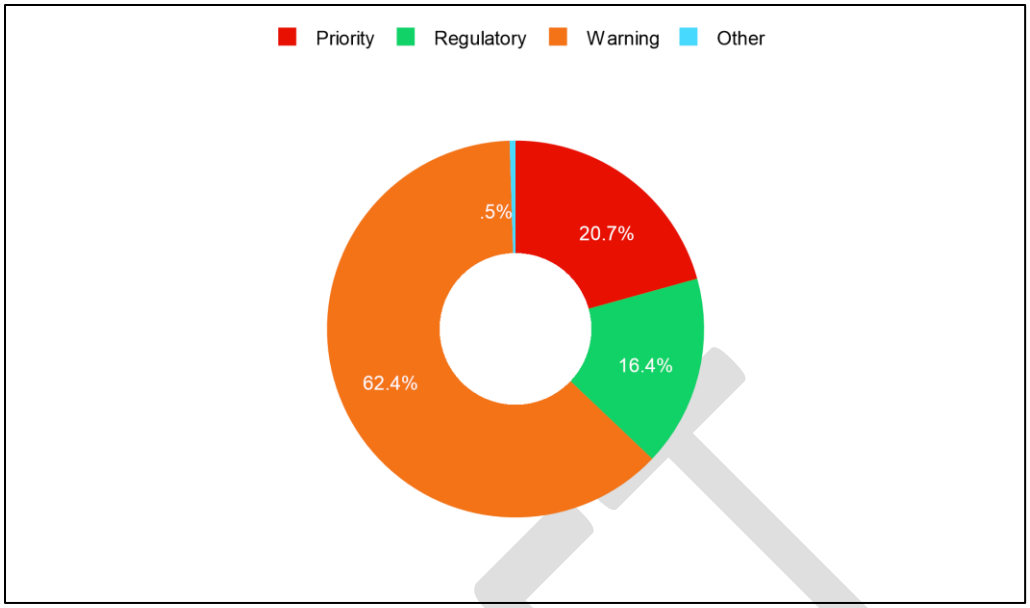


Figure 40: Traffic Sign by Sign Type

5.4.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for traffic signs is determined through an age-based analysis. The three (3) Condition States are defined as follows:

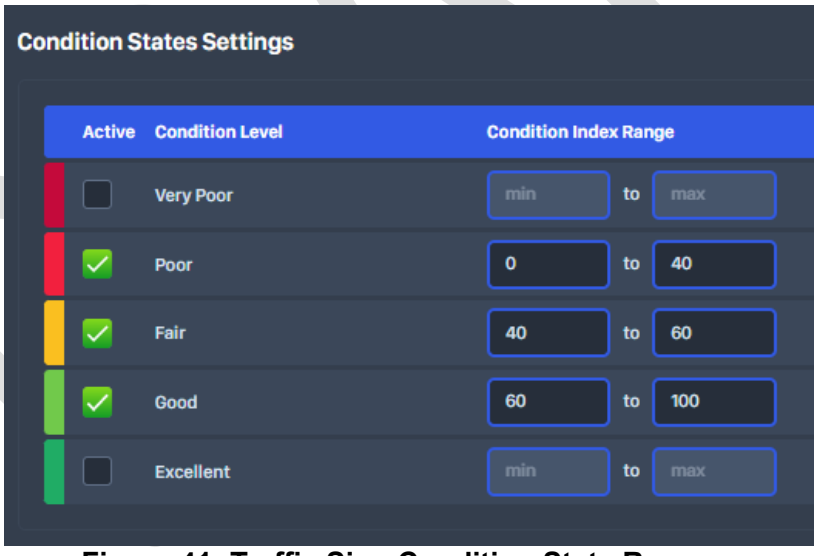


Figure 41: Traffic Sign Condition State Ranges

The current 2020 Overall Network Condition of the Traffic Signs is 67. This represents an overall "Good" condition state.

Title	Condition	Condition State
Network Overall Condition	69	Good

The Condition Status Distribution is shown here:

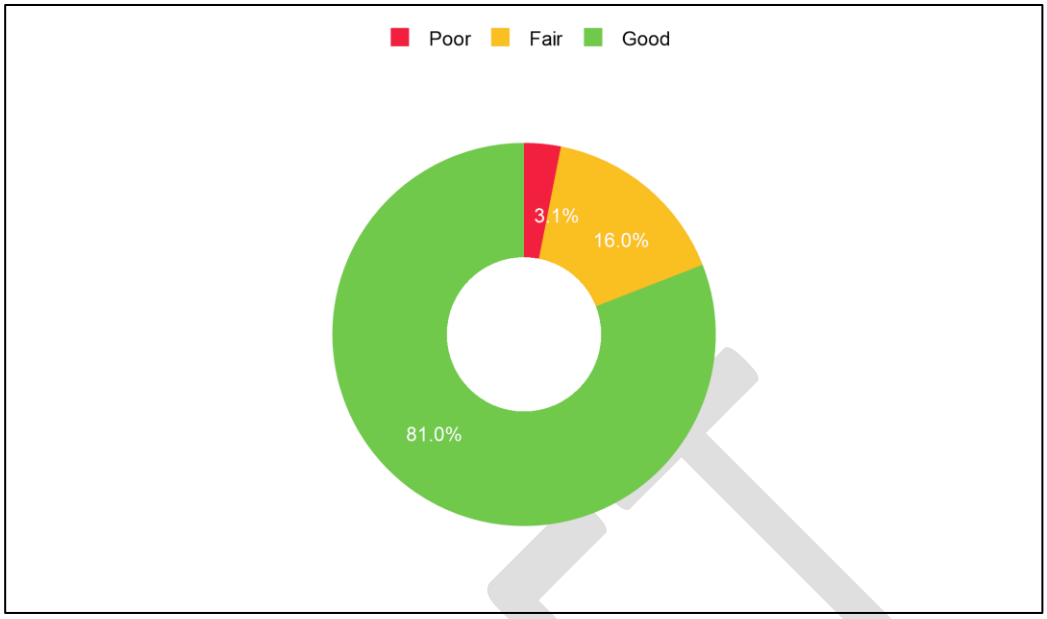


Figure 42: Traffic Sign Condition Status

Figure 43 shows the Condition Status by Sign Type:

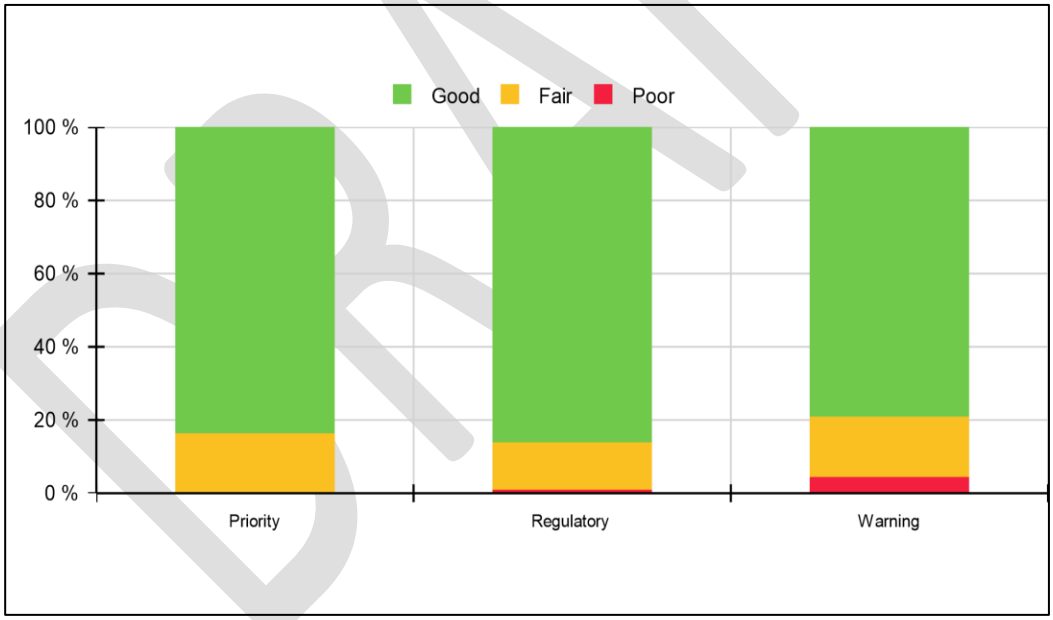


Figure 43: Traffic Sign Condition Status by Sign Type

5.4.3 CRITICALITY AND RISK CRITERIA

Criticality

Based on the data attributes available, the Criticality settings were applied based on Asset Status only, with in-service assets being critical. Socio-economic factors were not included.

Criticality Settings	
Asset Status	**5**
Abandoned	0
In-service	50
Removed	0
Unassumed	0

Risk

The Risk settings for Traffic Signs are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.4.4 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace signs before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.4.5 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for traffic signs, and it is a replacement treatment.

Treatment Methods				
Treatment	**Description**	**Unit Cost**	**Inflation Rate**	**Cost Estimation Year**
Replacement	Replacement	100.00 %	0.0%	2020

5.4.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Traffic Signs, and in this case it is a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario	
Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings	
Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True
Rollover	0

Optimization Objective			
Type	**Min/Max**	**Weight (Sum = 1)**	**Performance Attribute**
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 44 shows the network overall network performance throughout the plan period:

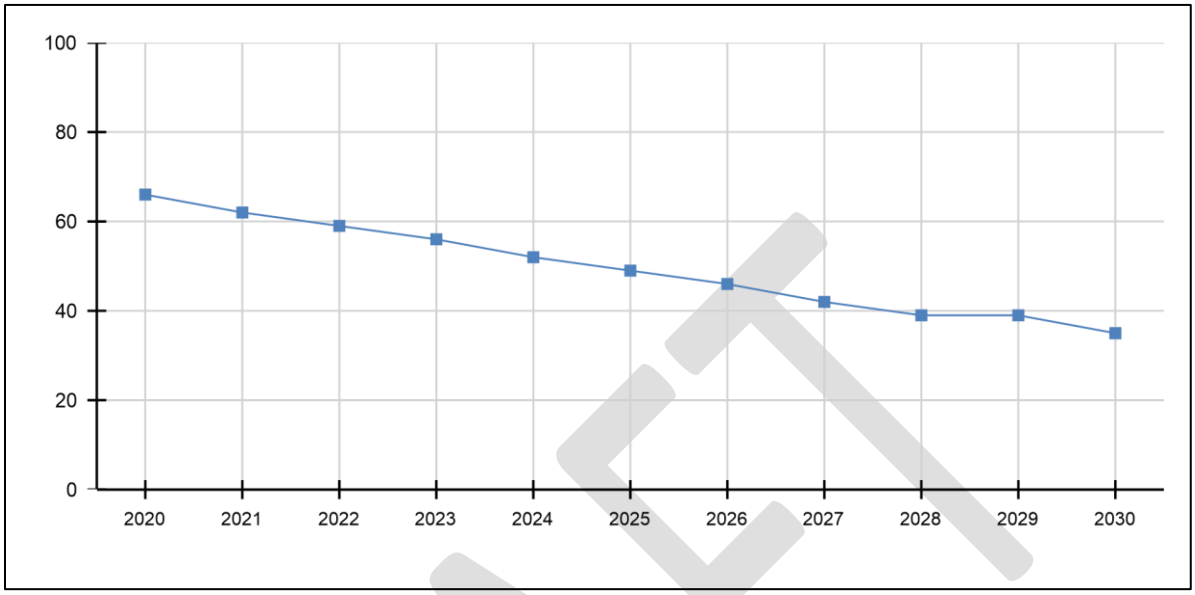


Figure 44: Traffic Signs Network Performance

Over the next 10 years, the performance of the Bridge network decreases from 69 to 38 at the end of plan.

Figure 45 shows the condition status distribution of the Bridge network at each year of the plan:

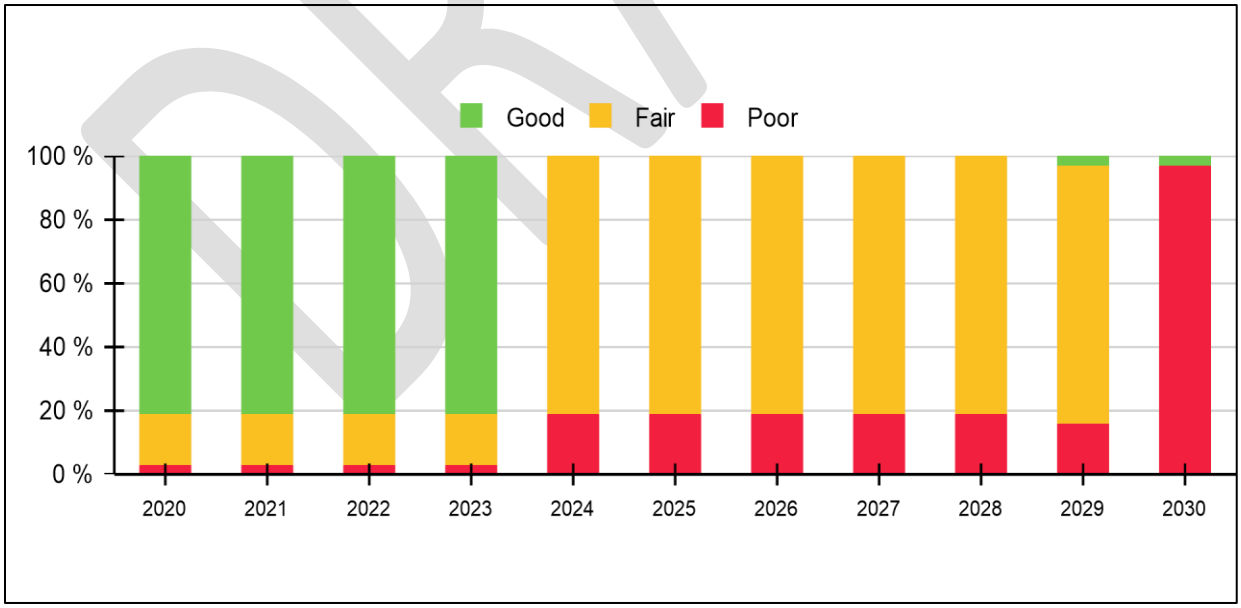


Figure 45: Traffic Sign Annual Network Condition Status

As shown in this figure, at the beginning of the plan 81% is in good, 16% in fair, and 3 % in poor condition. At the end of the 10-year plan, 3% will be in good, and 97% in poor condition.

The projected Capital expenditures for Traffic Signs are shown in Figure 46:

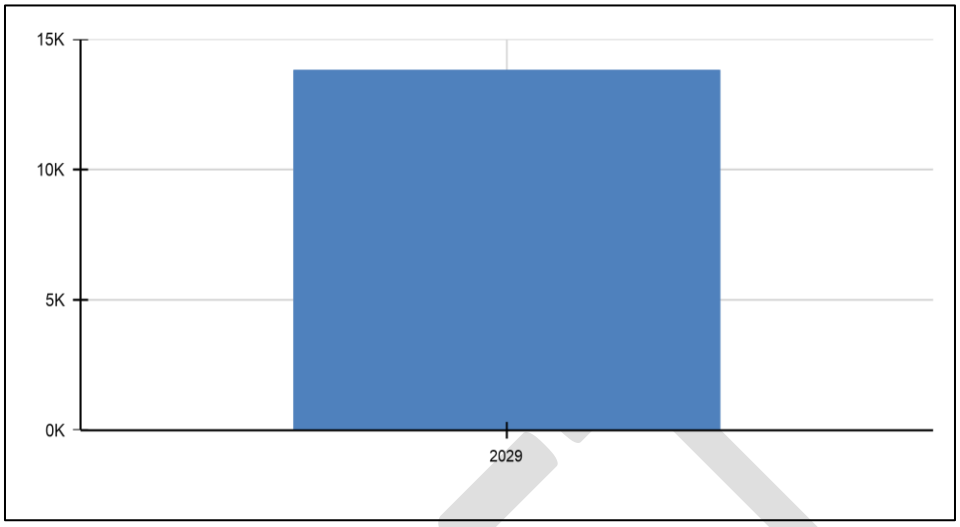


Figure 46: Traffic Sign Capital Expenditures

None of the Traffic Signs will be in a deficit position throughout the plan period.

5.5 BRIDGES

The Township of Alnwick/Haldimand has a total of 20 Bridges.

5.5.1 BRIDGE GEOMETRICS AND ATTRIBUTES

There are 16 Concrete Bridges, and 4 Steel Bridges in the Inventory. The distribution by Material based on Replacement Cost is shown here:

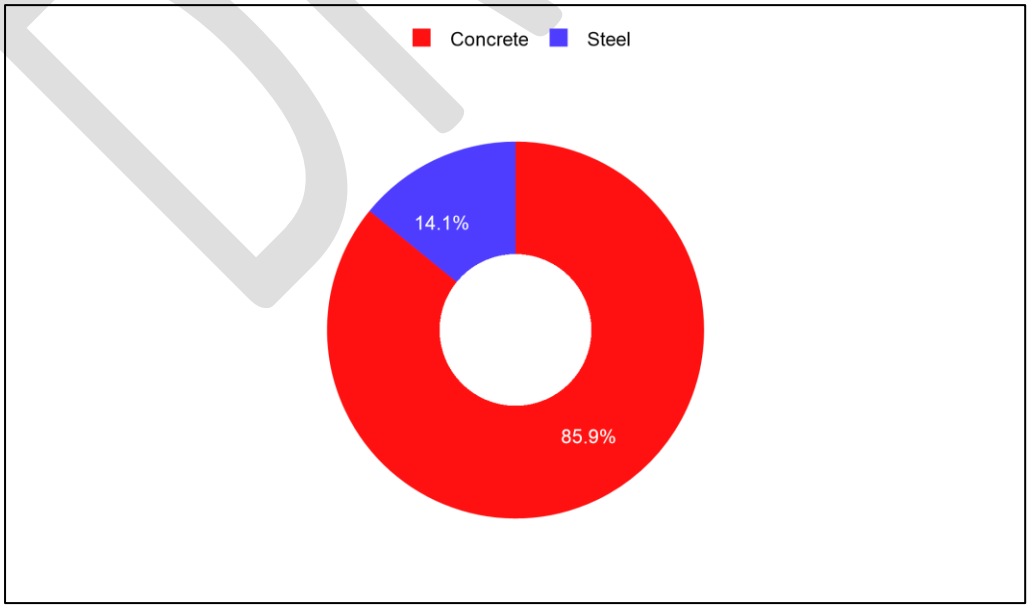


Figure 47: Bridge Material by Replacement Cost

5.5.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Bridges is determined through a condition based analysis. The five (5) Condition States are defined as follows:

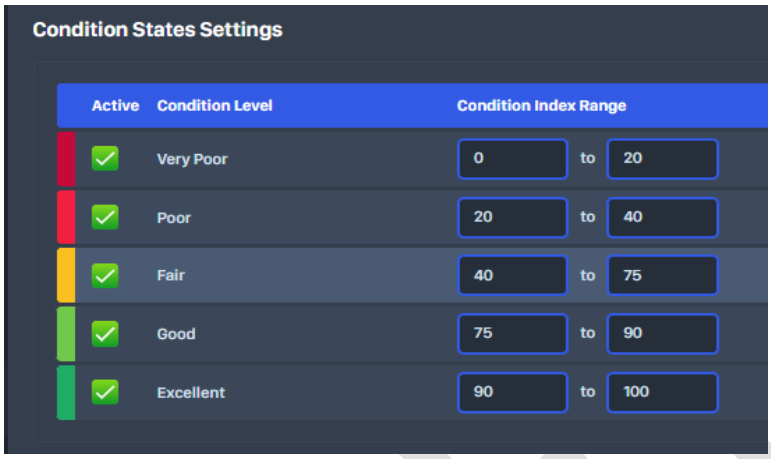


Figure 48: Bridge Condition State Ranges

The most recent OSIM Bridge inspection was done in 2019 by Jewell Engineering. Element level data was not provided, so a Bridge level analysis was done for this Plan. An overall BCI (Bridge Condition Index) was provided for each Bridge. The Overall Bridge Network has a BCI of 69.1, weighed by Replacement Cost. This is a Fair condition state.

Title	Condition	Condition State
Network Overall Condition	69.1	Fair

The following summarizes the Network Bridge condition states:

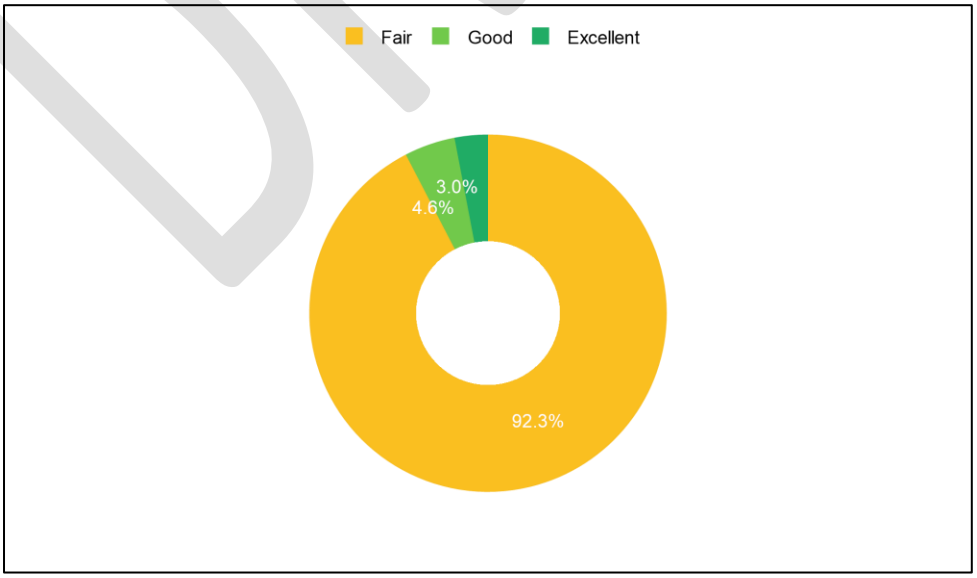


Figure 49: Bridge Network Condition

5.5.3 CRITICALITY AND RISK CRITERIA

Criticality
Based on the Data Attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included at this time.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Bridges are done as described in section 4. There are no risk targets set in the planning.

5.5.4 LEVEL OF SERVICE REQUIREMENTS

The Township targets to undertake the projects suggested by the bridge inspection engineers within the suggested time frame.

5.5.5 LIFECYCLE MANAGEMENT STRATEGY

With recommended projects as per 2019 OSIM Report are classified according to the following treatment methods:

Treatment Methods

Treatment	Description	Cost	Inflation Rate	Cost Estimation Year
Minor Rehab	2019 OSIM Report Recommended Work	Estimated Cost as per 2019 OSIM Report	0.0%	2019
Major Rehab	2019 OSIM Report Recommended Work	Estimated Cost as per 2019 OSIM Report	0.0%	2019
Structure Replacement	2019 OSIM Report Recommended Work	Estimated Cost as per 2019 OSIM Report	0.0%	2019

5.5.6 BUDGET CONSTRAINTS

No Capital budget limit is specified.

5.5.7 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Bridges. The Optimization Analysis Settings are as follows:

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 50 shows the network overall network performance throughout the plan period:

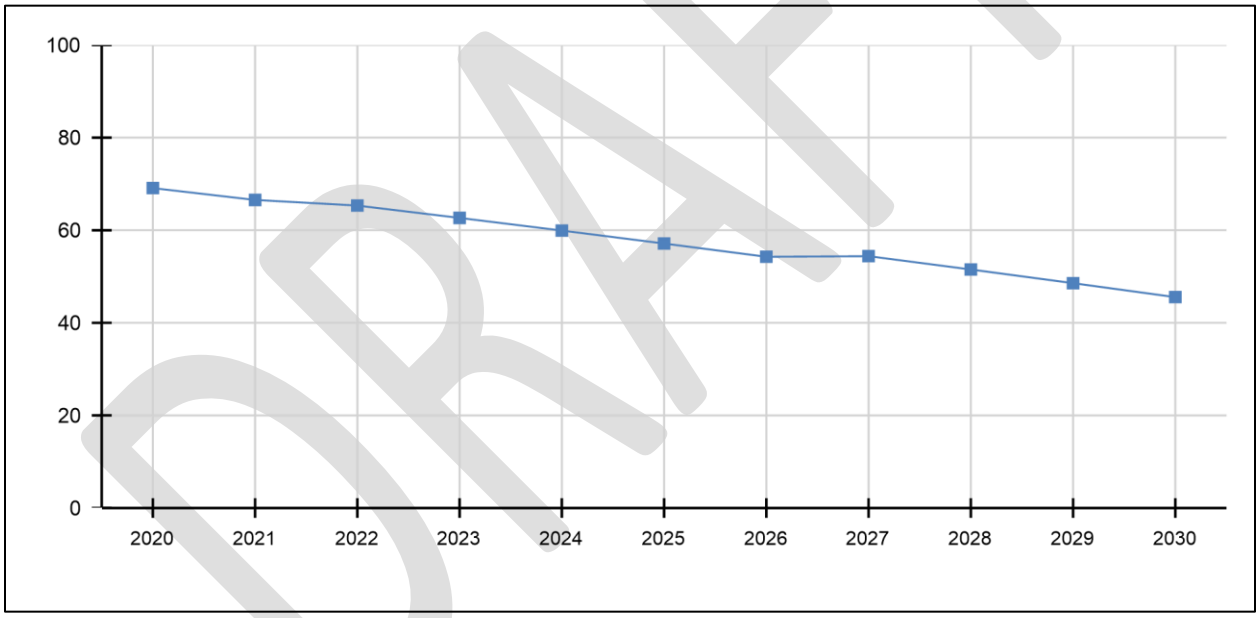


Figure 50: Bridge Network Performance

Over the next 10 years, the performance of the Bridge network decreases from 69.1 to 45.6 at the end of plan.

Figure 51 shows the Network Performance by Bridge Material:

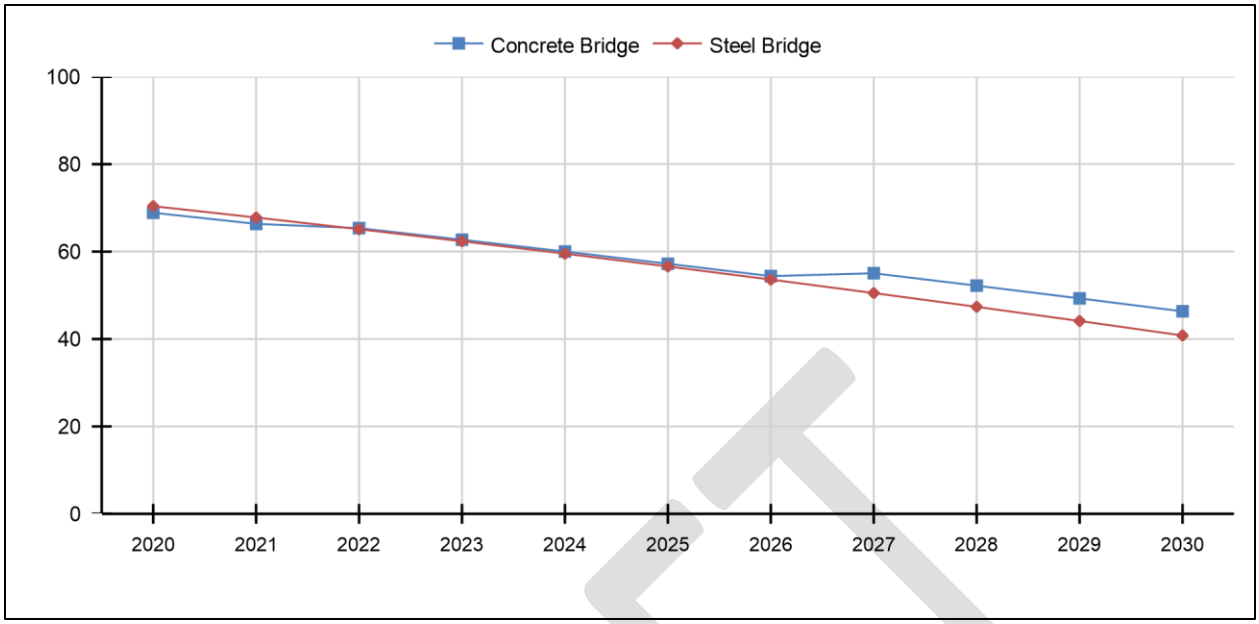


Figure 51: Bridge Network Performance by Bridge Element Type

Figure 52 shows the condition status distribution of the Bridge network at each year of the plan:

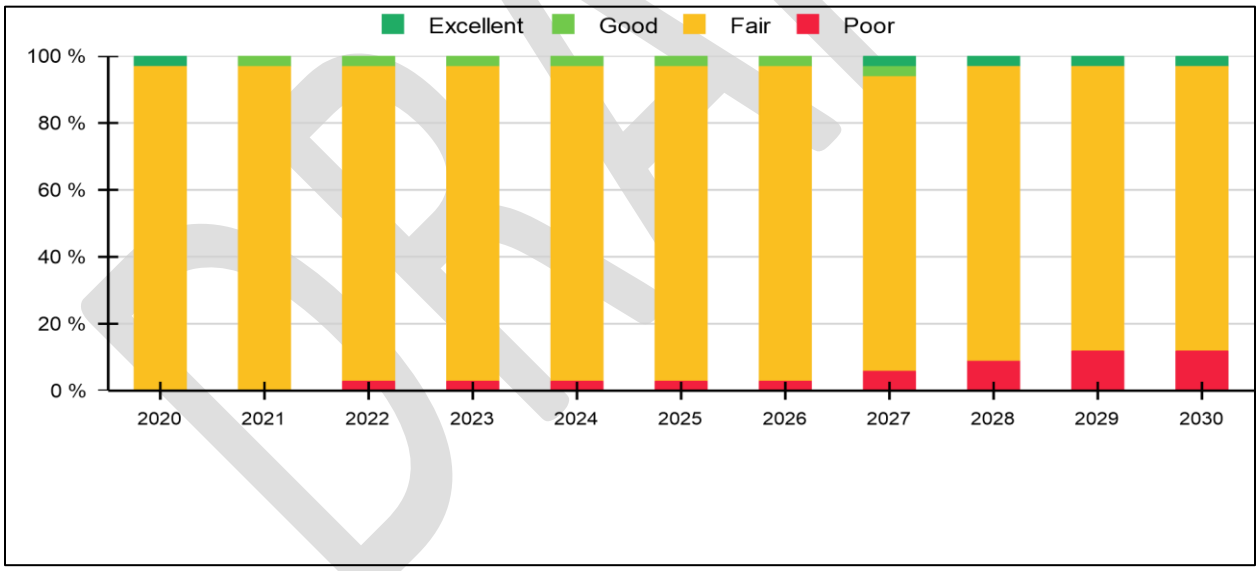


Figure 52: Bridge Annual Network Condition Status

As shown in this figure, at the beginning of the plan 3% is in Excellent, and 97% is in Fair condition. At the end of the 10-year plan, 3% will be in Excellent, 85% in Fair, and 12% in Poor condition. Also, as per Level of Service target, none of the Bridges are in a deficit position at the end of the plan period.

The capital expenditures for Bridges during the 10 year plan period is shown here:

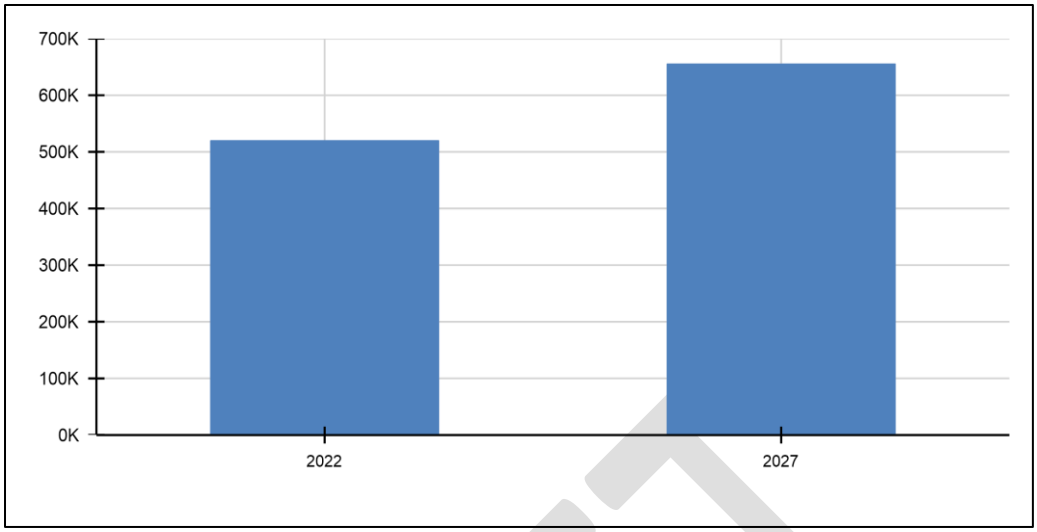


Figure 53: Bridge Annual Capital Expenditures

5.5.8 RECOMMENDED PROJECTS

An overview of the annual capital projects is shown in Figure 54.

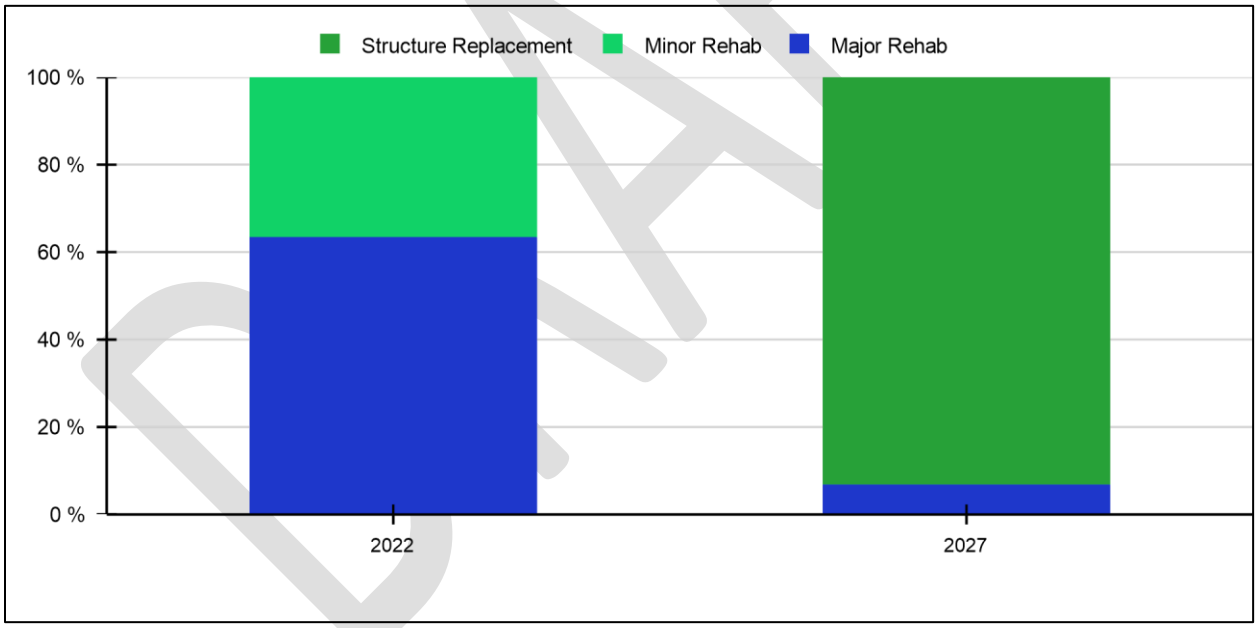


Figure 54: Bridges Recommended Projects by Treatment Type

A detailed Capital Plan is provided in Appendix A.

5.6 CULVERTS (STRUCTURAL)

The Township of Alnwick/Haldimand has a total of 26 Structural Culverts.

5.6.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Bridges is determined through a condition based analysis. The five (5) Condition States are defined as follows:

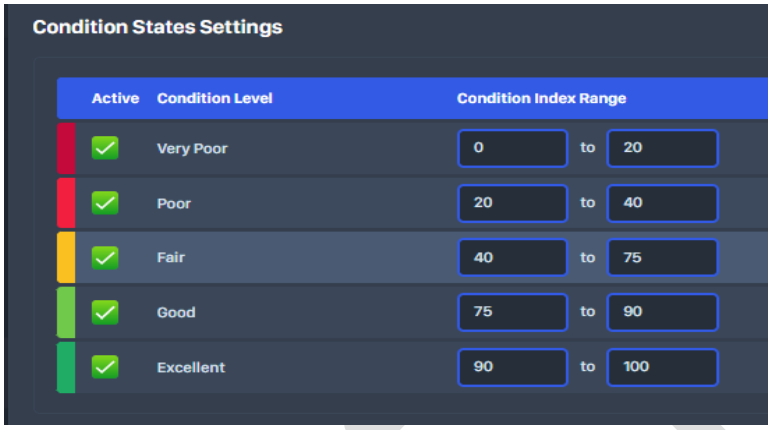


Figure 55: Bridge Condition State Ranges

The most recent OSIM Bridge inspection was done in 2019 by Jewell Engineering. Element level data was not provided, so a Culvert level analysis was done for this Plan. An overall BCI (Bridge Condition Index) was provided for each Structural Culvert. The Overall Structural Culvert Network has a BCI of 66.3, weighed by Replacement Cost. This is a Fair condition state.

Title	Condition	Condition State
Network Overall Condition	66.3	Fair

The following summarizes the Network Structural Culvert condition states:

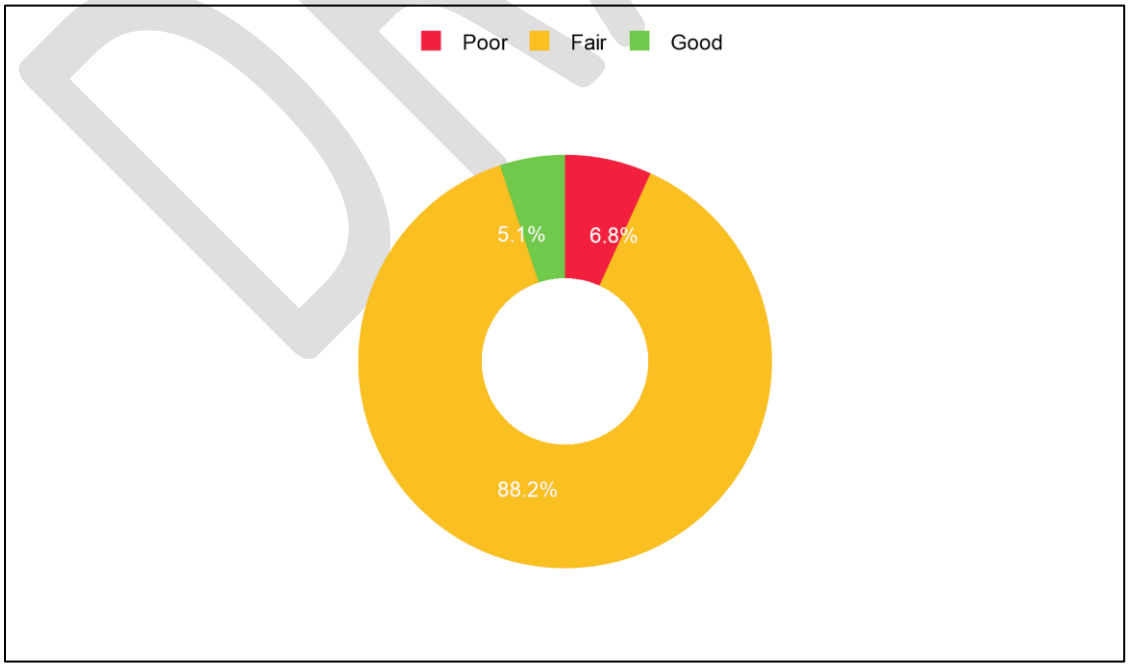


Figure 56: Culvert (Structural) Network Condition

5.6.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the Data Attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included at this time.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Structural Culverts are done as described in section 4. There are no risk targets set in the planning.

5.6.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to undertake the projects suggested by the Structural Culvert inspection engineers within the suggested time frame.

5.6.4 LIFECYCLE MANAGEMENT STRATEGY

With recommended projects as per 2019 OSIM Report are classified according to the following treatment methods:

Treatment Methods

Treatment	Description	Cost	Inflation Rate	Cost Estimation Year
Minor Rehab	2019 OSIM Report Recommended Work	Estimated Cost as per 2019 OSIM Report	0.0%	2019
Major Rehab	2019 OSIM Report Recommended Work	Estimated Cost as per 2019 OSIM Report	0.0%	2019
Structure Replacement	2019 OSIM Report Recommended Work	Estimated Cost as per 2019 OSIM Report	0.0%	2019

5.6.5 BUDGET CONSTRAINTS

No Capital budget limit is specified.

5.6.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Structural Culverts. The Optimization Analysis Settings are as follows:

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 57 shows the network overall network performance throughout the plan period:

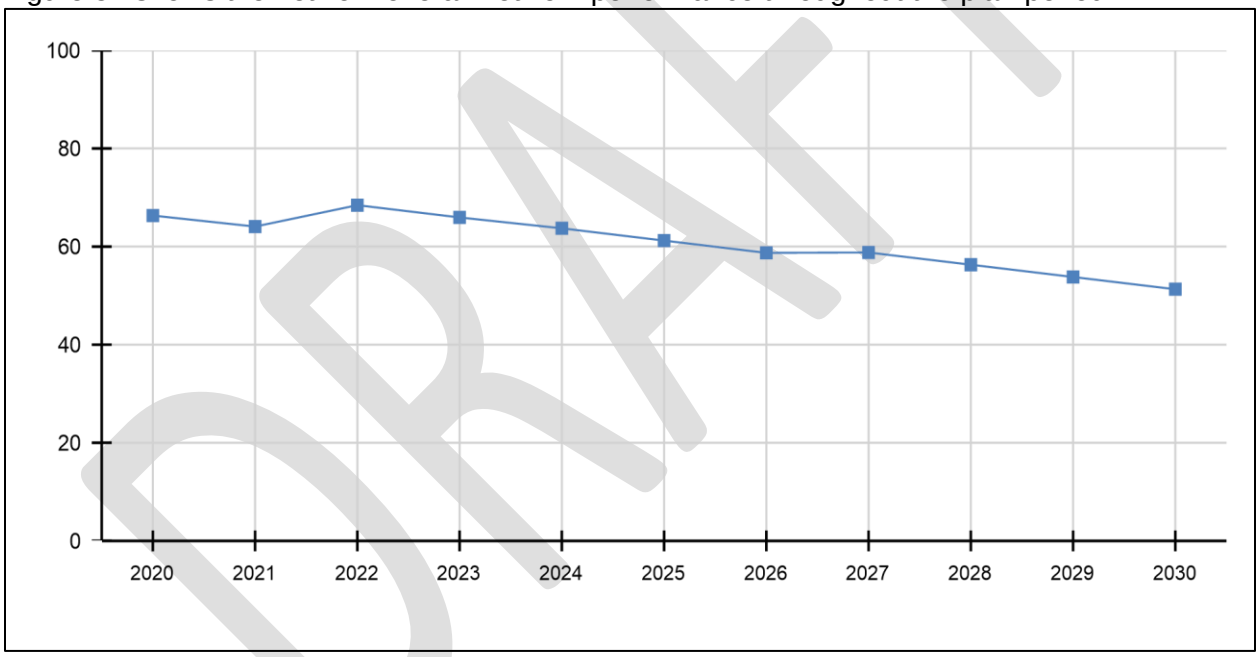


Figure 57: Structural Culvert Network Performance

Over the next 10 years, the performance of the Structural Culvert network decreases from 66.3 to 51.3 at the end of plan.

Figure 58 shows the condition status distribution of the Structural Culvert network at each year of the plan:

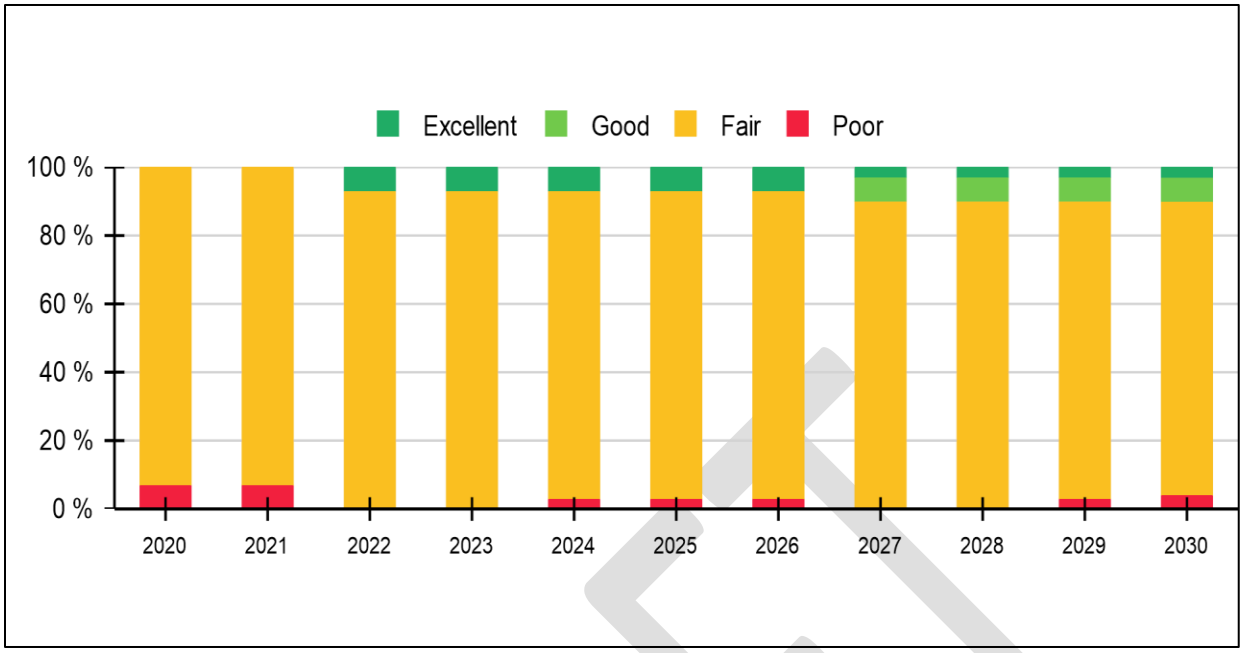


Figure 58: Structural Culvert Annual Network Condition Status

As shown in this figure, at the beginning of the plan 97% is in Fair, and 7% in Poor condition . At the end of the 10-year plan, 3% will be in Excellent, 7% in Good, 85% in Fair, and 4% in Poor condition. Also, as per Level of Service target, none of the Structural Culverts are in a deficit position at the end of the plan period.

The capital expenditures for Structural Culverts during the 10-year plan period is shown here:

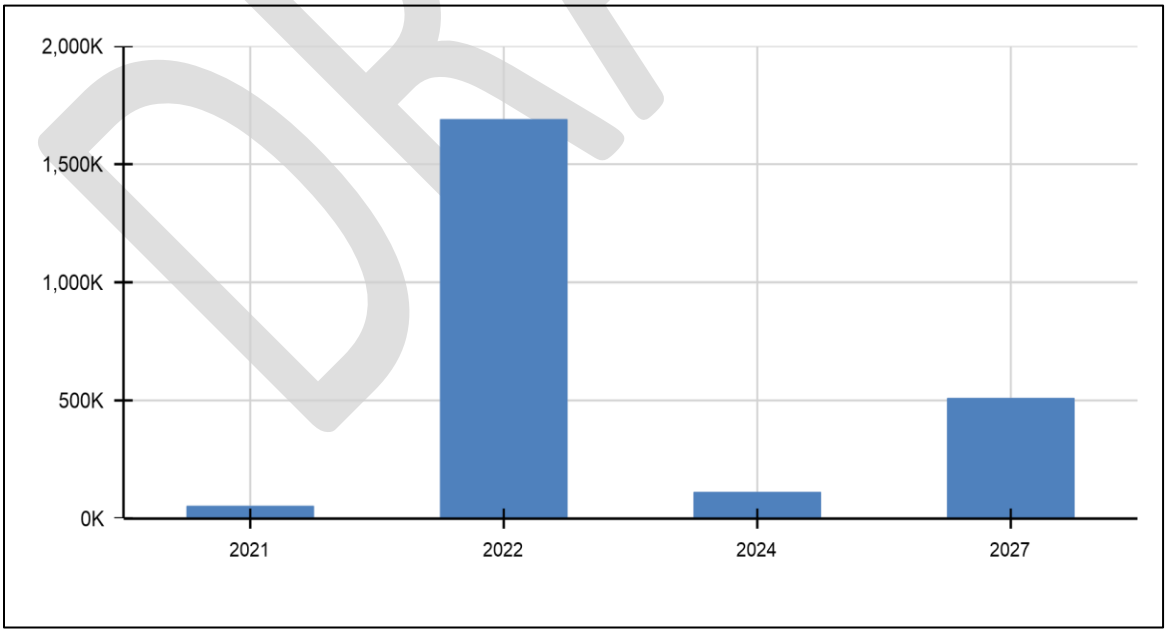


Figure 59: Structural Culverts Annual Capital Expenditures

5.6.7 RECOMMENDED PROJECTS

An overview of the annual capital projects is shown in Figure 60.

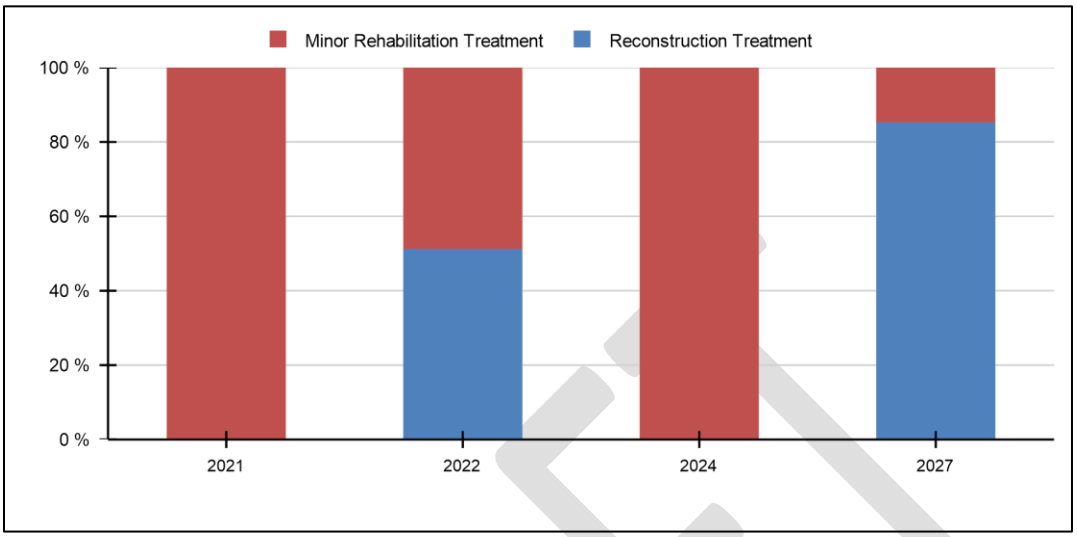


Figure 60: Structural Culverts Recommended Projects by Treatment Type

A detailed Capital Plan is provided in Appendix A.

5.7 WATERLINES

The Township of Alnwick/Haldimand has a total of 19 km of waterlines, with 0.1 km Ductile Iron, and 18.8 km of PVC pipes.

5.7.1 WATERLINE ATTRIBUTES

The following summarizes the waterline material types within the Municipality:

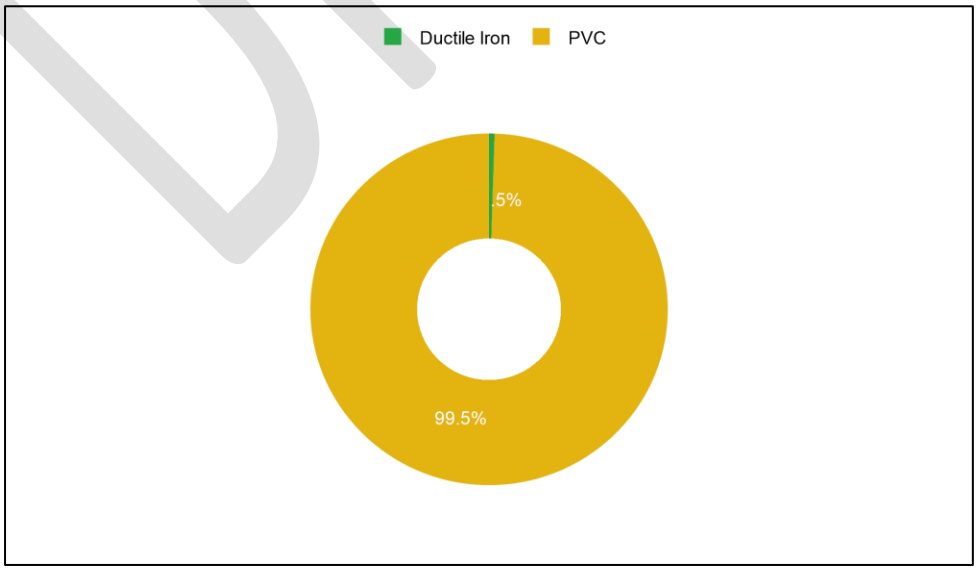


Figure 61: Waterline by Material

5.7.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for waterlines is determined through an age-based condition analysis, as no condition data was available. The five (5) Condition States are defined as follows:

Figure 62: Waterline Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the waterlines is 67. This represents an overall "Good" condition state.

Title	Condition	Condition State
Network Overall Condition	67	Good

The following summarizes the 2020 Network Condition, weighted by section length:

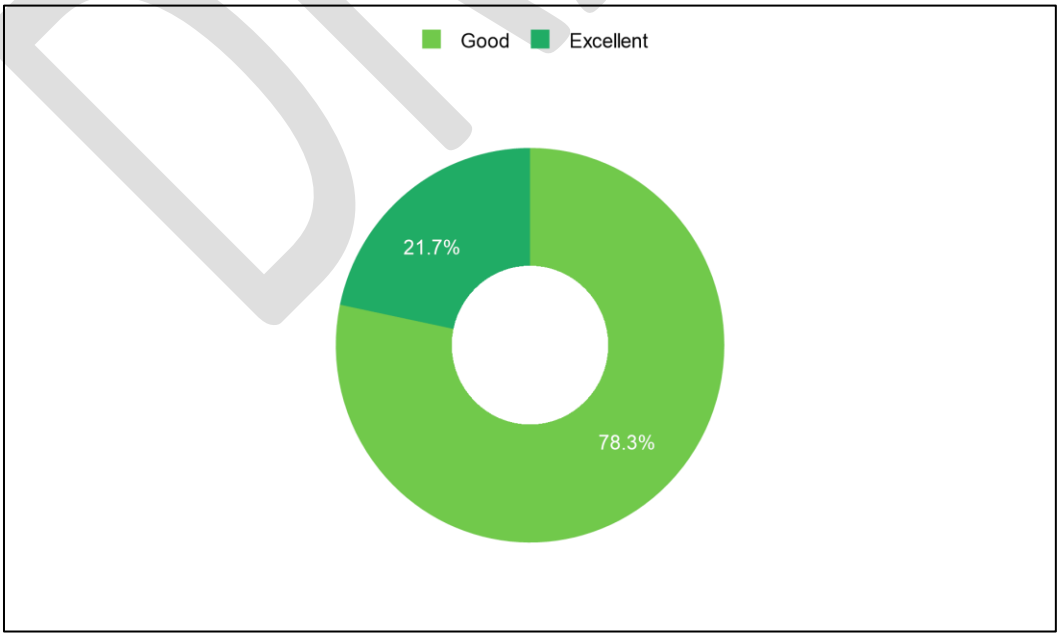


Figure 63: Waterline Network Condition

The Condition States by Material are shown in Figure 64:

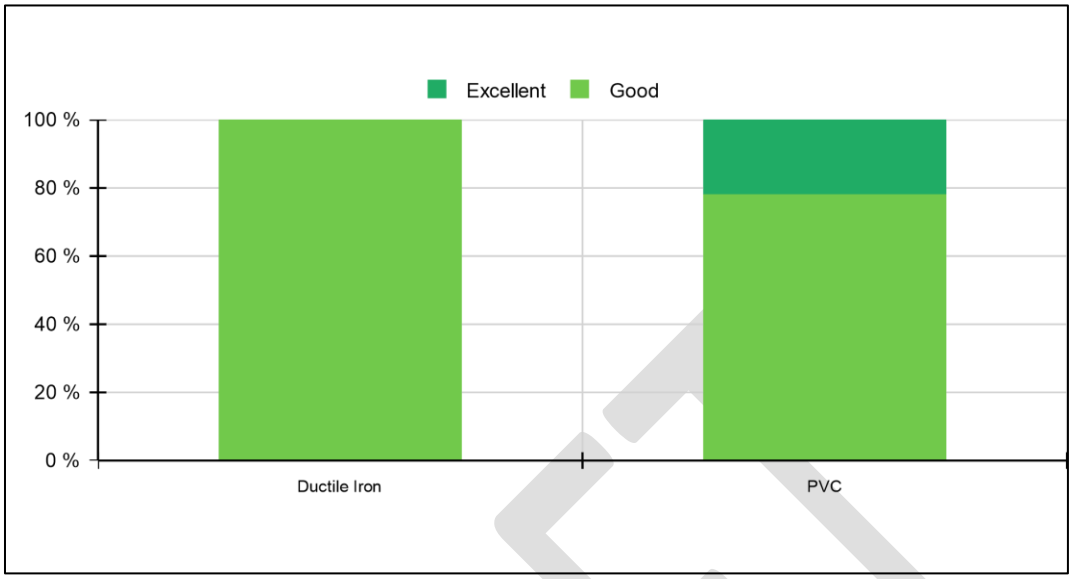


Figure 64: Waterline Network Condition by Material

The Map view of the condition states is shown in Figure 65:

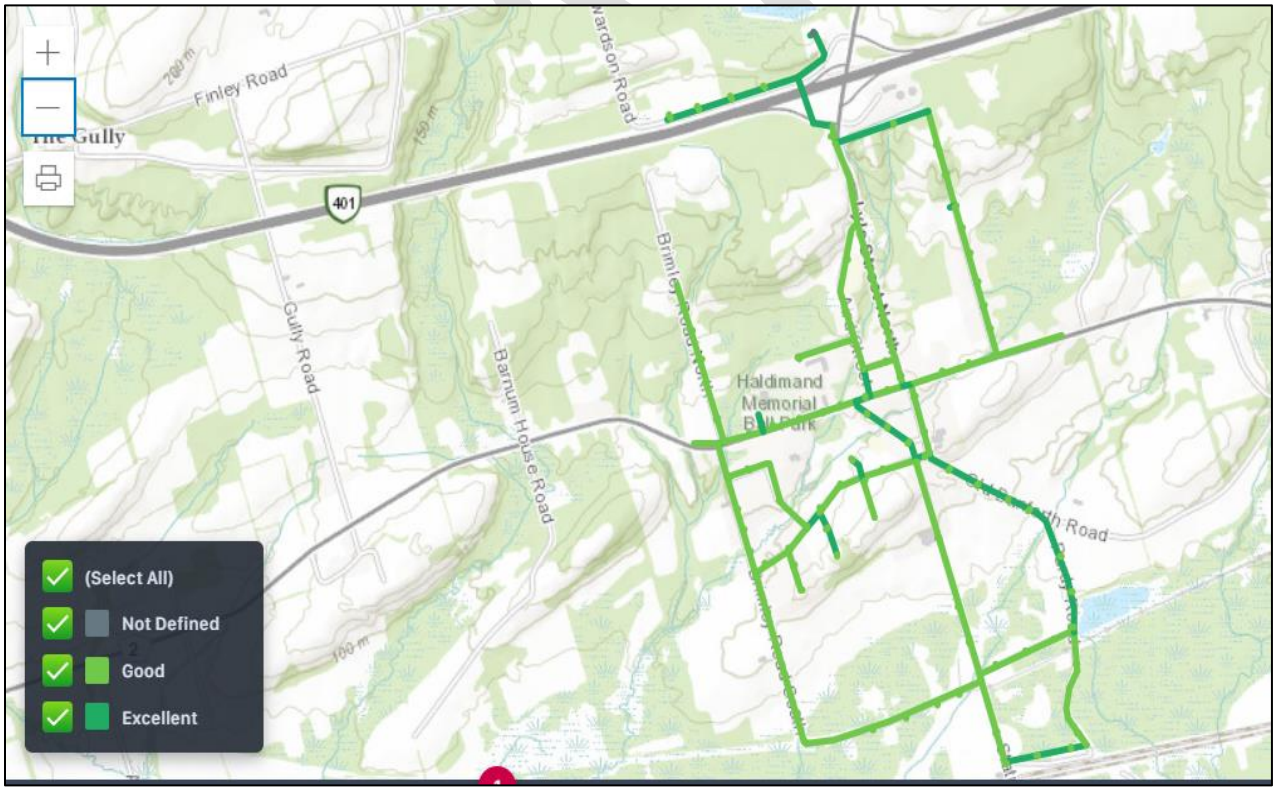


Figure 65: Waterlines Current Network Condition Map

5.7.3 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Pipe Diameter. Socio-economic factors were not included.

Criticality Settings

Diameter	10
0 - 175	20
175 - 250	40
> 250	70

This figure 66 shows the criticality states of the Waterlines:

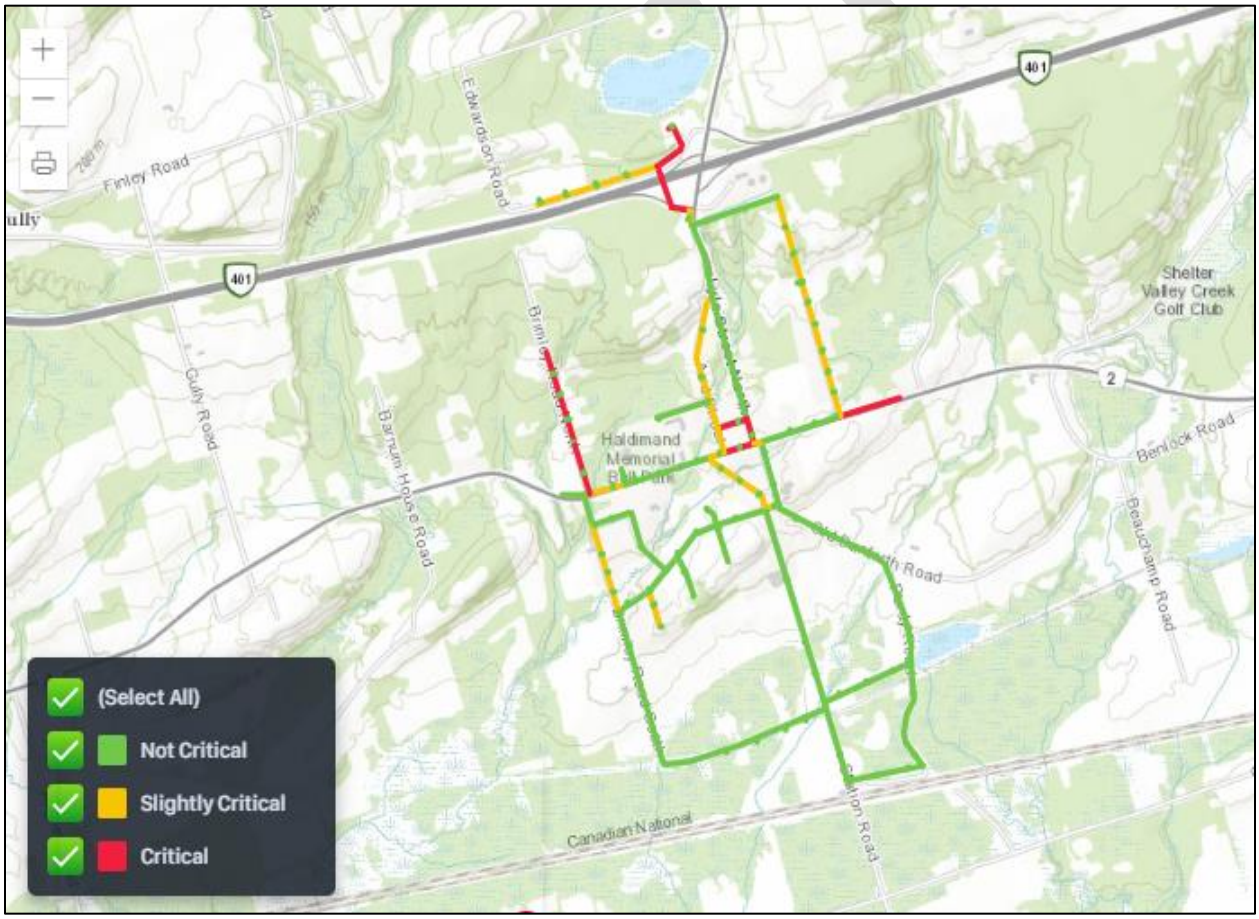


Figure 66: Waterlines Network Criticality Map

Risk
The Risk settings for Waterlines are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

This Figure 67 shows the Risk levels of the Waterlines:

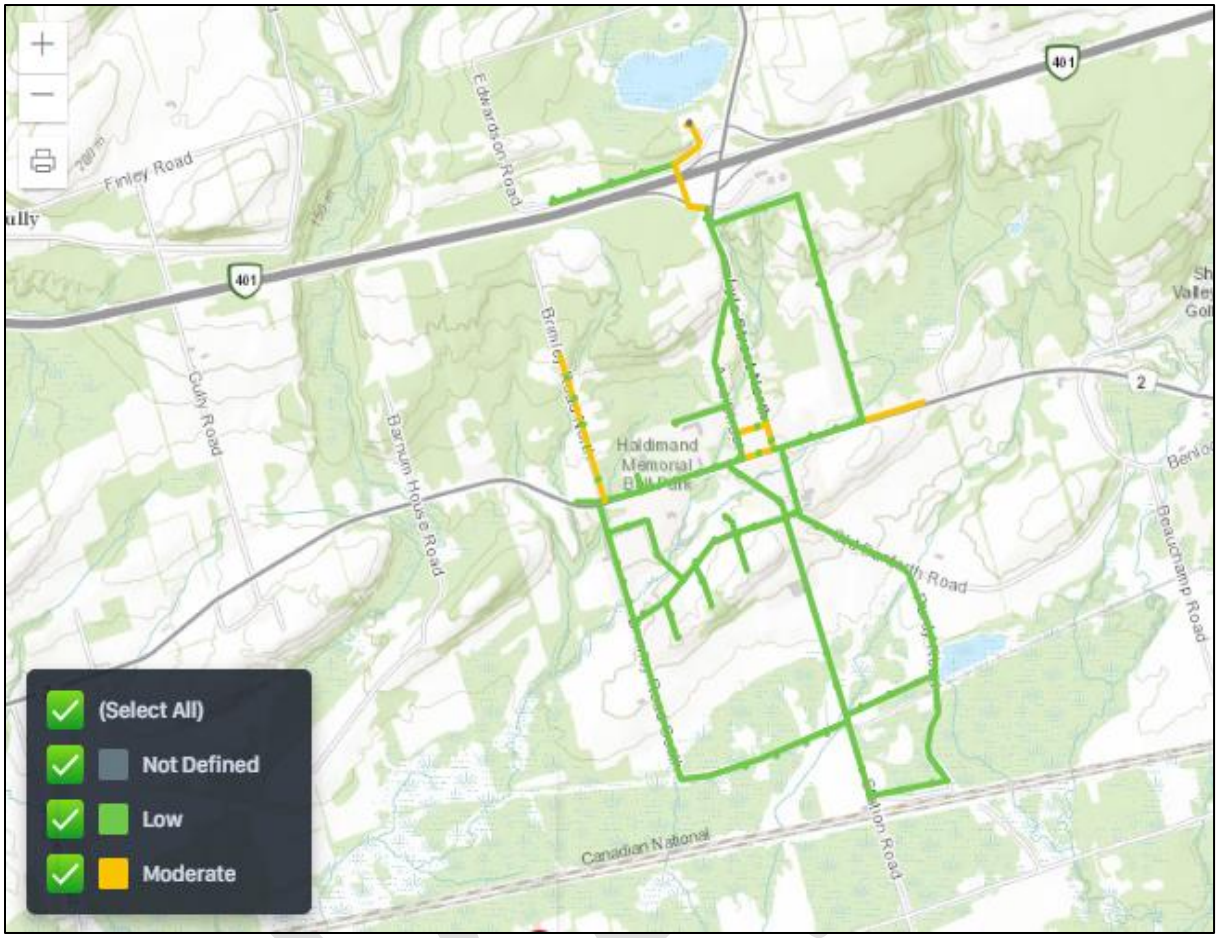


Figure 67: Waterlines Network Risk Map

5.7.4 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace waterlines before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.7.5 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for waterlines, and it is a replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	2.0%	2020

5.7.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the waterlines, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario	
Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings	
Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 68 shows the Waterline overall network performance throughout the plan period:

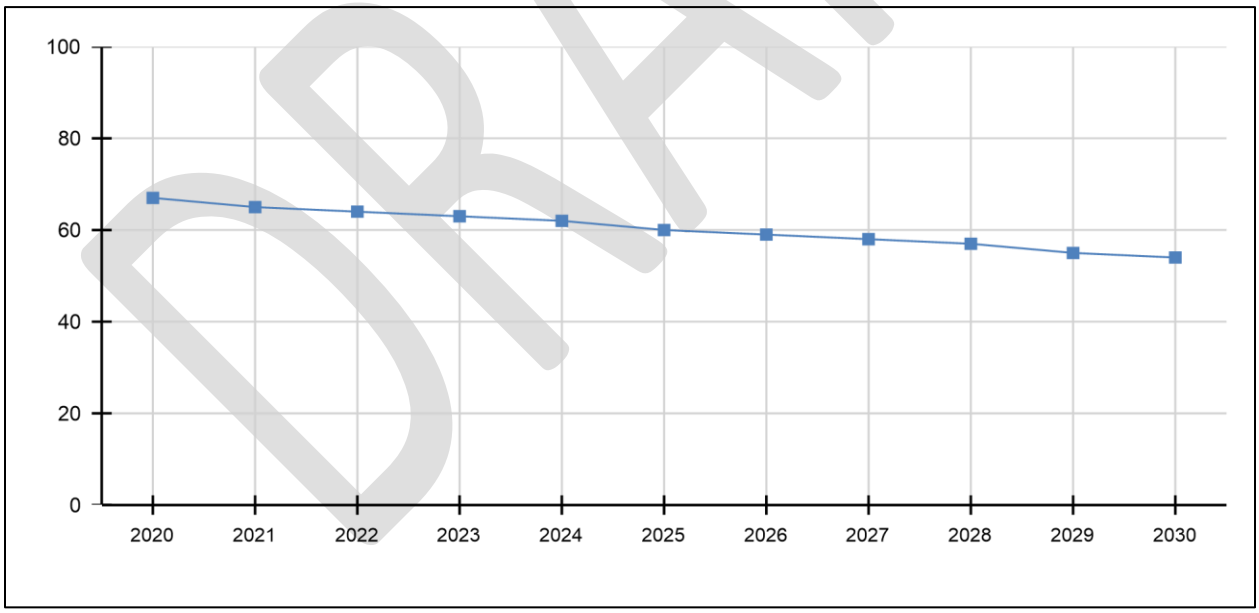


Figure 68: Waterlines Network Performance

Over the next 10 years, as the pipes age, the performance of the waterline network decrease from 67 to 54 at the end of plan.

Figure 69 shows the Waterline overall network performance by Pipe Diameter throughout the plan period:

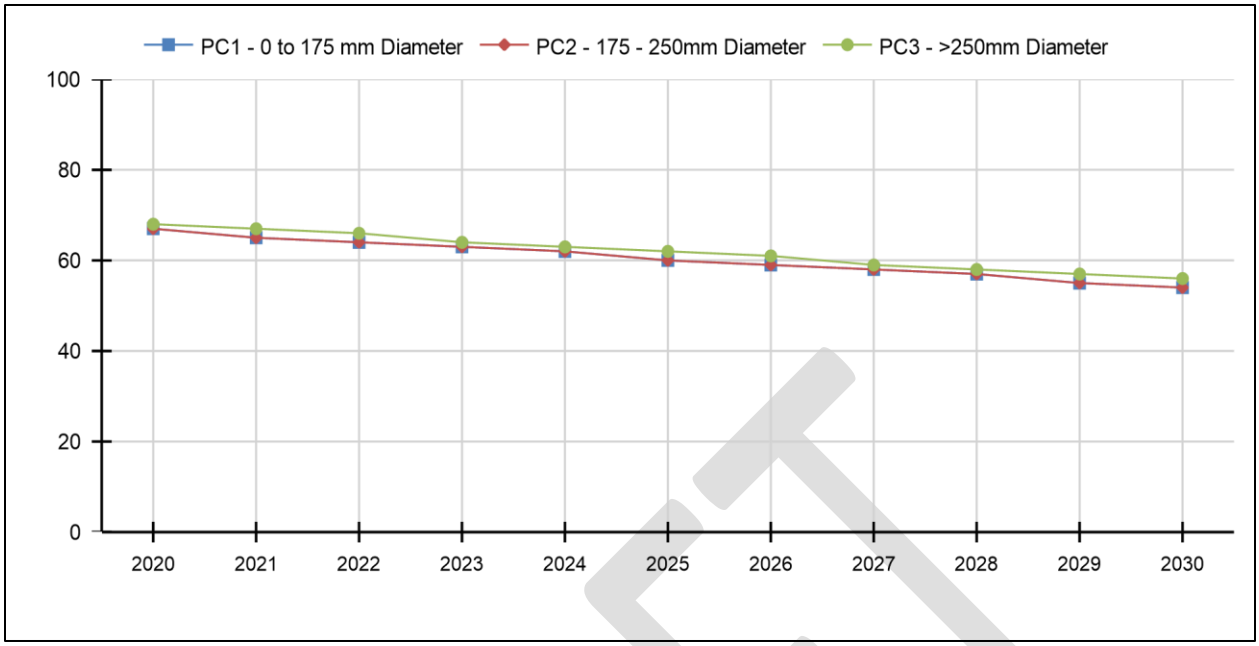


Figure 69: Waterlines Network Performance by Pipe Diameter

Figure 70 shows the condition status distribution of the waterline network at each year of the plan:

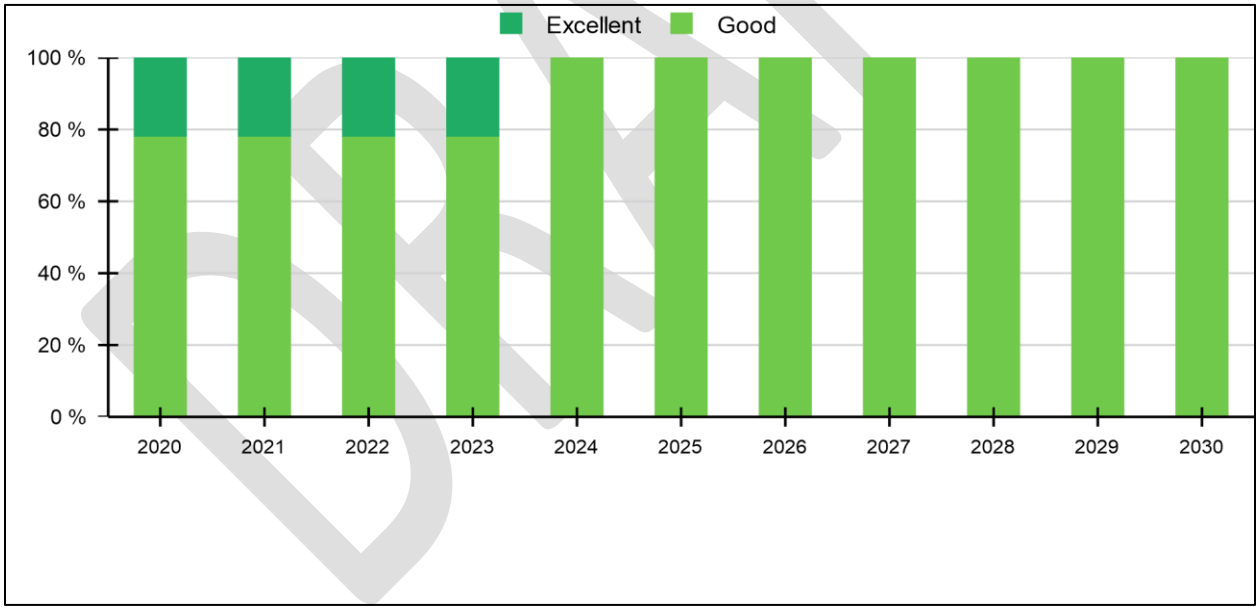


Figure 70: Waterlines Annual Network Condition Status

As shown in this figure, at the beginning of the plan 22% is in excellent, and 78% in good condition. At the end of the 10-year plan 100% of the Waterline network will be in good condition.

There are no capital projects scheduled for Waterlines during the Plan period. Also, as per Level of Service target, none of the Waterline sections are in a deficit position at the end of the plan period.

5.8 WATER TREATMENT PLANT

The Township of Alnwick/Haldimand has a total of 38 Water Treatment Plants Assets.

5.8.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Water Treatment Plants Assets is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 71: Treatment Plant (Water) Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Water Treatment Plant Assets is 47, a "Fair condition state. The Network Condition is calculated based on replacement cost due to the large variance in costs.

Title	Condition	Condition State
Network Overall Condition	47	Fair

The following summarizes the 2020 Network Condition States:

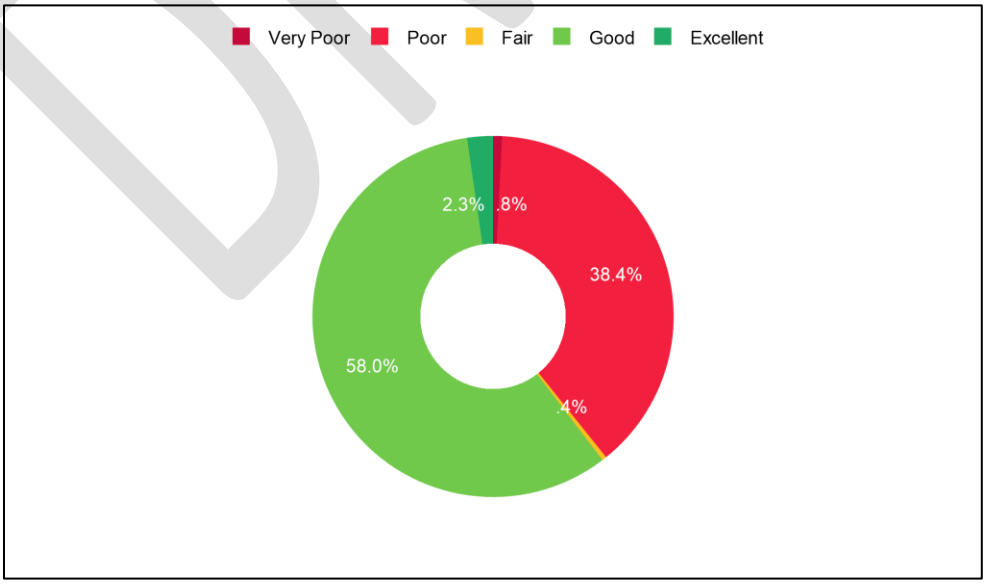


Figure 72: Treatment Plant (Water) Assets Network Condition Status

5.8.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings	
Asset Status	**5**
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Water Treatment Plant Assets are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.8.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Water Treatment Plant Assets before the end of their service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.8.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Water Treatment Plants Assets, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	2.0%	2020

5.8.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Water Treatment Plants Assets, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario	
Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 73 shows the Water Treatment Plants Assets overall network performance throughout the plan period:

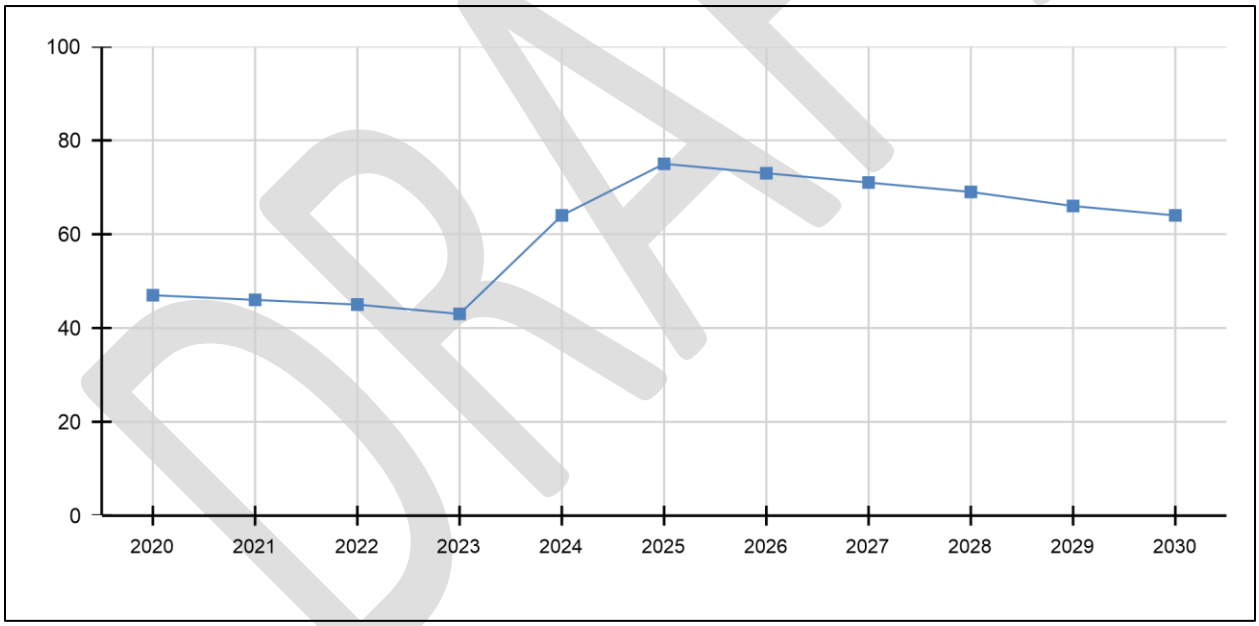


Figure 73: Water Treatment Plant Network Performance

Over the next 10 years, the performance of the Water Treatment Plants Assets network improves from 47 to 66 at the end of plan.

Figure 74 shows the condition status distribution of the Water Treatment Plants Assets network at each year of the plan:

Figure 74: Treatment Plant (Water) Annual Network Condition Status

As shown in this figure, at the beginning of the plan 2% is in excellent, 58% is in good, 38% in poor condition, and 1% in very poor condition. At the end of the 10-year plan 37% will be in excellent, 59% in good, 2% in fair, and 2% in poor condition.

The scheduled capital expenditures are shown in Figure 75:

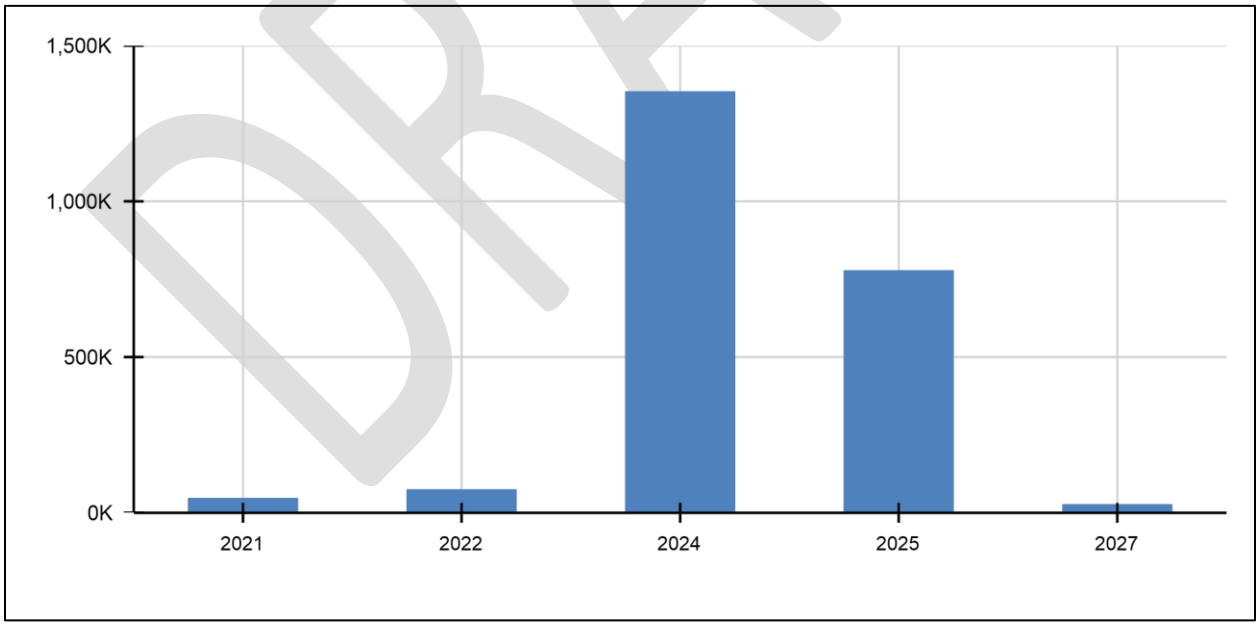


Figure 75: Treatment Plant (Water) Capital Expenditures

The backlog is cleared in the first year of the capital plan, and there is no deficit during the remainder of the plan period.

5.9 WATER VALVES

This category includes a total of 224 Water valves in the Township of Alnwick/Haldimand' s inventory. Condition data for the water valves were not available. An age-based condition (% Remaining Service Life) was calculated for the assets.

5.9.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Water Valves is determined through an age-based analysis. The five (5) Condition States are defined as follows:

Figure 76: Water Valve Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Valves is 70. Du due the large variation in cost, the Network condition is weighed by replacement cost. This represents an overall "Good" condition state.

Title	Condition	Condition State
Network Overall Condition	70	Good

The Network Condition Status distribution is shown in Figure 77:

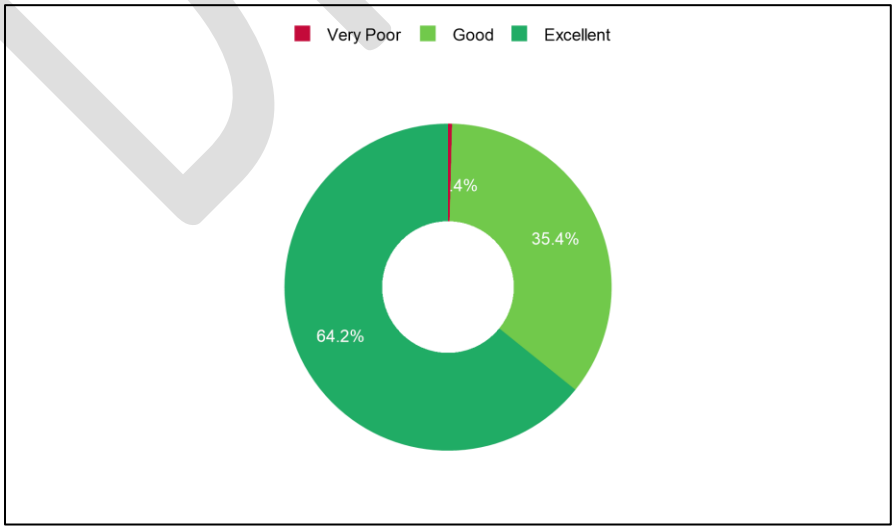


Figure 77: Water Valve Condition State

The Map view of the condition state is shown in Figure 78:

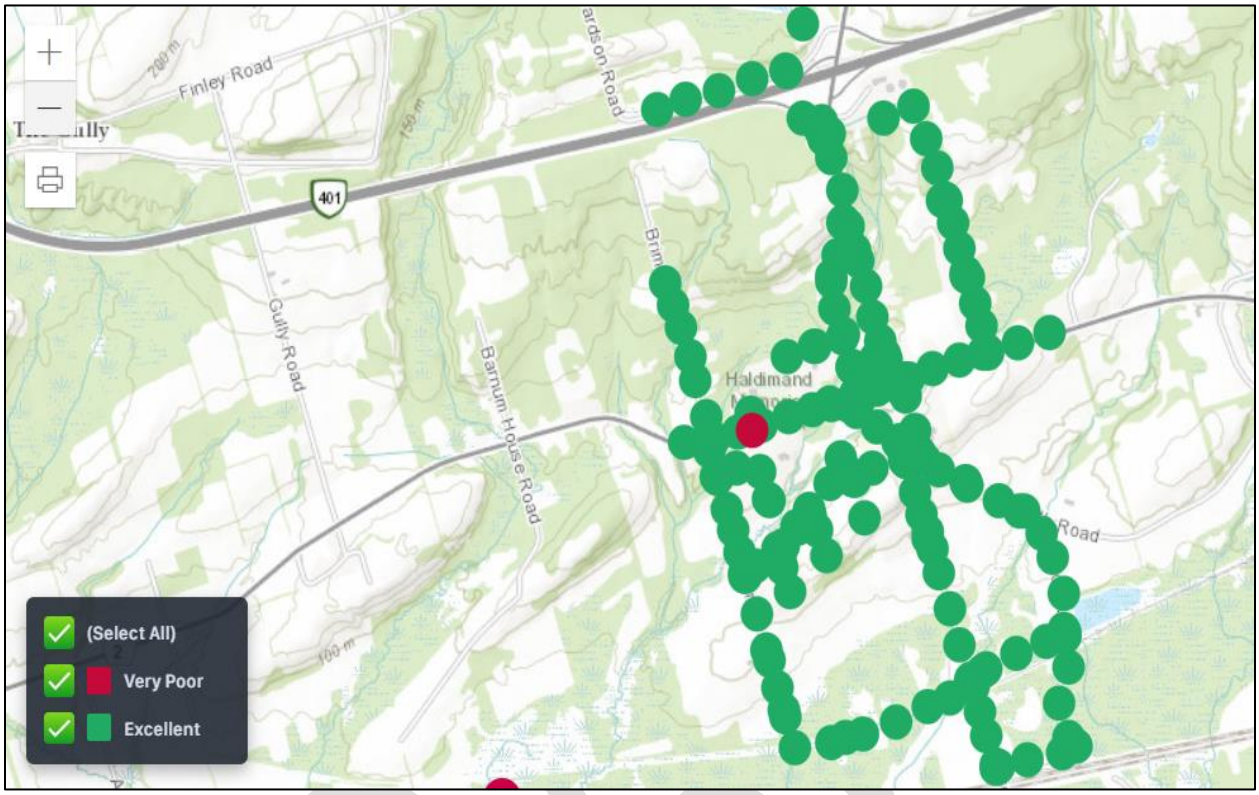


Figure 78: Water Valves Current Network Condition Map

5.9.2 CRITICALITY AND RISK CRITERIA

Criticality

Based on the data attributes available, the Criticality settings were applied based on Asset Status only, with in-service assets being critical. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk

The Risk settings for Water valve settings are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.9.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace water valves before the end of their service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.9.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for water valves, and it is a replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.9.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Water valves and is a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 79 shows the Valve overall network performance throughout the plan period:

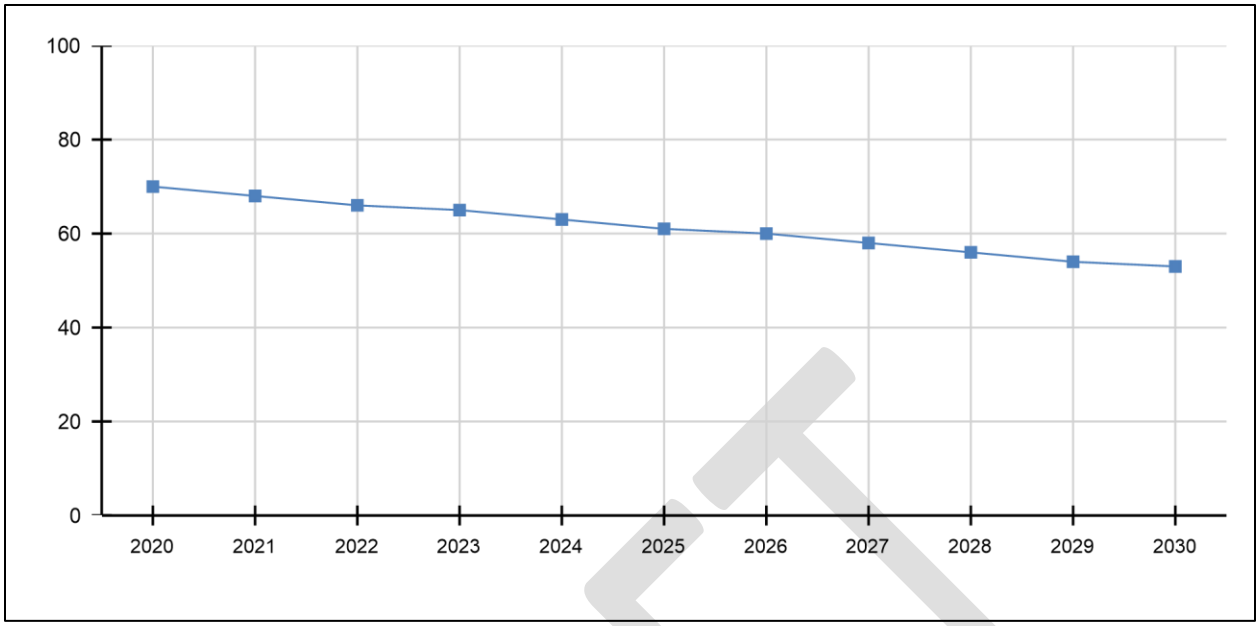


Figure 79: Overall Valves Network Performance

Over the next 10 years, as the assets age, the performance of the valve network declines from 70 to 53 at the end of plan.

Figure 80 shows the condition status distribution of the valve network at each year of the plan:

Figure 80: Annual Valves Network Condition Status

As shown in this figure, at the beginning of the plan 60% is in excellent, and 40% is in good condition. At the end of the 10-year plan 47% of sections will be in good, and 53% of sections will be in fair condition.

There are no capital projects scheduled for Waterlines during the Plan period. Also, as per Level of Service target, none of the Waterline sections are in a deficit position at the end of the plan period.

5.10 HYDRANTS

The Township of Alnwick/Haldimand has 118 Hydrants assets in its inventory. Condition data for the Hydrants were not available, so an age-based condition (% Remaining Service Life) was calculated.

5.10.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Hydrants is determined through an age-based analysis. The five (5) Condition States are defined as follows:

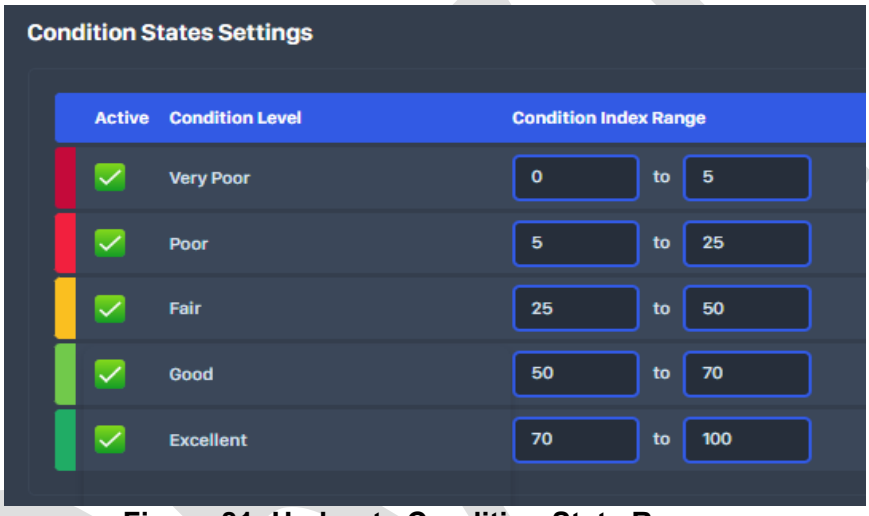


Figure 81: Hydrants Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) is 48. This represents an overall “Fair” condition state.

Title	Condition	Condition State
Network Overall Condition	48	Fair

The Map view of the condition state is shown in Figure 82.

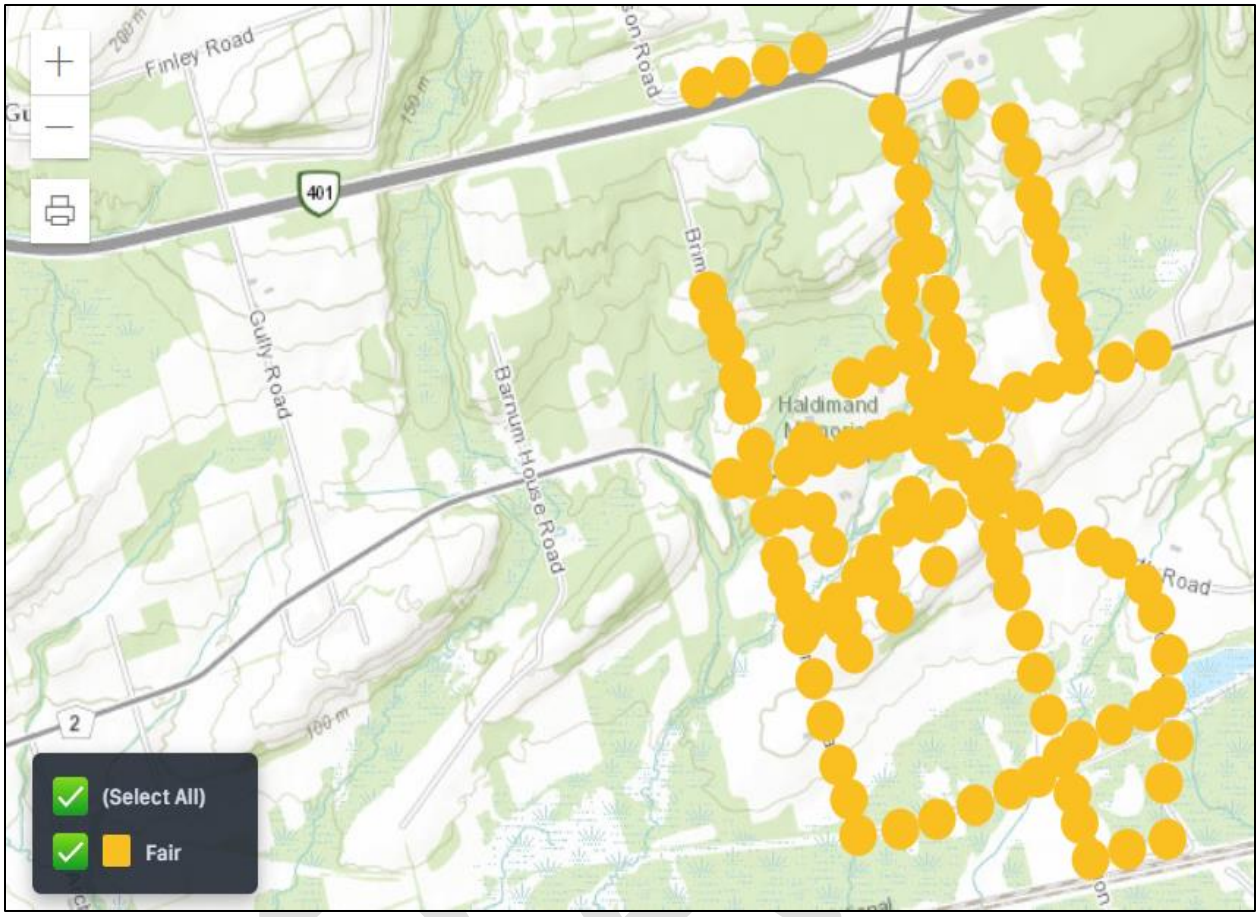


Figure 82: Hydrants Current Network Condition Map

5.10.2 CRITICALITY AND RISK CRITERIA

Criticality

Based on the data attributes available, the Criticality settings were applied based on Asset Status only, with in-service assets being critical. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk

The Risk settings for Hydrant are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.10.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Hydrants before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.10.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Hydrants, and it is a replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	2.0%	2020

5.10.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Hydrants, and in this case, it is a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 83 shows the Hydrant overall network performance throughout the plan period:

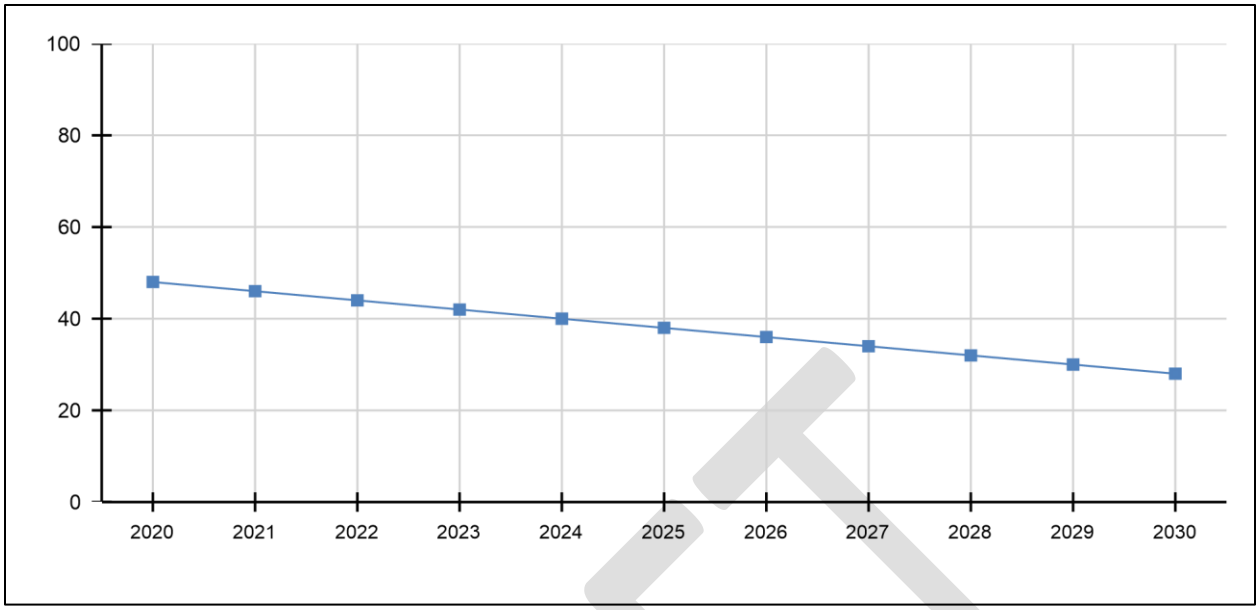


Figure 83: Overall Hydrants Network Performance

Over the next 10 years, as the assets age, the performance of the Hydrant network decreases from 48 to 28 at the end of plan.

Figure 84 shows the condition status distribution of the Hydrant network at each year of the plan:

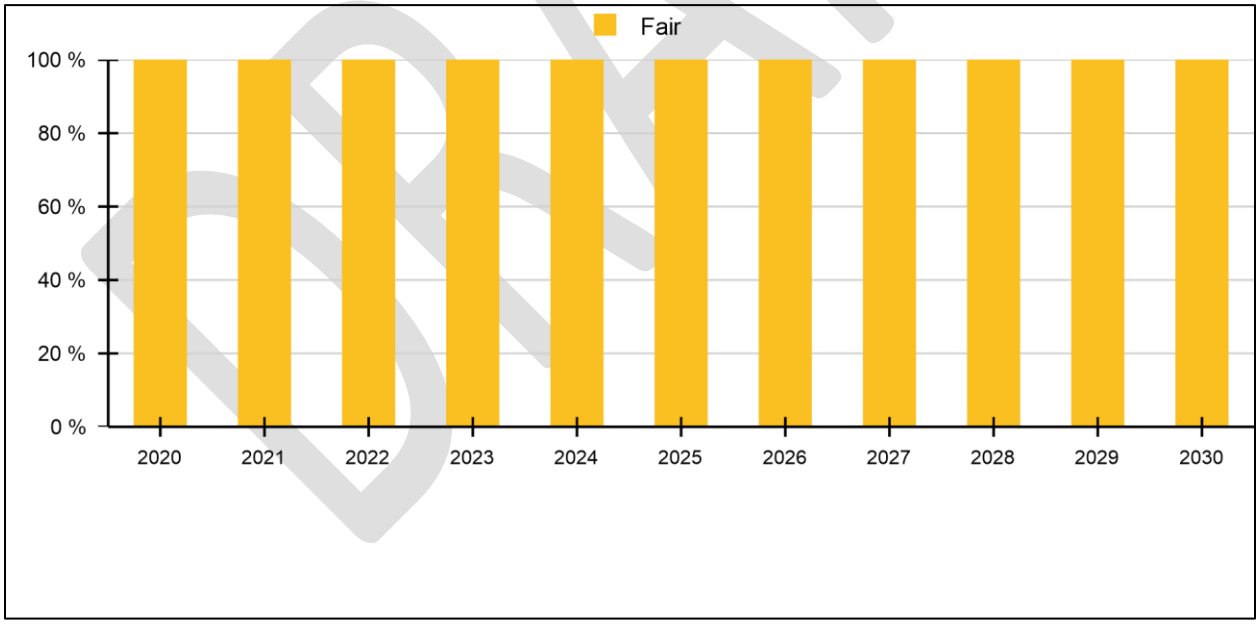


Figure 84: Annual Network Condition State - Hydrants

As shown in this figure, at the beginning of the plan 100% fair, with no change in the condition states throughout the plan period.

None of the Hydrant's sections are in a deficit position throughout the plan period, and no replacements are scheduled.

5.11 WATER METERS

The Township of Alnwick/Haldimand has a total of 3 pooled Water Meter assets.

5.11.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Water Meter assets is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 85: Water Meter Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Water Meters Assets, weighed by replacement cost, is 73. This represents an overall "Good" condition state.

Title	Condition	Condition State
Network Overall Condition	73	Good

The following summarizes the 2020 Network Condition States:

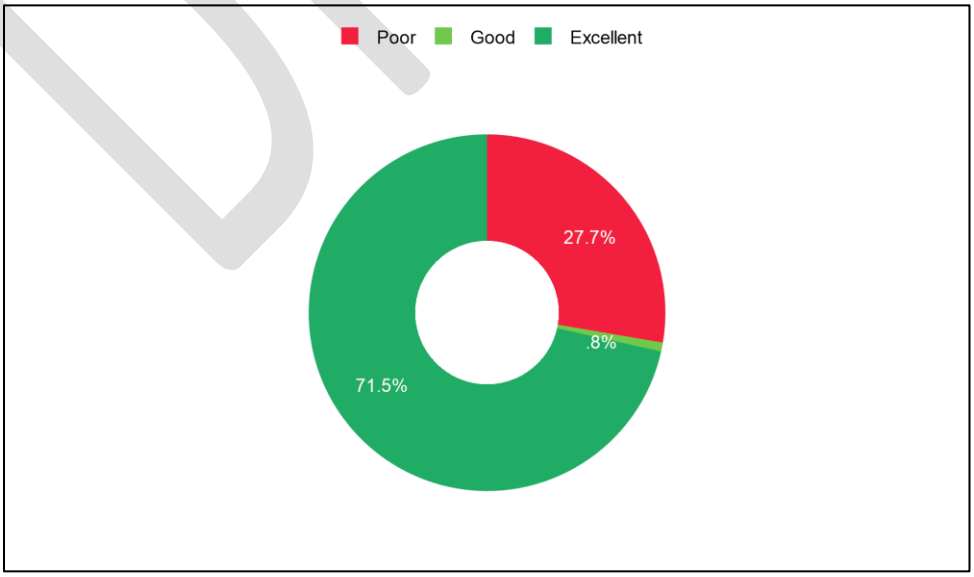


Figure 86: Water Meter Assets Network Condition

5.11.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Water Meter assets are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.11.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Water Meters assets before the end of their service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.11.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Water Meters Assets, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	2.0%	2020

5.11.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Water Meter assets, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 87 shows the Water Meters Assets overall network performance throughout the plan period:

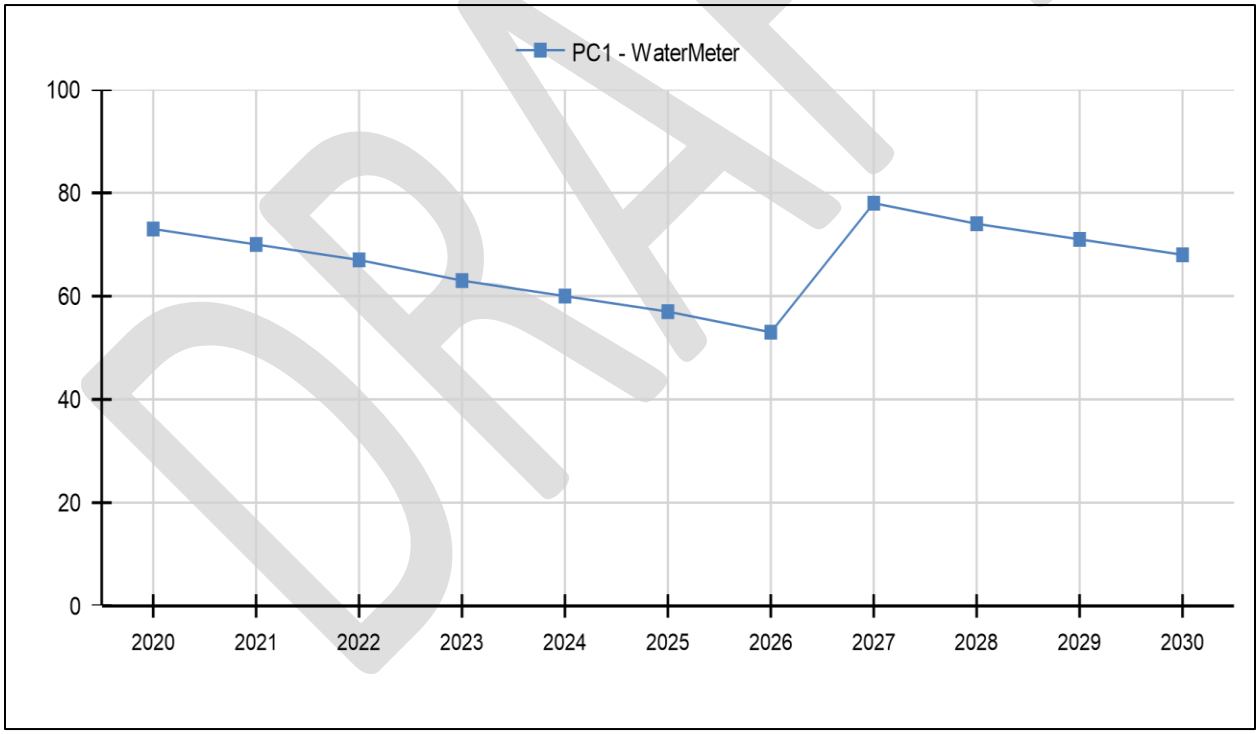


Figure 87: Water Meter Network Performance

Over the next 10 years, the performance of the Water Meter network declines from 73 to 68 at the end of plan.

Figure 88 shows the condition status distribution of the Water Meter network at each year of the plan:

Figure 88: Water Meter Annual Network Condition Status

As shown in this figure, at the beginning of the plan 72% is in excellent, 1% in good, and 28% in poor condition. At the end of the 10-year plan 28% will be in excellent, 72% in good, and 1% in fair condition.

The scheduled capital expenditures are shown in Figure 89:

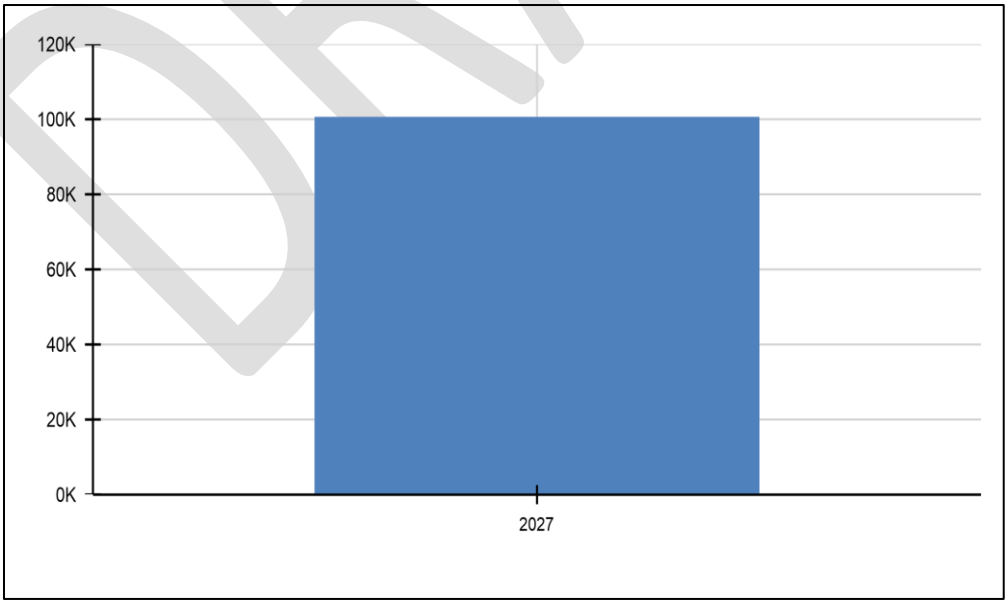


Figure 89: Water Meter Capital Expenditures

None of the Water Meters will be in a deficit position throughout the plan period.

5.12 WELLS

The Township of Alnwick/Haldimand has a total of 2 Water wells.

5.12.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Water wells Assets is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 90: Treatment Plant (Water) Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Water Meters Assets, weighed by replacement cost, is 66. This represents an overall “Fair” condition state.

Title	Condition	Condition State
Network Overall Condition	18	Poor

The following summarizes the 2020 Network Condition States:

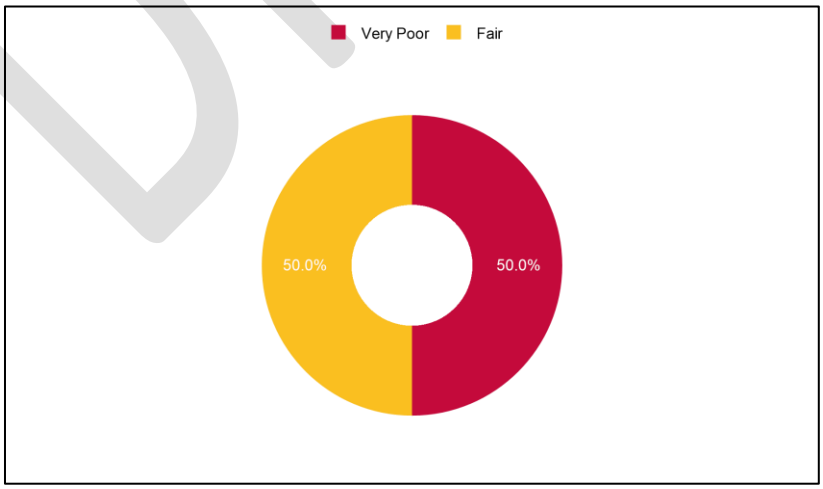


Figure 91: Wells Network Condition

5.12.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Wells are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.12.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Wells before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.12.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Wells, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	2.0%	2020

5.12.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Wells, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 92 shows the Wells overall network performance throughout the plan period:

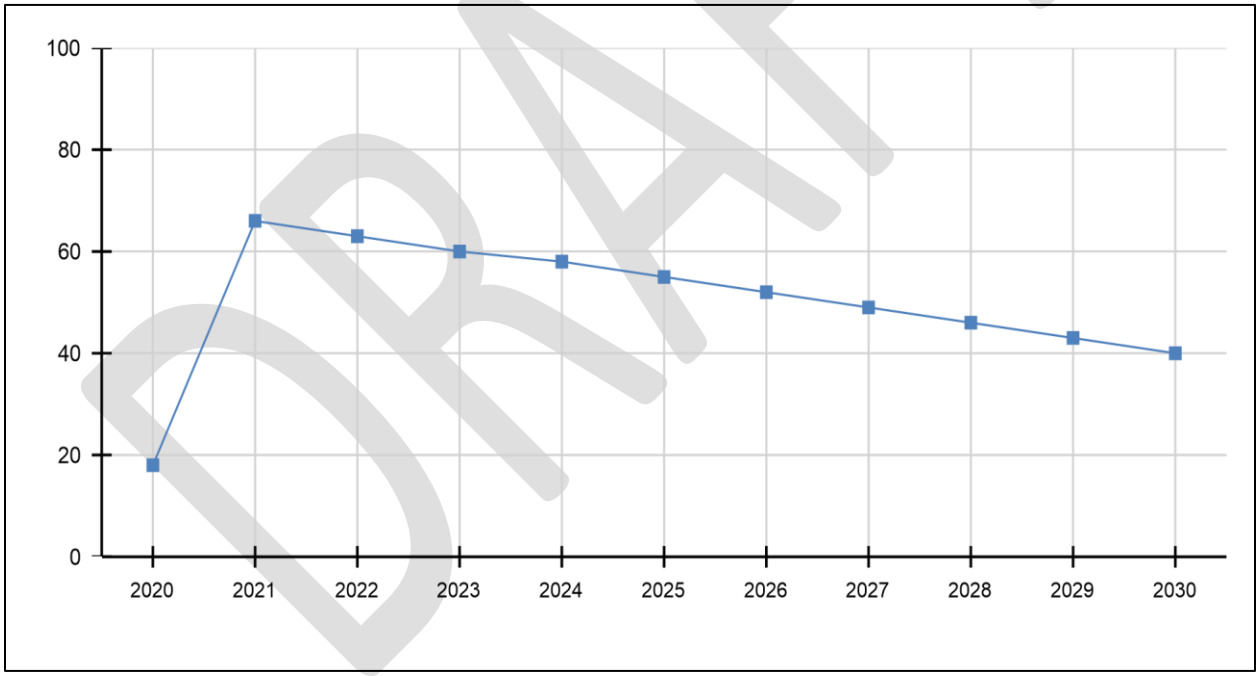


Figure 92: Wells Network Performance

Over the next 10 years, the performance of the Wells network improves from 18 to 40 at the end of plan.

Figure 93 shows the condition status distribution of the Water Meters Assets network at each year of the plan:

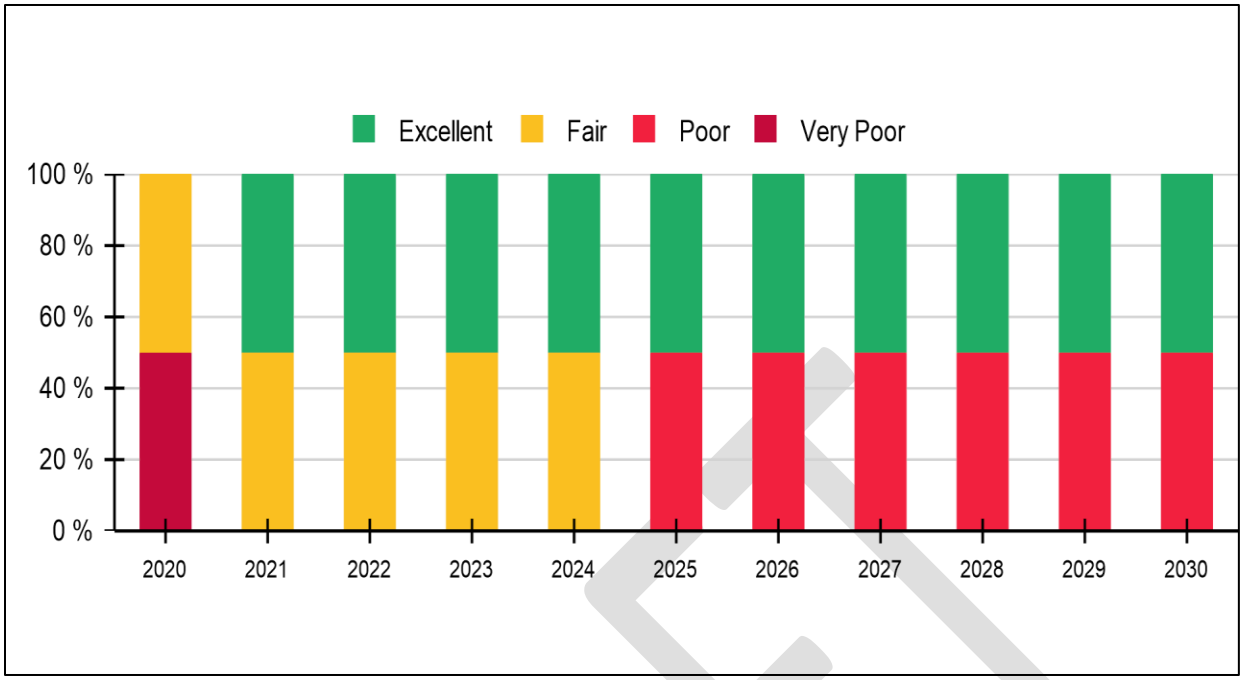


Figure 93: Wells Annual Network Condition Status

As shown in this figure, at the beginning of the plan 50% is in fair, and 50% in very poor condition. At the end of the 10-year plan 50% will be in excellent, and 50% will be in poor condition.

The scheduled capital expenditures are shown in Figure 94:

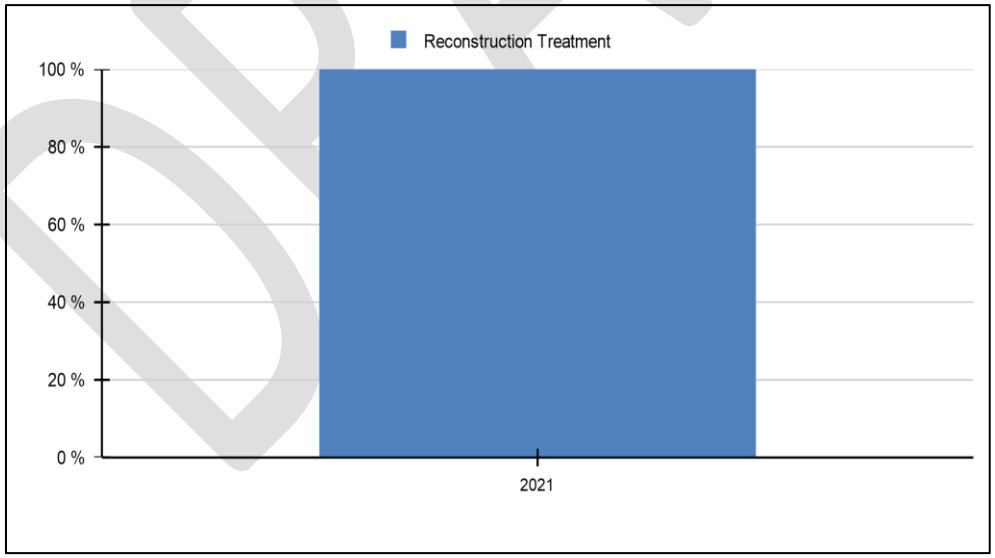


Figure 94: Wells Capital Expenditures

One of the two Wells has to be replaced due to an ammonia contamination. The condition of that Well was adjusted to 0. The replacement is scheduled for the first year of the plan. The Wells will not be in a deficit position for the remainder of the 10-year plan.

5.13 BUILDINGS

The Township of Alnwick/Haldimand has a total of 39 Building Assets. No data for Building Elements/Components was available, so the buildings are analyzed on the whole.

5.13.1 BUILDINGS ATTRIBUTES

The Buildings are classified by Department. The Network size is weighed by replacement cost.

Department	Replacement Cost	Percentage
General Government	1,466,188	7.9%
Recreation Facilities	8,450,233	45.3%
Fire Protection	3,842,175	20.6%
Library	1,421,658	7.6%
Transportation services	3,464,942	18.6%

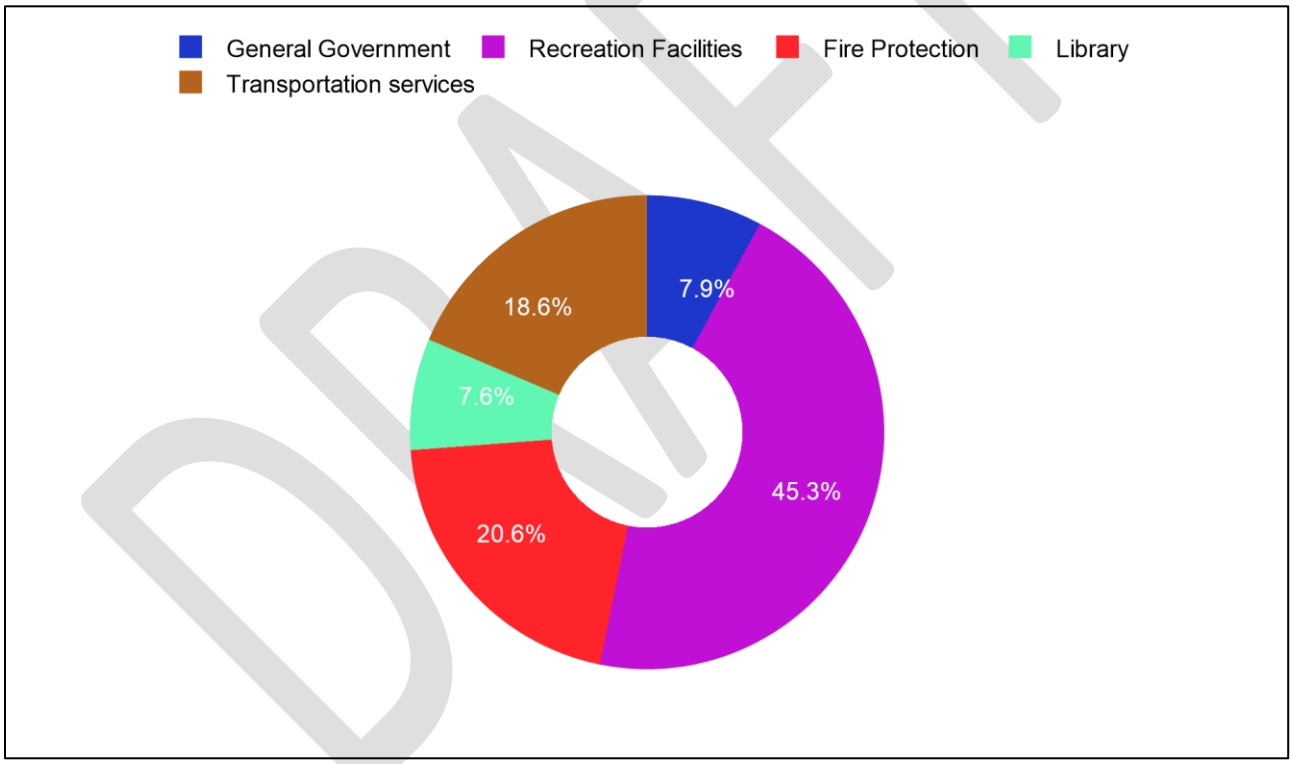


Figure 95: Buildings by Department

5.13.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Buildings is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Active	Condition Level	Condition Index Range		
✓	Very Poor	0	to	5
✓	Poor	5	to	20
✓	Fair	20	to	60
✓	Good	60	to	80
✓	Excellent	80	to	100

Figure 96: Buildings Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the buildings is 49. The network condition is weighed by replacement cost. This represents an overall "Fair" condition state.

Title	Condition	Condition State
Network Overall Condition	49	Fair

The following summarizes the 2020 Network Pavement Condition, weighted by section length:

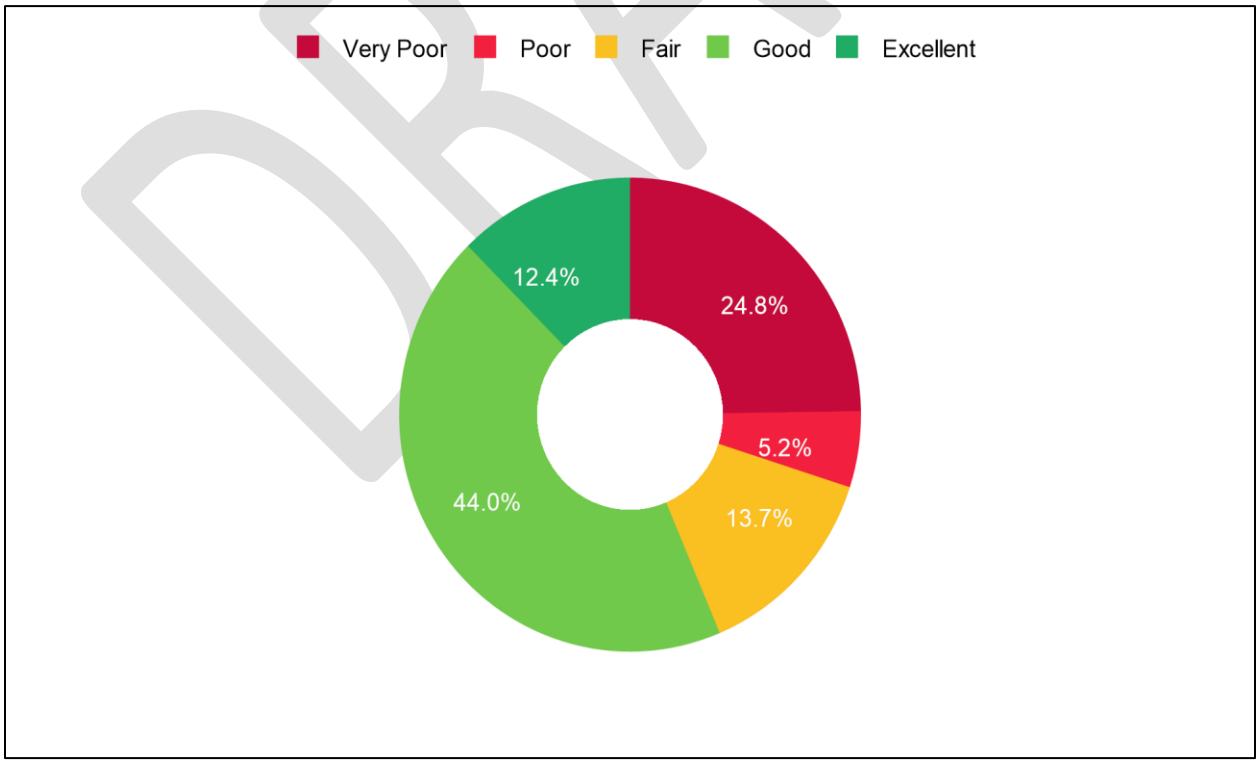


Figure 97: Buildings Network Condition

The Condition States by department are shown in Figure 98:

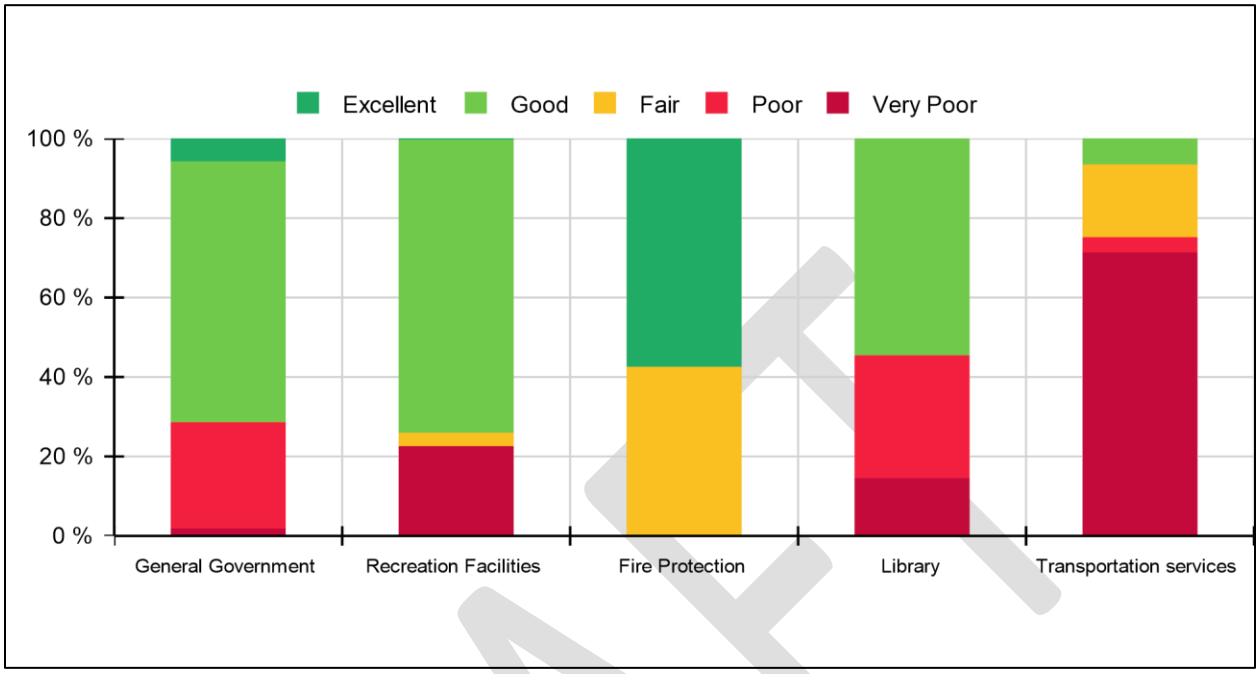


Figure 98: Buildings Network Condition by Department

5.13.3 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on asset status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0

Risk
The Risk settings for Buildings are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.13.4 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Buildings before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.13.5 LIFECYCLE MANAGEMENT STRATEGY

One Treatment option is available for buildings, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.13.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the buildings, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 99 shows the buildings overall network performance throughout the plan period:

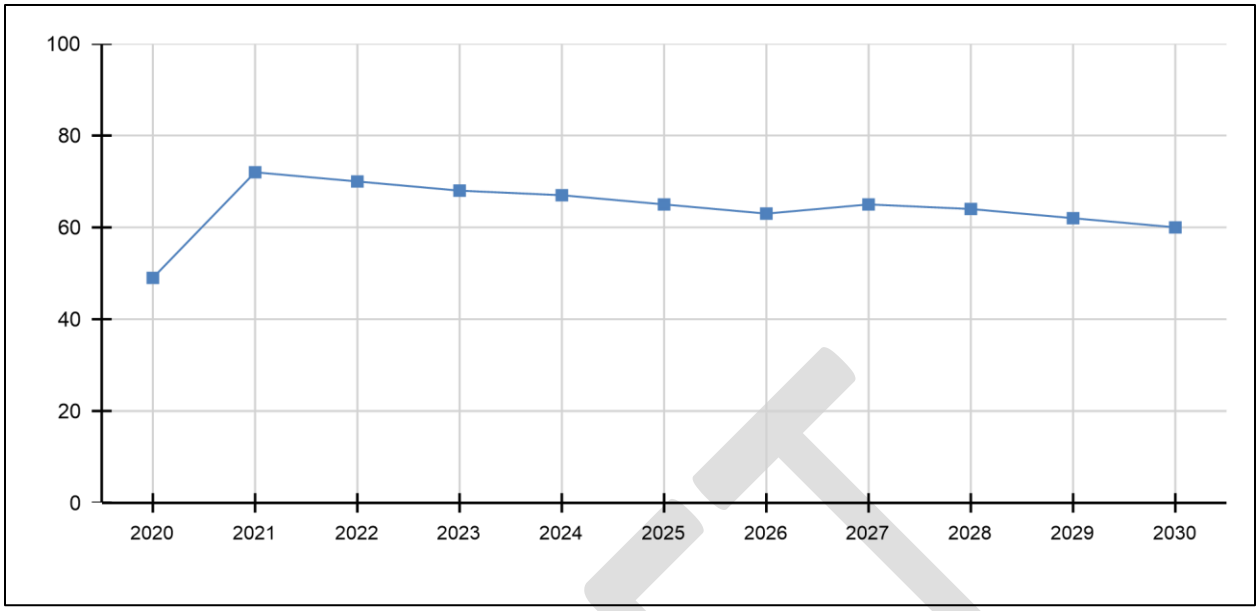


Figure 99: Building Network Performance

Over the next 10 years, the performance of the building network increases from 49 to 60 at the end of plan.

Figure 100 shows the condition status distribution of the building network at each year of the plan:

Figure 100: Building Annual Network Condition Status

As shown in this figure, at the beginning of the plan 12% is in excellent, 44% in good, 14% in fair, 5% in poor condition, and 25% in very poor condition. At the end of the 10-year plan 31% of the building assets will be in excellent, 12% in good, and 56% will be in fair condition.

The following capital expenditures for replacements are scheduled:

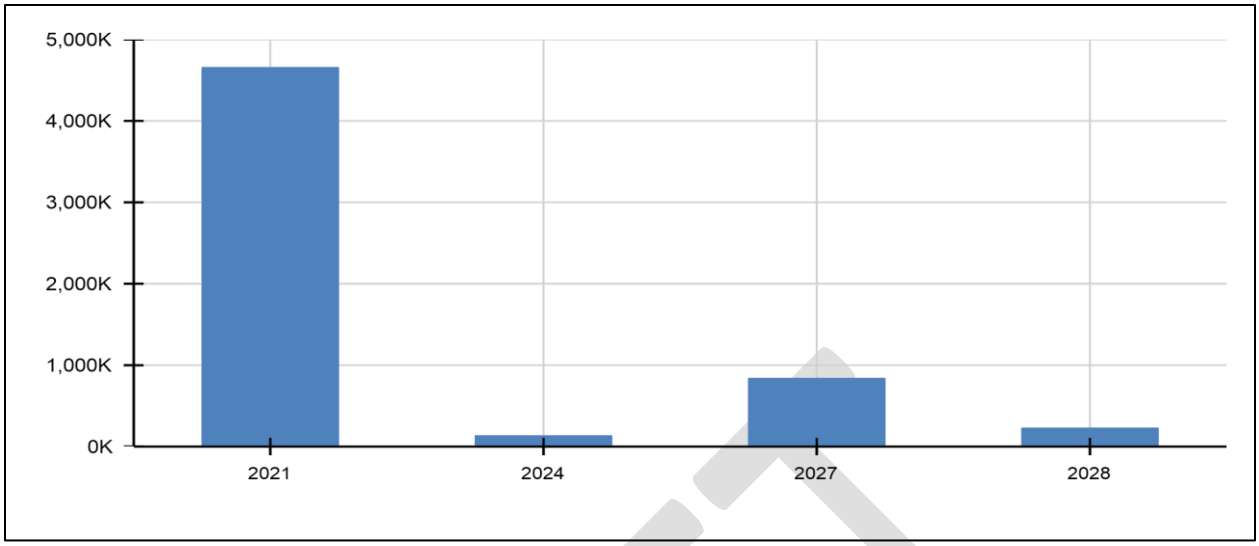


Figure 101: Building Projected Capital Expenditures

The backlog is taken care of in the first year of the plan, and there is no deficit position throughout the plan period.

These Building replacement projects are based on age triggers. Because no condition assessment, component-based data or renovation history is available, the scheduled replacement projects may not be required as specified.

5.14 VEHICLES

The Township of Alnwick/Haldimand has a total of 41 Vehicles, classified as Transportation service, Fire Department, Parks & Recreation, and CBO/By-law departments. Due to the large variation in cost, the Vehicles are weighed by Replacement Cost.

5.14.1 VEHICLES ATTRIBUTES

The Vehicles are classified by Department. The Network size is weighed by replacement cost.

Department	Replacement Cost ($)	Percentage
Fire Protection	5,778,728.0	68.1%
Transportation Services	2,640,762.0	31.1%
Parks & Recreation	33,155.0	0.4%
CBO/By-law	35,696.0	0.4%

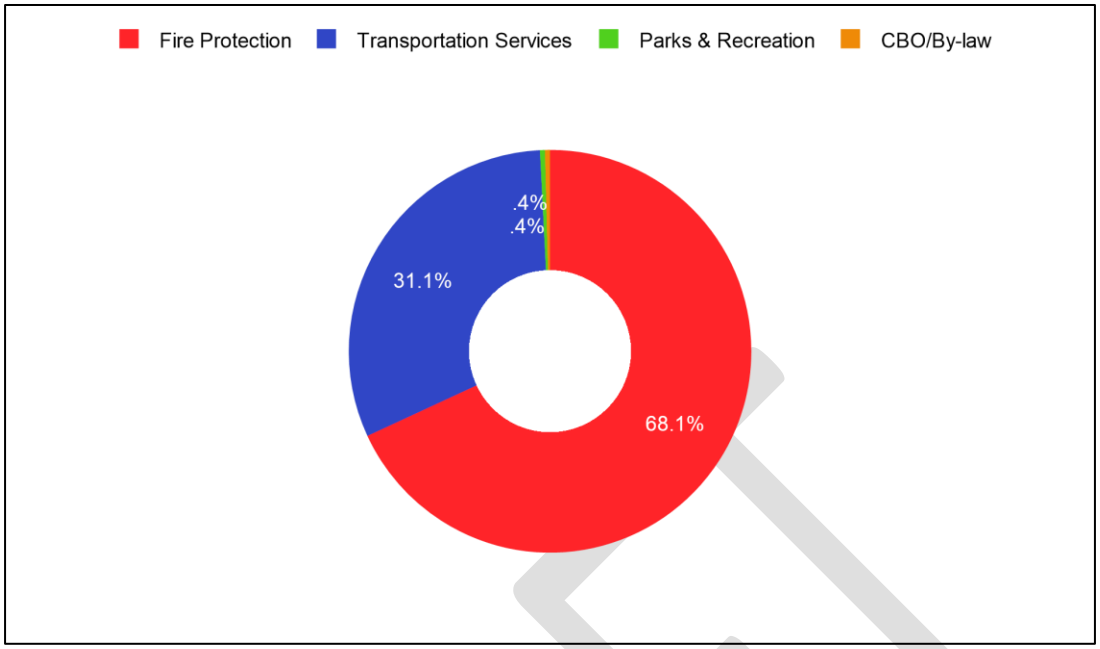


Figure 102: Vehicles by Department

5.14.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Vehicles is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 103: Vehicle Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Vehicles is 52. This represents an overall “Fair” condition state.

Title	Condition	Condition State
Network Overall Condition	52	Fair

The following summarizes the 2020 Network Pavement Condition, weighted by section length:

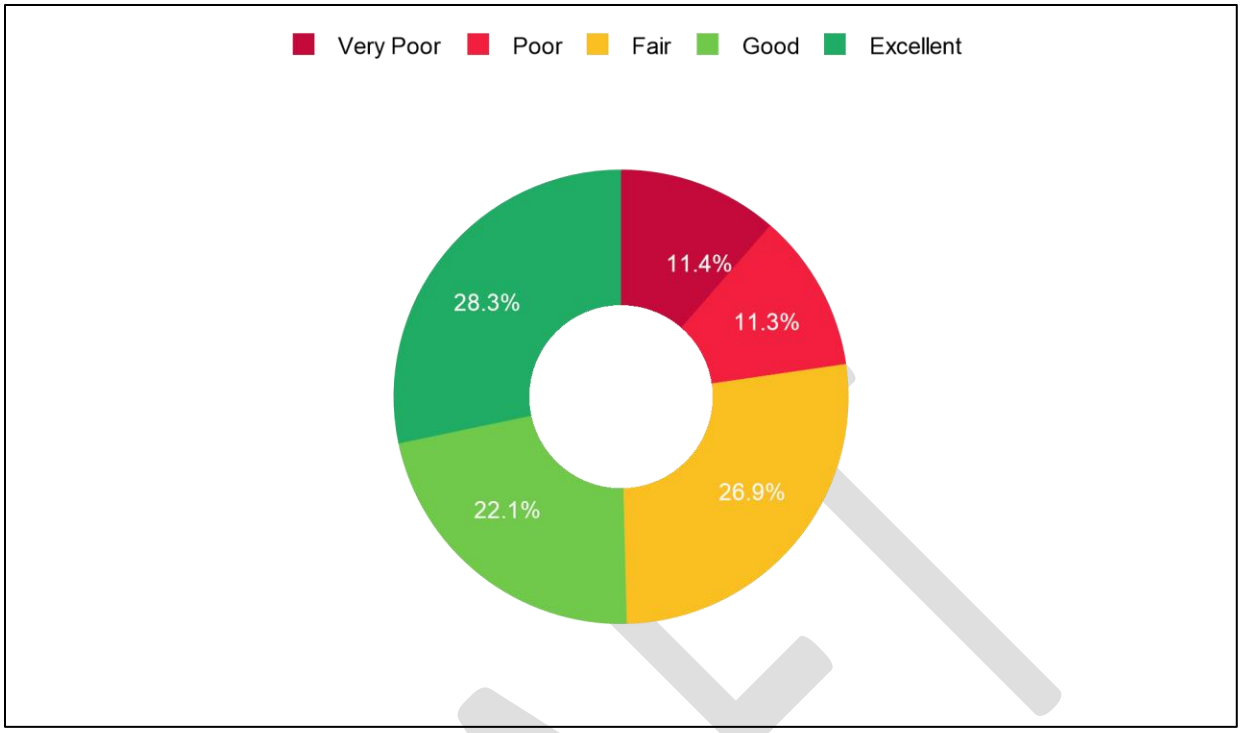


Figure 104: Vehicles Network Condition

The Condition States by department are shown in Figure 105:

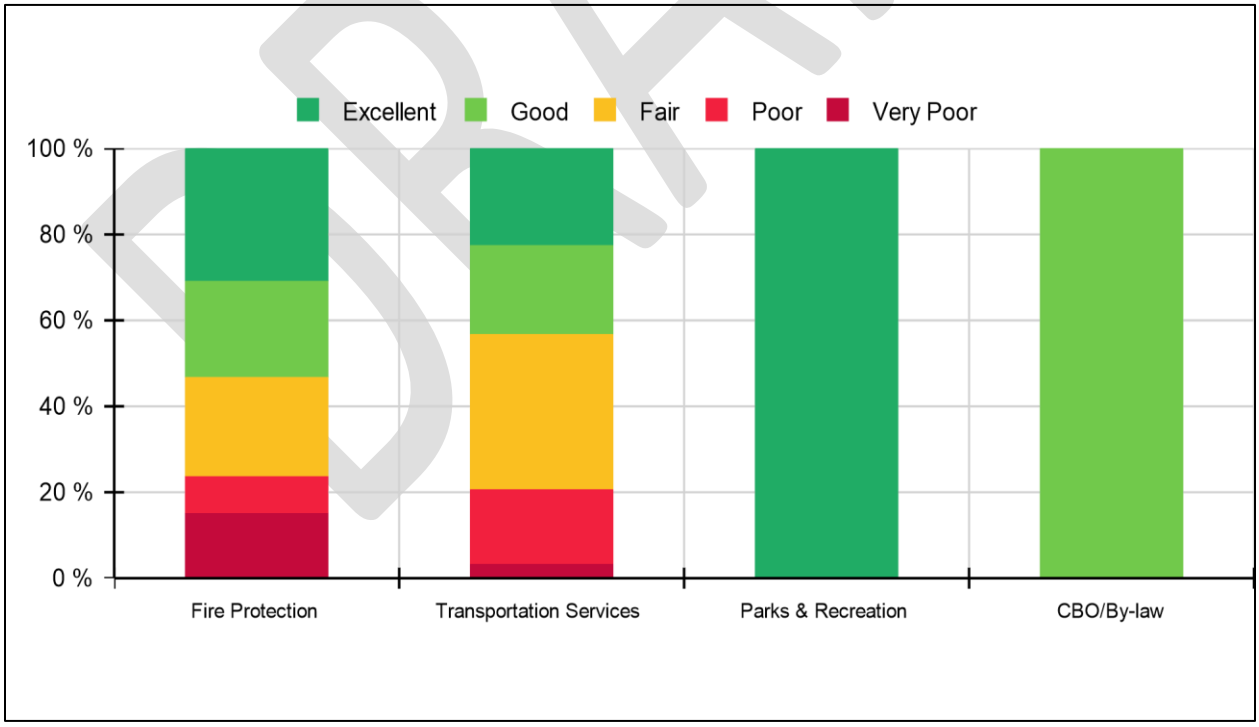


Figure 105: Vehicles Network Condition by Department

5.14.3 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Vehicle Class. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Vehicles are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.14.4 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Vehicles before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.14.5 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Vehicles, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	2.0%	2020

5.14.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Vehicles, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 106 shows the Vehicles overall network performance throughout the plan period:

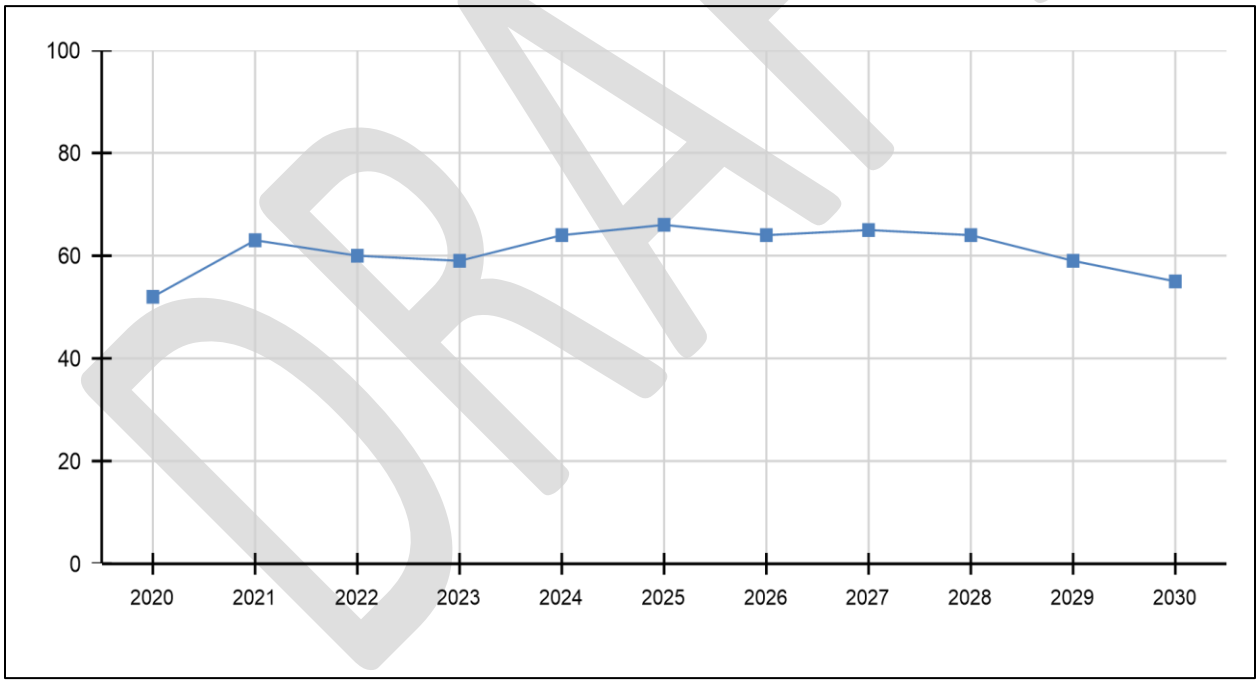


Figure 106: Vehicles Network Performance

Over the next 10 years, the performance of the Vehicles network improves from 52 to 55 at the end of plan.

Figure 107 shows the condition status distribution of the Vehicles network at each year of the plan:

Figure 107: Vehicle's Annual Network Condition Status

As shown in this figure, at the beginning of the plan 29% is in excellent, 23% in good, 28% in fair, 9% in poor, and 12% in very poor condition. At the end of the 10-year plan 18% will be in excellent, 30% in good, 52% in fair, and 1% in poor condition.

The scheduled capital expenditures are shown in Figure 108:

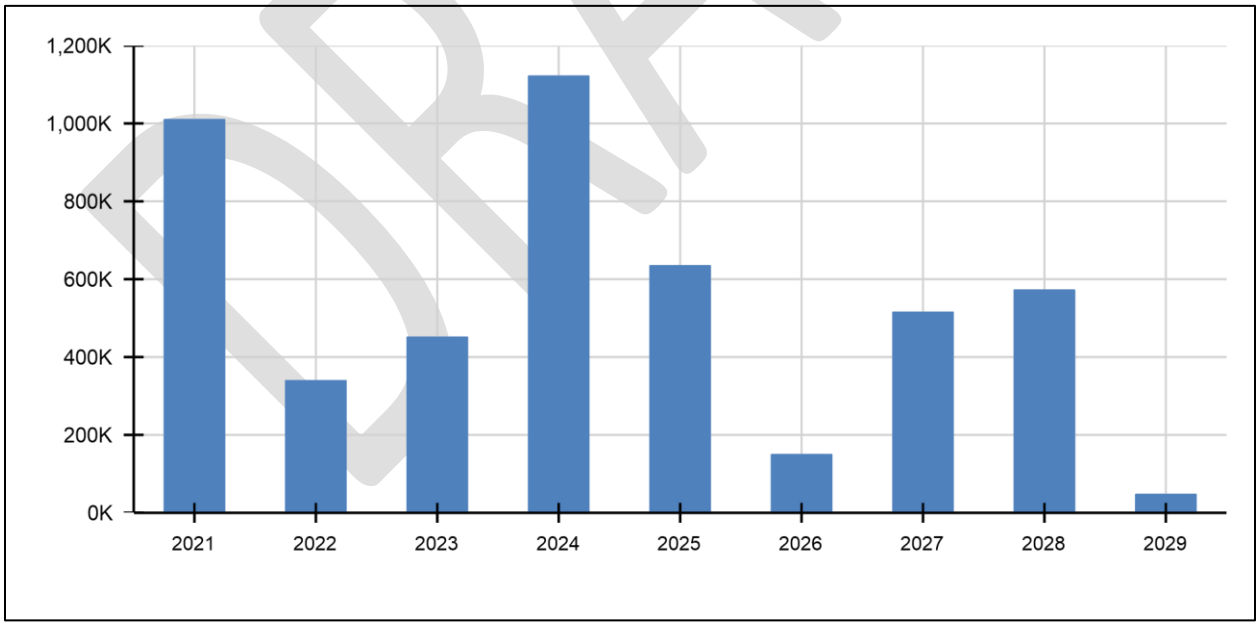


Figure 108: Vehicles Capital Expenditures

The backlog is cleared in the first year of the capital plan, and no Vehicles will be in a deficit position throughout the plan period.

5.15 EQUIPMENT

The Township of Alnwick/Haldimand has a total of 85 Equipment Assets.

5.15.1 EQUIPMENT ATTRIBUTES

The Equipment is classified by Department. The Network size is weighed by replacement cost.

Department	Replacement Cost ($)	Percentage
General Government	363,378.1	8.3%
Parks & Recreational	518,502.5	11.8%
Fire Protection	1,139,910.1	26.0%
Library	257,277.0	5.9%
Transportation Services	2,113,598.5	48.1%

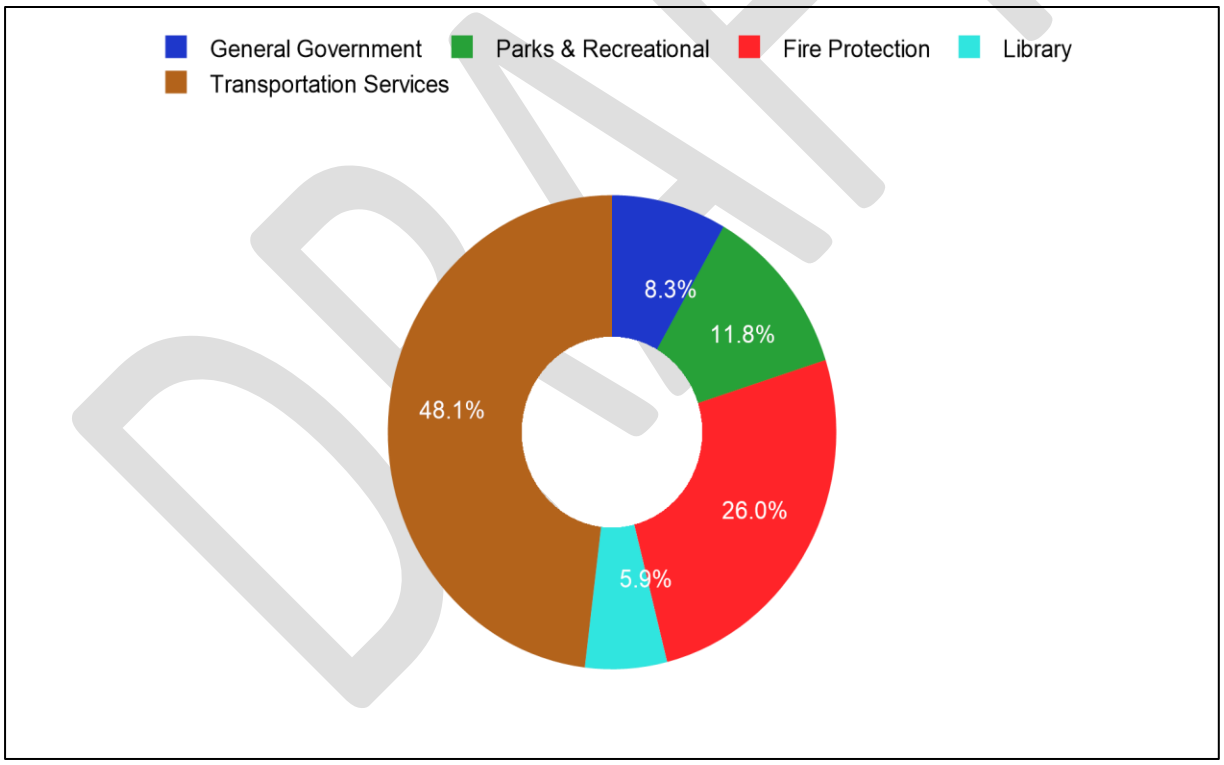


Figure 109: Equipment by Department

5.15.2 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Equipment Assets is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 110: Equipment Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Equipment Assets, weighed by replacement cost, is 41. This represents an overall "Fair" condition state.

Title	Condition	Condition State
Network Overall Condition	41	Fair

The following summarizes the 2020 Network Condition States:

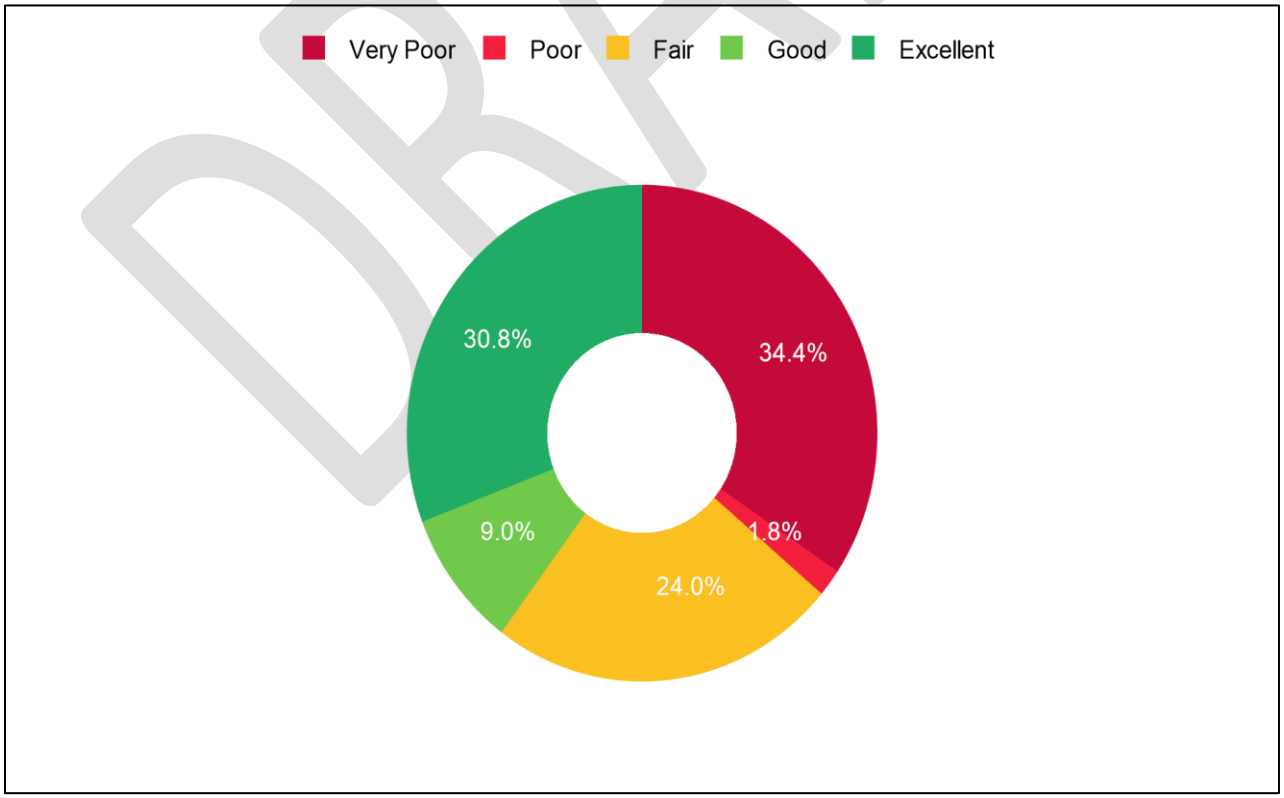


Figure 111: Equipment Assets Network Condition

The Condition States by Department are shown in Figure 112:

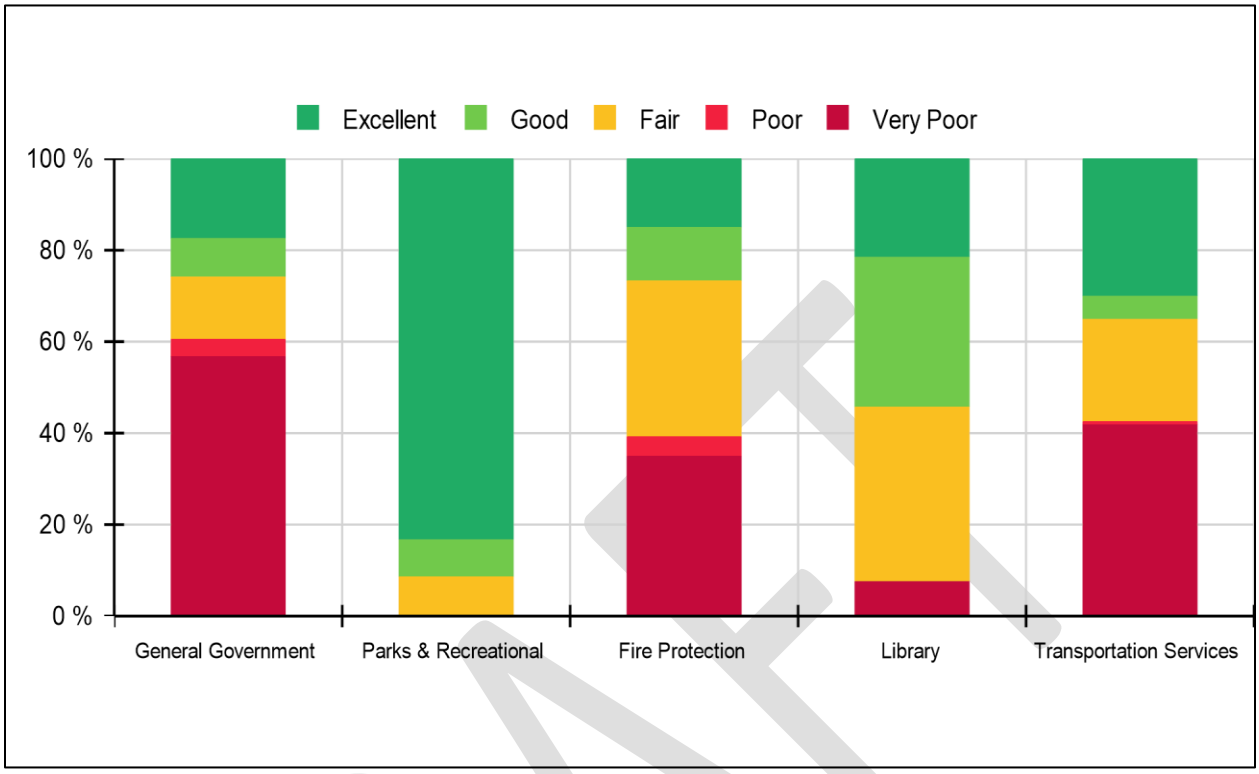


Figure 112: Equipment's Network Condition by Department

5.15.3 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Equipment Assets are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.15.4 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Equipment Assets before the end of their service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.15.5 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Equipment Assets, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.15.6 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Equipment Assets, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life scenario 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 113 shows the Equipment Assets overall network performance throughout the plan period:

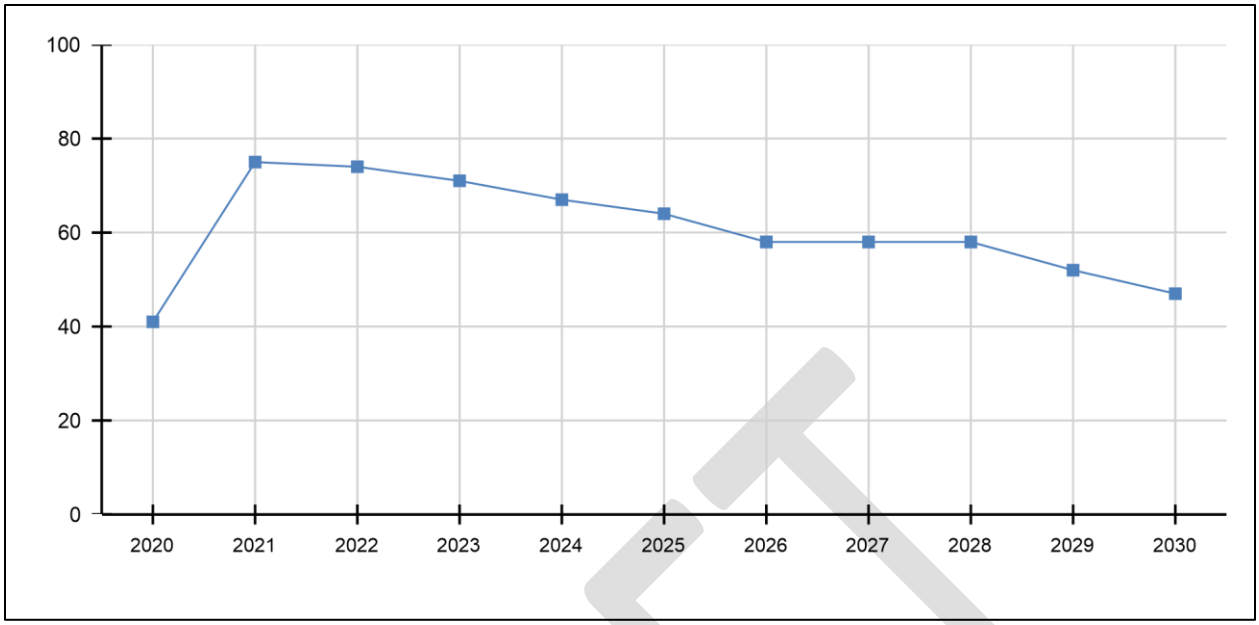


Figure 113: Equipment Network Performance

Over the next 10 years, the performance of the Equipment Assets network improves from 41 to 47 at the end of plan.

Figure 114 shows the condition status distribution of the Equipment Assets network at each year of the plan:

Figure 114: Equipment Annual Network Condition Status

As shown in this figure, at the beginning of the plan 31% is in excellent, 9% in good, 24% in fair, 2% in poor, and 34% in very poor condition. At the end of the 10-year plan 10% will be in excellent, 32% in good, 35% in fair, and 24% in poor condition.

The scheduled capital expenditures are shown in Figure 115:

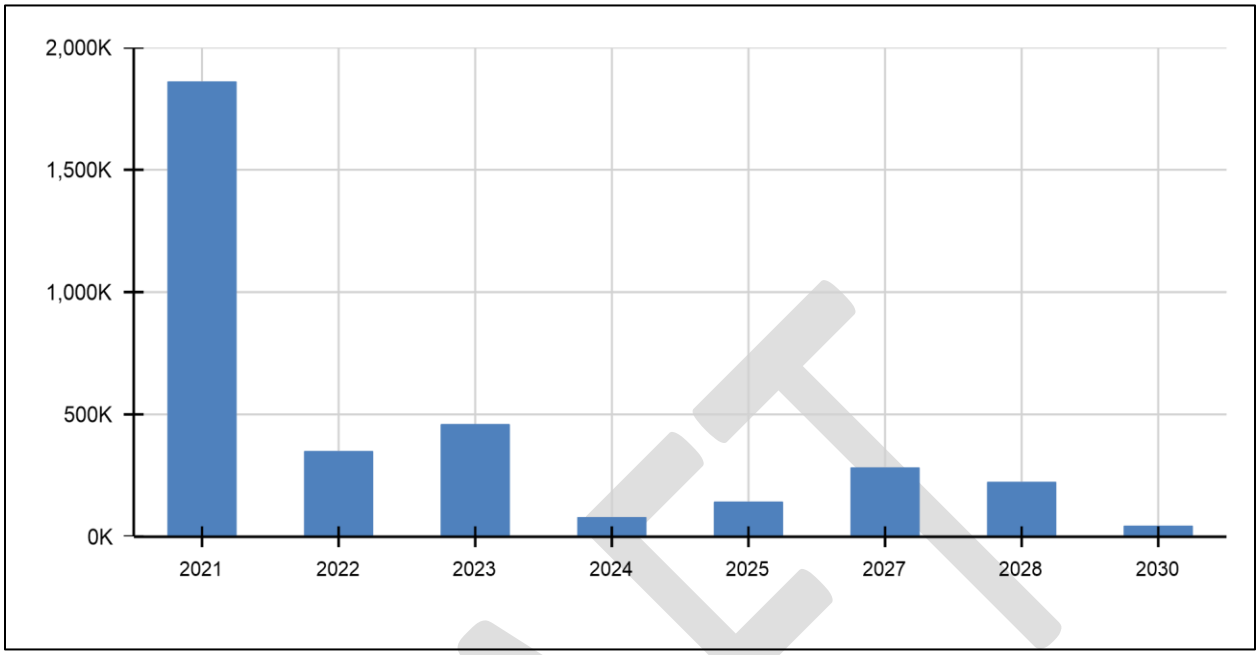


Figure 115: Equipment Capital Expenditures

The backlog is cleared in the first year of the capital plan, and no equipment will be in a deficit position by 2030 throughout the plan period.

5.16 BALL FIELD DIAMONDS

The Township of Alnwick/Haldimand has a total of four (4) Ball field Diamond Asset.

5.16.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for The Ball Field Diamond is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Active	Condition Level	Condition Index Range		
✓	Very Poor	0	to	5
✓	Poor	5	to	20
✓	Fair	20	to	60
✓	Good	60	to	80
✓	Excellent	80	to	100

Figure 116: Ball field Diamonds Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Ball Field Diamond is 0. This represents an overall “Very Poor” condition state.

Title	Condition	Condition State
Network Overall Condition	0	Very Poor

5.16.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for the Ball Field Diamond are done as described in section 4. Due to the lack of data, there are no risk targets set in the planning.

5.16.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Ball field Diamonds Assets before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.16.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for the Ball Field Diamonds, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.16.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Ball Field Diamond, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario	
Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings	
Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 117 shows the Ball field Diamond overall performance throughout the plan period:

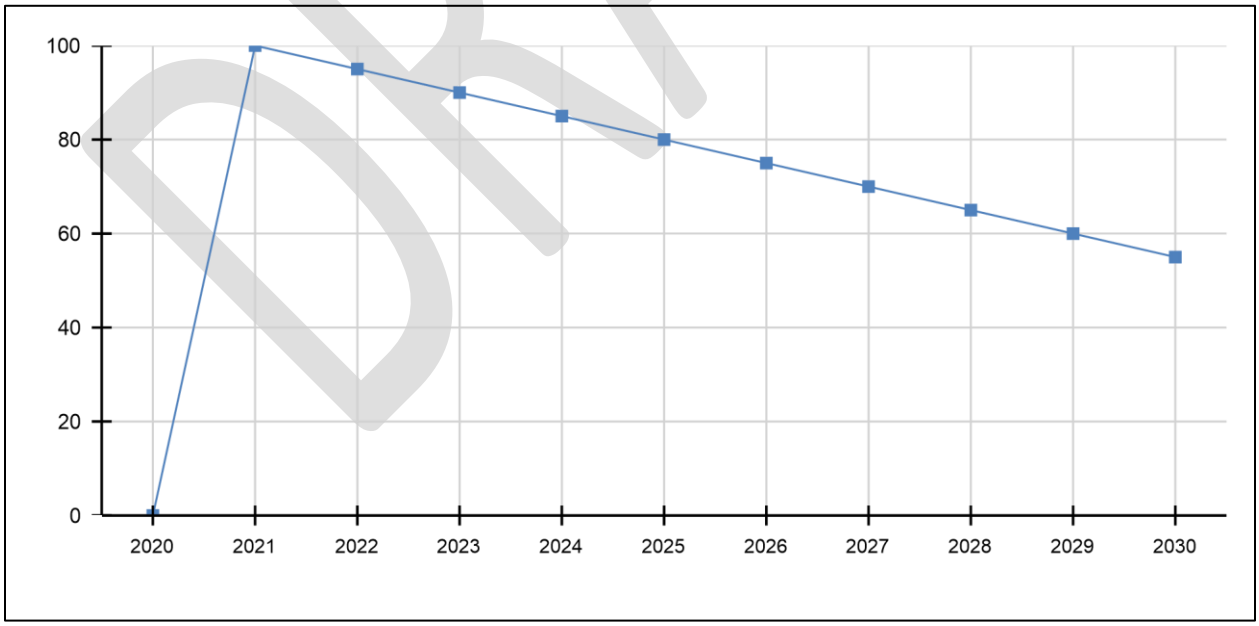


Figure 117: Ball field Diamond Performance

Over the next 10 years, the performance of the Ball Field Diamond improves from 0 to 55 at the end of plan.

Figure 118 shows the condition status distribution of the Ball field Diamond at each year of the plan:

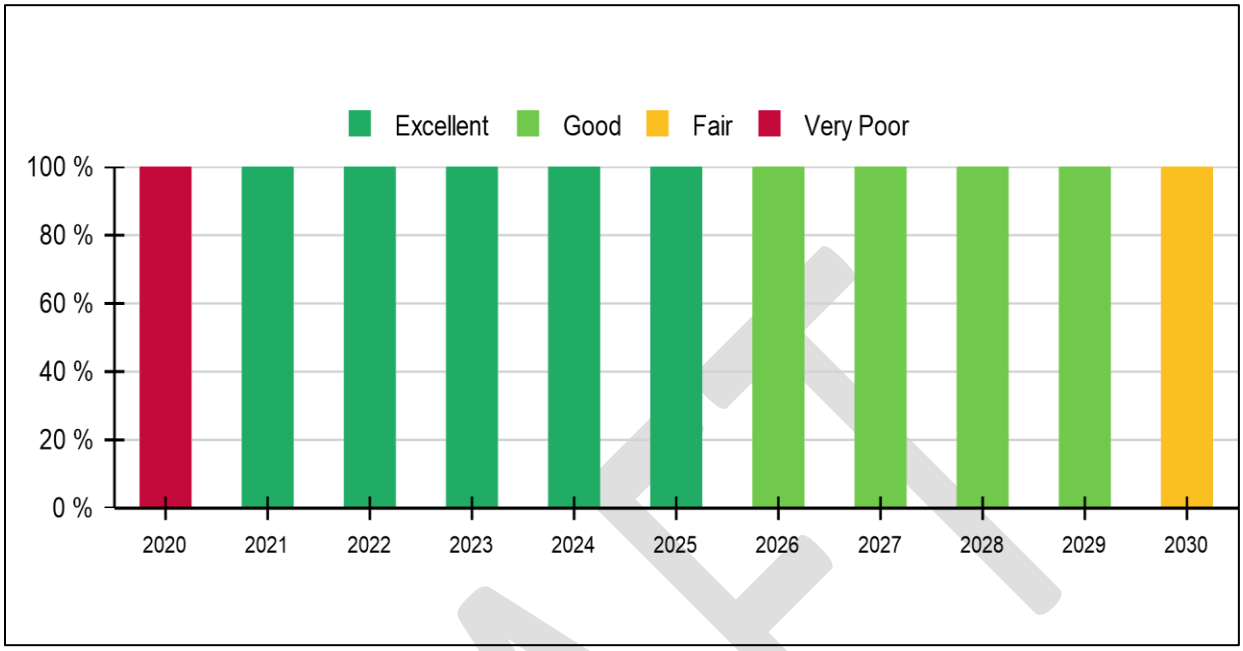


Figure 118: Ball field Diamond Annual Condition Status

As shown in this figure, at the beginning of the plan the Ball Field Diamond is in very poor condition. At the end of the 10-year plan it will be in fair condition.

The scheduled capital expenditures are shown in Figure 119:

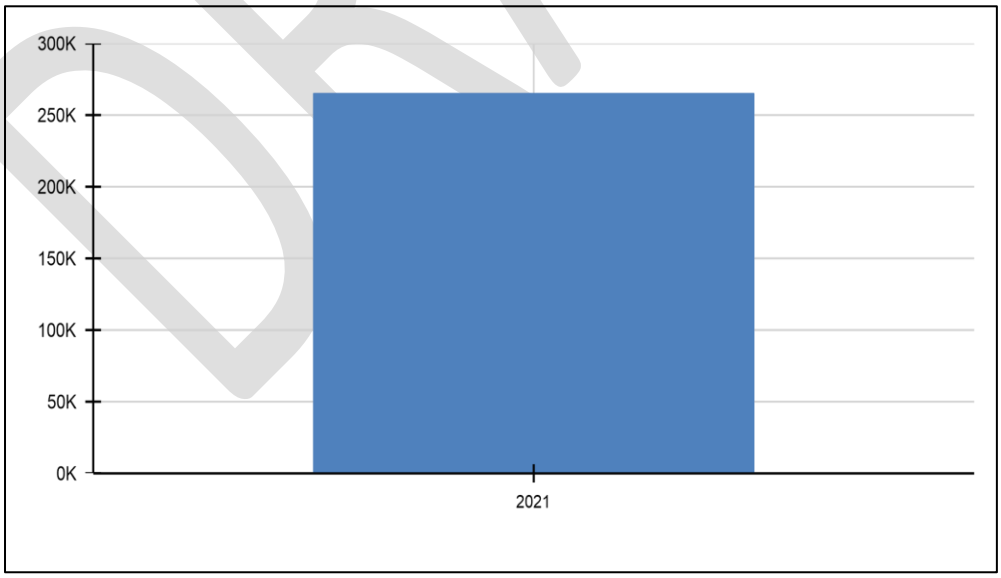


Figure 119: Ball field Diamond Capital Expenditures

The backlog is cleared in the first year of the capital plan. and there will be no deficit position throughout the plan period.

5.17 PLAYGROUNDS

The Township of Alnwick/Haldimand has a total of four (4) Playgrounds.

5.17.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Playgrounds Assets is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Figure 120: Playgrounds Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Playgrounds Assets, weighed by replacement cost, is 90. This represents an overall “Excellent” condition state.

Title	Condition	Condition State
Network Overall Condition	82	Excellent

The following summarizes the 2020 Network Condition States:

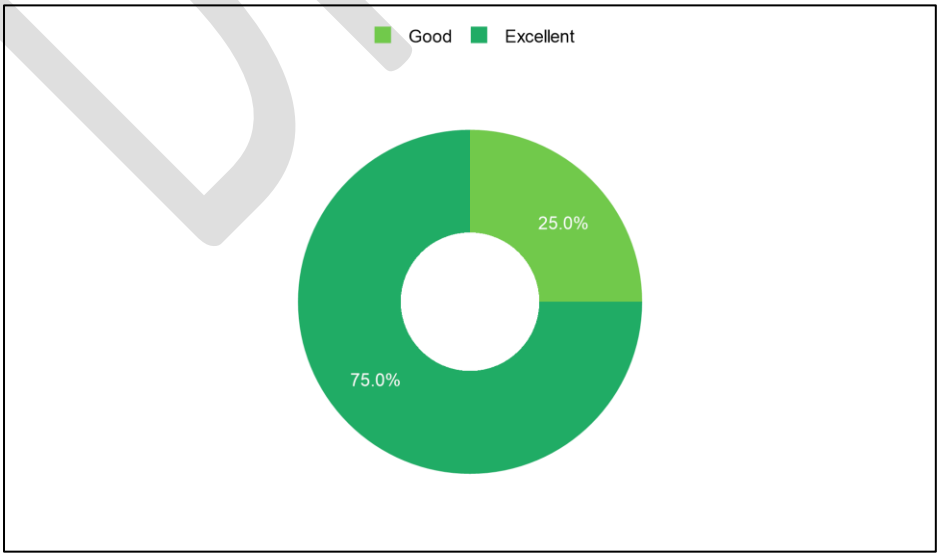


Figure 121: Playgrounds Network Condition

5.17.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Playgrounds are done as described in section 5. Due to the lack of data, there are no risk targets set in the planning.

5.17.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Playgrounds before the end of their Service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.17.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Playgrounds, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.17.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Playgrounds, on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 122 shows the Playgrounds overall network performance throughout the plan period:

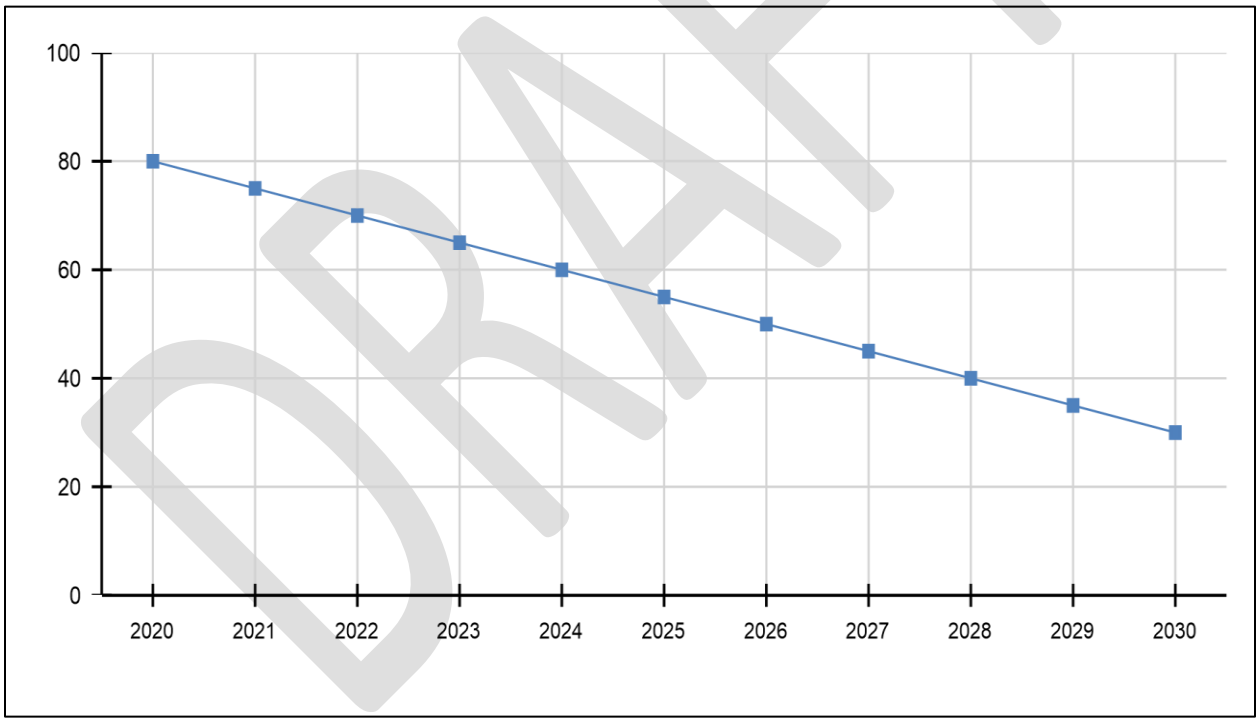


Figure 122: Playgrounds Network Performance

Over the next 10 years, the performance of the Playgrounds network declines from 80 to 30 at the end of plan.

Figure 123 shows the condition status distribution of the Playgrounds network at each year of the plan:

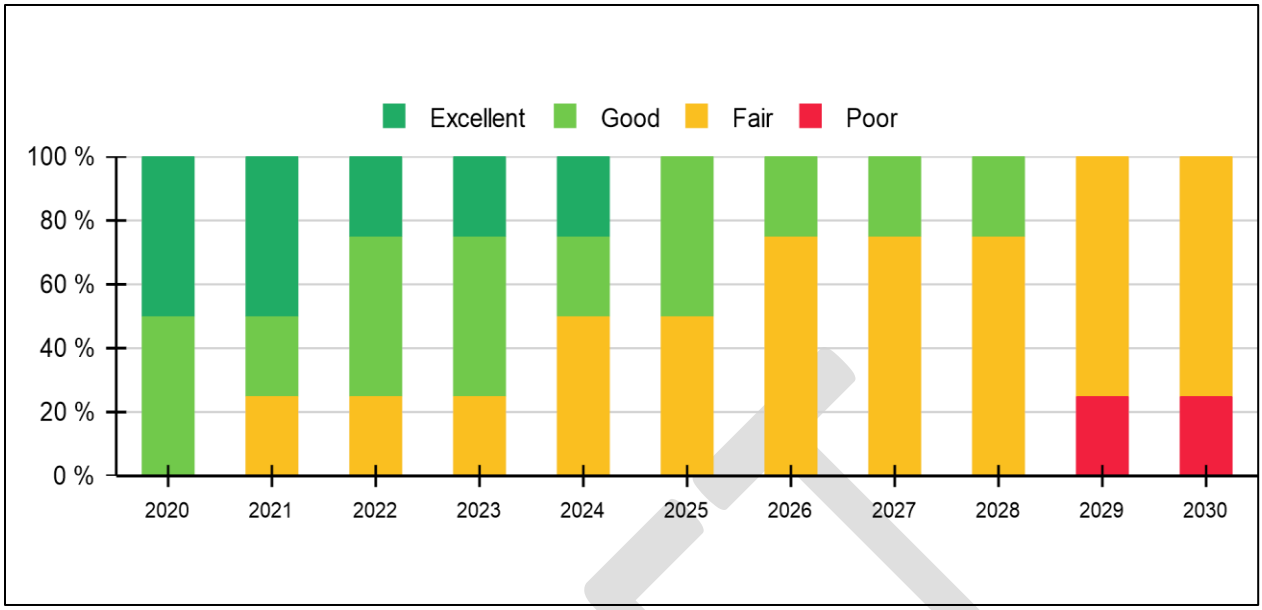


Figure 123: Playgrounds annual Network Condition Status

As shown in this figure, at the beginning of the plan 50% is in excellent, and 50% in good condition. At the end of the 10-year plan 75% will be in fair, and 25% will be in poor condition. None of the Playground's sections are in a deficit position throughout the plan period, and no replacements are scheduled.

5.18 LAND IMPROVEMENTS

The Township of Alnwick/Haldimand has a total of 3 Land Improvement Assets.

5.18.1 CONDITION ASSESSMENT APPROACH

The state of the infrastructure for Land Improvement Assets is determined through an age-based condition analysis. The five (5) Condition States are defined as follows:

Active	Condition Level	Condition Index Range		
✓	Very Poor	0	to	5
✓	Poor	5	to	20
✓	Fair	20	to	60
✓	Good	60	to	80
✓	Excellent	80	to	100

Figure 124: Land Improvements Condition State Ranges

The age-based condition was calculated to the year 2020, and the current Network Condition (%RSL) of the Land Improvements Assets, weighed by replacement cost, is 63. This represents an overall “Good” condition state.

Title	Condition	Condition State
Network Overall Condition	63	Good

The following summarizes the 2020 Network Condition States:

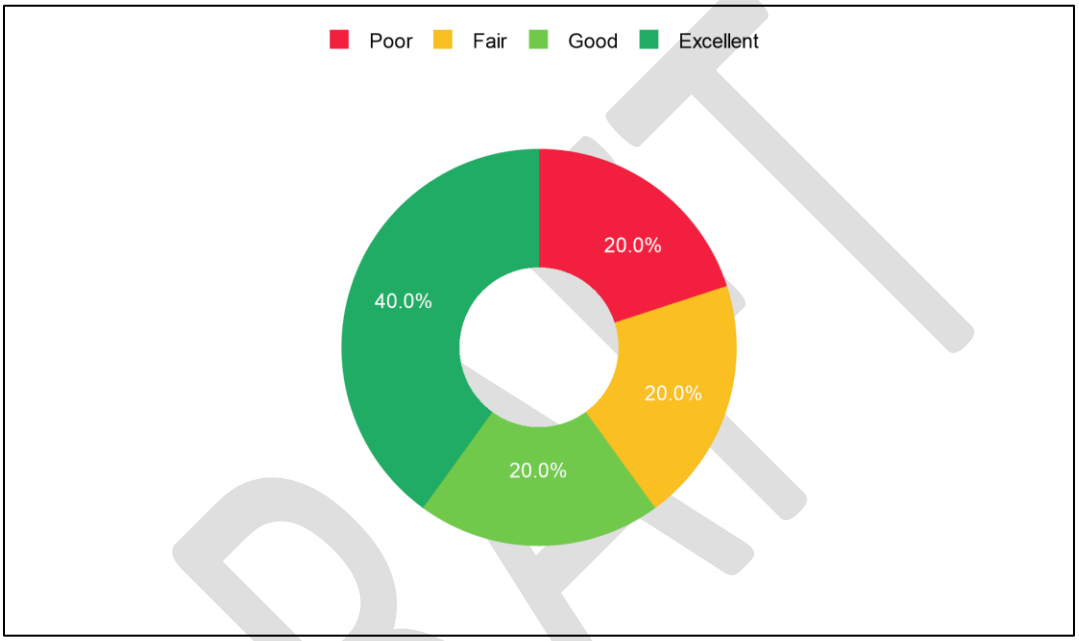


Figure 125: Land Improvements Assets Network Condition

5.18.2 CRITICALITY AND RISK CRITERIA

Criticality
Based on the data attributes available, the Criticality settings were applied based on Asset Status. Socio-economic factors were not included.

Criticality Settings

Asset Status	5
Abandoned	0
In-service	100
Removed	0
Unassumed	0

Risk
The Risk settings for Land Improvement Assets are done as described in section 5. Due to the lack of data, there are no risk targets set in the planning.

5.18.3 LEVEL OF SERVICE REQUIREMENTS

The Township targets to replace Land Improvement Assets before the end of their service life is reached. The analysis was done based on an end-of-life replacement, with no budget constraint.

5.18.4 LIFECYCLE MANAGEMENT STRATEGY

A single treatment is available for Land Improvements Assets, and it is a full replacement treatment.

Treatment Methods

Treatment	Description	Unit Cost	Inflation Rate	Cost Estimation Year
Replacement	Replacement	100.00 %	0.0%	2020

5.18.5 OPTIMIZED CAPITAL PLANNING RESULTS

Optimization analysis has been performed for the Land Improvements on the basis of a straight end-of-life replacement.

The Optimization Analysis Settings are as follows:

Scenario Summary

Scenario

Name:	End of life replacement 10 years
Description:	
Year:	2021

Optimization Settings

Optimization Mode	Standard
Planning Horizon (Years)	10
Include Priorities	Yes
Operational Efficiency	No
Estimate Current Condition	True

Optimization Objective

Type	Min/Max	Weight (Sum = 1)	Performance Attribute
Maximize Network Performance	Max	1	NA

Network Optimization Results

Figure 126 shows the Land Improvements Assets overall network performance throughout the plan period:

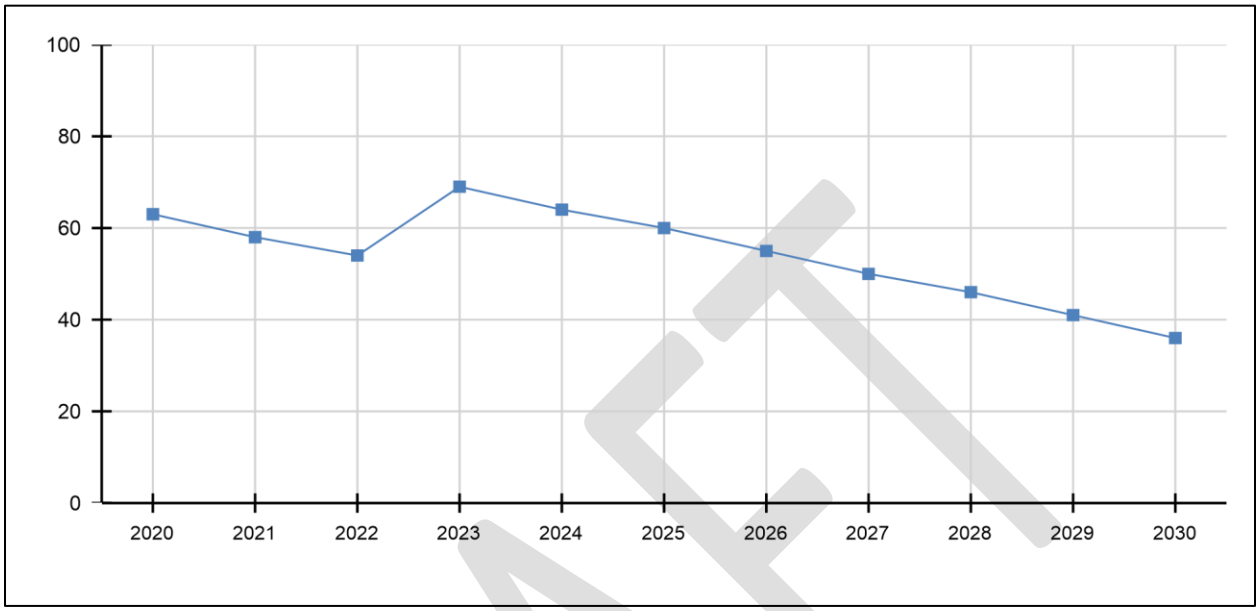


Figure 126: Land Improvements Network Performance

Over the next 10 years, the performance of the Land Improvement Assets network declines from 63 to 36 at the end of plan.

Figure 127 shows the condition status distribution of the Land Improvements Assets network at each year of the plan:

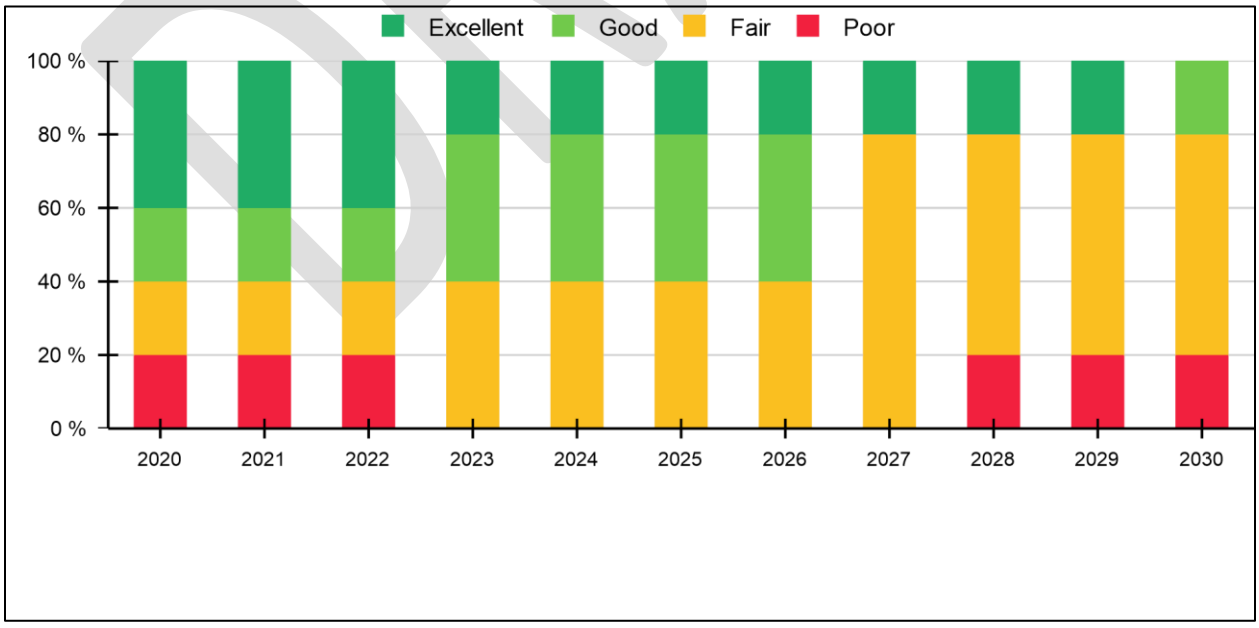


Figure 127: Land Improvements annual Network Condition Status

As shown in this figure, at the beginning of the plan 40% is in excellent, 20% in good, 20% in fair, and 20% in poor condition. At the end of the 10-year plan 20% will be in good, 60% in fair, and 20% in poor condition.

The scheduled capital expenditures are shown in Figure 128:

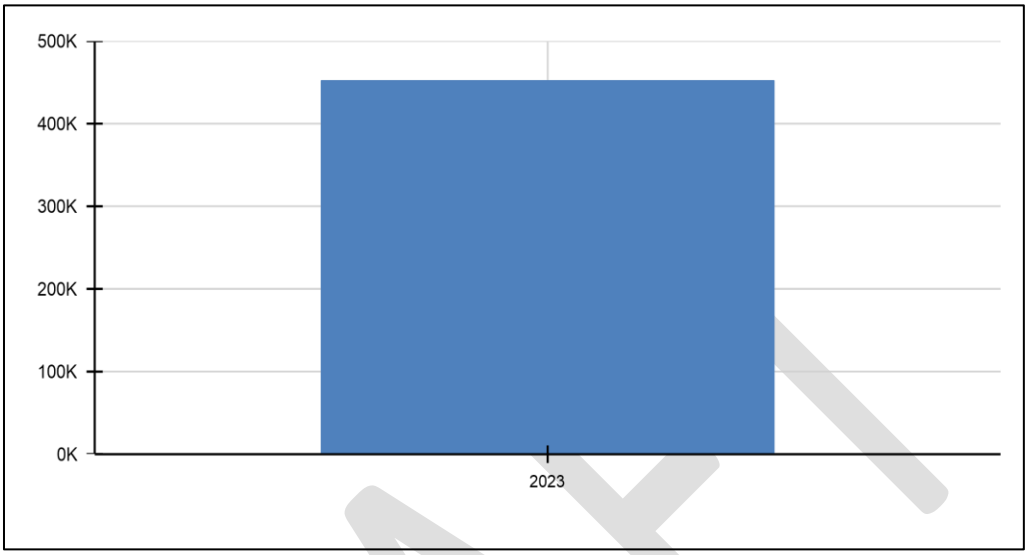


Figure 128: Land Improvements Capital Expenditures

There is no deficit position throughout the plan period.

6 CAPITAL PLAN

6.1 BACKGROUND

Managing the Municipality's capital assets requires an assessment of the long-term capital project requirements and the establishment of the funding for high-priority projects in an efficient, timely and cost-effective manner. As a result of this analysis, the Municipality will be able to more effectively monitor, track and manage infrastructure assets, to ensure that policy makers obtain sufficient funding in order to maintain, at a minimum, and potentially enhance future service levels. Through capital planning, the Township of Alnwick/Haldimand can plan the future operating budget expenses and reserve funds to manage the financial position over a long-term period. Capital planning also provides the core information needed for implementing the Council's planning and fiscal policies.

An Asset Management Plan provides many benefits including:

- A systematic evaluation of all potential projects at the same time.
- The ability to stabilize the debt and consolidate projects to reduce borrowing costs.
- To serve as a public relations and economic development tool.
- A focus on preserving a municipal government's infrastructure while ensuring the efficient use of public funds.
- An opportunity to foster cooperation among departments and the general public regarding the Municipality's priorities.

6.2 OVERVIEW

The Capital Plan, an integral part of an Asset Management Plan, is a blueprint for planning a community's capital expenditures and is one of the most important responsibilities of local government officials. It coordinates community planning, financial capacity, and physical development. It is a tool to assess the long-term capital project requirements of a Municipality and to establish funding of high-priority projects in a timely and cost-effective fashion. The development of a Capital Plan is intended to ensure that policy makers are responsible to residents and businesses of the community with respect to the expenditure of public funds. It also promotes the provision of continuous efficient services.

The Capital Plan provides a detailed understanding of anticipated investments into tangible capital assets. These assets include basic facilities, services, and installations needed for the functioning of the community. The development of a CIP that will ensure sound fiscal and capital planning requires effective leadership and the involvement and cooperation of all municipal departments. A complete, properly developed CIP has the following benefits:

- Facilitates coordination between capital needs and the operating budgets
- Enhances the community's credit rating, control of its tax rate, and avoids sudden changes in its debt service requirements
- Identifies the most economical means of financing capital projects
- Increases opportunities for obtaining federal and provincial aid
- Relates public facilities to other public and private development and redevelopment policies and plans
- Focuses attention on community objectives and fiscal capacity
- Keeps the public informed about future needs and projects
- Encourages careful project planning and design to avoid costly mistakes and help a community reach desired goals

A municipal government must take care of two key responsibilities in managing its infrastructure:

- The first major responsibility is the maintenance and repair of existing infrastructure. Given the high cost to replace linear assets and the fact that they are essential to providing programs and services to the public, it is extremely important that regular maintenance and periodic refurbishments be done to keep facilities and other assets in good working condition for as long as possible.
- The second major responsibility that municipal governments have is to plan and construct new community infrastructure. This involves several steps including deciding what services are to be provided, identifying community needs, careful planning, determining priority investments, figuring out how to finance projects and good management to ensure projects are completed on time and on budget.

Although the Capital Plan is generally maintained separately from the operating budget, they do work in unison since the debt charges on funds borrowed for capital expenditures become expense items in the annual operating budget. In addition, operating and maintenance costs of capital assets have an impact on the operating budget. In order to have a realistic, workable Capital Plan, therefore, it is necessary to estimate the effect that debt service and operating costs will have on future tax rates. In this way, non-essential capital expenditures will not be undertaken at the expense of pending essential capital projects and the Municipality will thus be in a better position to control future debt levels.

6.3 METHODOLOGY

The Township of Alnwick/Haldimand's Capital Plan addresses infrastructure deficiencies and future capital expenditures. It includes existing service infrastructure not meeting engineering standards, the cost of renovation or replacement of infrastructure which has exceeded its service life and which as a consequence, is not meeting required service standards. Provision is required to renovate or replace previously constructed infrastructure when it reaches the end of its service life. These costs do not include on-going operational and regular maintenance (which typically represent the greatest cost component of a facility's service life, for example). Unless informed by the Township, requirements such as investments required to support industrial, commercial and residential development in accordance with the growth projections required to serve the community and social needs as well as supply the increasing population and to service to the boundaries of new subdivisions have not been analyzed.

The Township's Capital Plan includes:

- Development of parameters for each asset class
- Development of rehabilitation and replacement unit costs
- Identifying the asset types to be included in the Capital Plan and determining and confirming the components of each asset class
- Identification of services to be provided and the capital expenditures to be incurred
- Determination of secondary cost estimates of capital expenditures (consideration of cost elements such as remoteness of the Township, land, architect/engineering fees, construction, legal fees, taxes, etc.). The non-rebatable portion of HST at 1.76% has been applied, for example
- Determination of the time periods over which the asset is to be constructed or acquired and the costs prorated accordingly

The methodology used for building this Capital Plan was to:

1) Determine the "unconstrained" rate of capital expenditure (assuming an unlimited budget).
2) Identify the Township's current infrastructure deficit.
3) Determine the Township's future requirements
4) Prepare a report detailing the capital required for each asset class based on current rehabilitation and replacement unit costs
5) Establish the cost of maintaining existing infrastructure while addressing the infrastructure deficit.

7 ASSET MANAGEMENT PLAN RESULTS

Like most other local governments in this province, Alnwick/Haldimand is dealing with aging infrastructure and constrained budgets. Upon completion of the collection of all the pertinent data, the capital plan was generated, broken down by asset class for the years 2021 to 2030. Inflation will be incorporated in the financial analysis. The results are as follows:

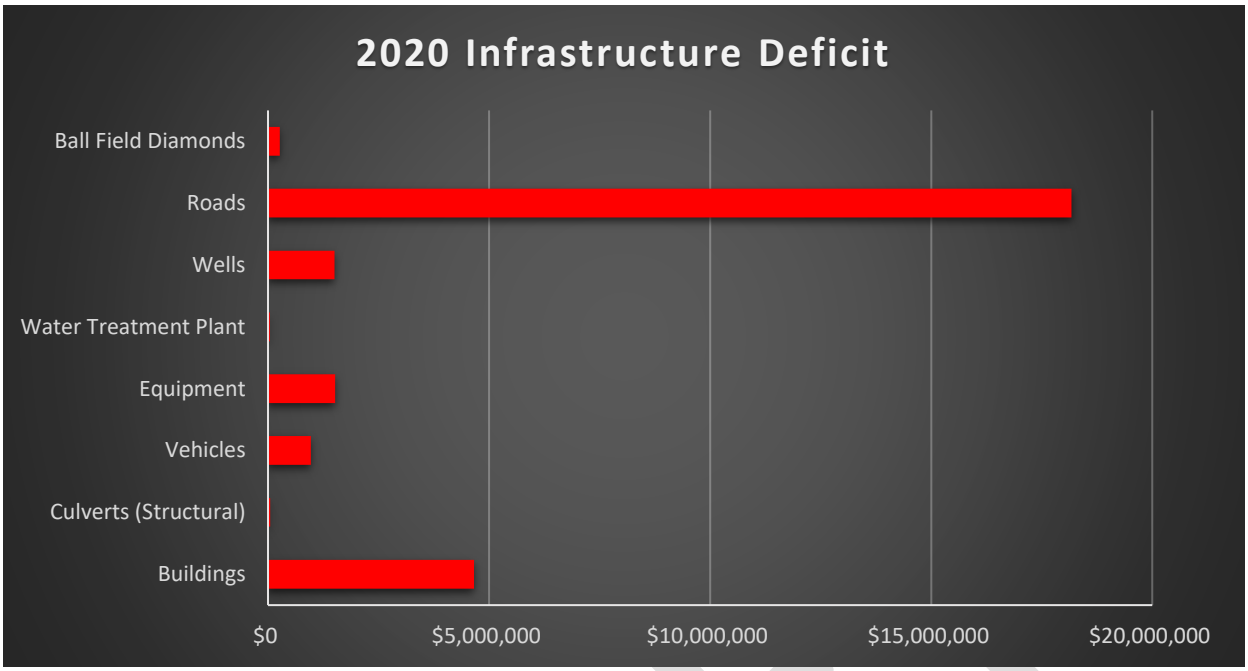


Figure 129: 2018 Infrastructure Deficit by Asset Category

The largest amounts of the infrastructure deficit are contributed by the Roads, at an amount of $18.2 million, and Buildings at $4.7 million. However, buildings are not included in the financial forecasting. A full asset replacement is triggered once the age-based end of its useful life has been reached. Unless detailed condition data for the buildings and their components is provided, it would be unreasonable to schedule the buildings for full replacement. The Fire Hall project has been accounted for and is being funded by a new debenture.

The 10-year Capital Plan is summarized below:

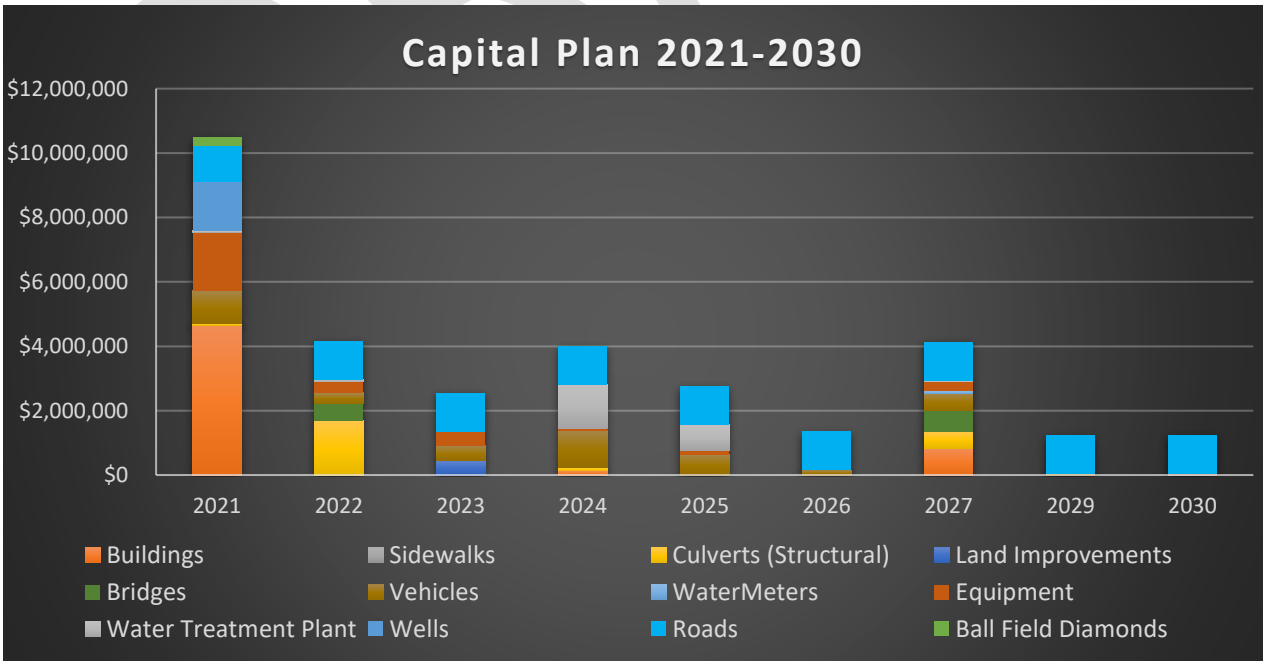


Figure 130: Summary of Capital Plan 2021-2030

Timeframe	Year	Capital Projects (Incl. HST)
Year 2021-2030	2021	$10,503,177
	2022	$4,306,321
	2023	$2,735,267
	2024	$4,416,613
	2025	$3,153,229
	2026	$1,596,661
	2027	$5,067,167
	2028	$2,819,130
	2029	$1,650,468
	2030	$1,687,672
Total		**$37,935,705**

Timeframe	Year	Buildings	Sidewalks	Culverts (Structural)	Bridges	Vehicles	Traffic Signs
Year 2021-2030	2021	$4,657,604	$0	$52,500	$0	$1,010,585	$0
	2022	$0	$0	$1,689,219	$520,000	$340,000	$0
	2023	$0	$0	$0	$0	$451,716	$0
	2024	$134,915	$0	$111,500	$0	$1,122,136	$0
	2025	$0	$0	$0	$0	$635,000	$0
	2026	$0	$0	$0	$0	$150,000	$0
	2027	$838,962	$0	$508,885	$655,380	$515,454	$0
	2028	$228,104	$0	$0	$0	$572,549	$0
	2029	$0	$0	$0	$0	$47,804	$10,987
	2030	$0	$3,947	$0	$0	$0	$0

Timeframe	Year	Equipment	Land Improvements	Water Meters	Water Treatment Plant	Wells	Roads	Ball - Field Diamonds
Year 2021-2030	2021	$1,819,443	$0	$0	$46,630	$1,500,721	$1,149,273	$267,112
	2022	$348,734	$0	$0	$74,093	$0	$1,189,836	$0
	2023	$456,476	$452,125	$0	$0	$0	$1,190,941	$0
	2024	$78,678	$0	$0	$1,352,084	$0	$1,185,535	$0
	2025	$141,746	$0	$0	$777,653	$0	$1,191,283	$0
	2026	$0	$0	$0	$0	$0	$1,193,566	$0
	2027	$281,622	$0	$100,503	$26,420	$0	$1,193,831	$0
	2028	$222,921	$0	$0	$0	$0	$1,194,570	$0
	2029	$0	$0	$0	$0	$0	$1,194,464	$0
	2030	$43,725	$0	$0	$0	$0	$1,190,952	$0

A detailed project-by-project breakdown of this Capital Plan and all proposed or consultant/study recommended projects are included in the capital project list in Appendix A.

8 FINANCIAL PROJECTIONS

Our first steps in Financial Forecasting include compounding/inflating historical costs to Present Value (2020), and then further compounding/inflating these numbers to meet future requirements. Due to the volatility of inflationary factors, we were not able to determine a comprehensive regional "*Municipal Cost Index (MCI)"* that was reliable enough to have confidence in. We therefore used the CPI (Consumer Price Index) for the historic analysis. For financial forecasting beyond 2020, we assumed an inflation rate of 3.5%. In recent years inflation has been in the 2% range but has recently gone up to as much as 5%. We therefore believe that a 3.5% inflation rate is a reasonable assumption for long range financial planning.

Our basic assumptions and calculations, included within this document, are key to the planning process and serve as the base for the forecasting and predicting your future budgetary requirements and needs.

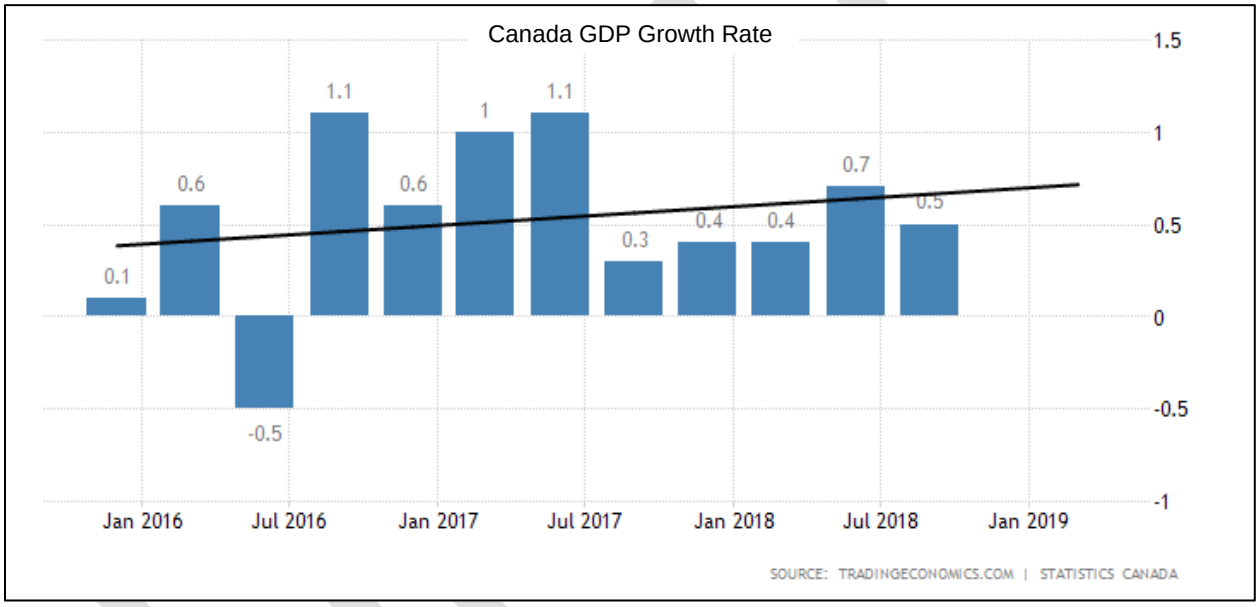
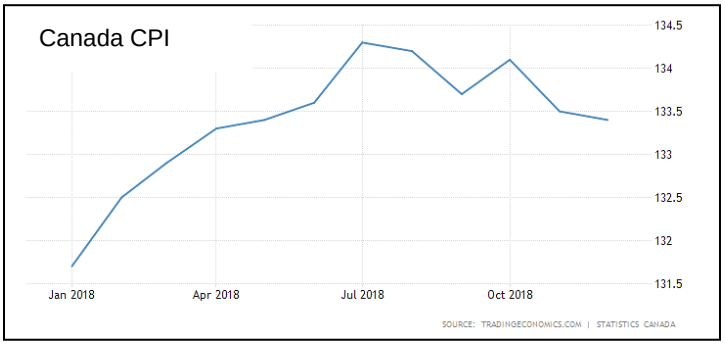


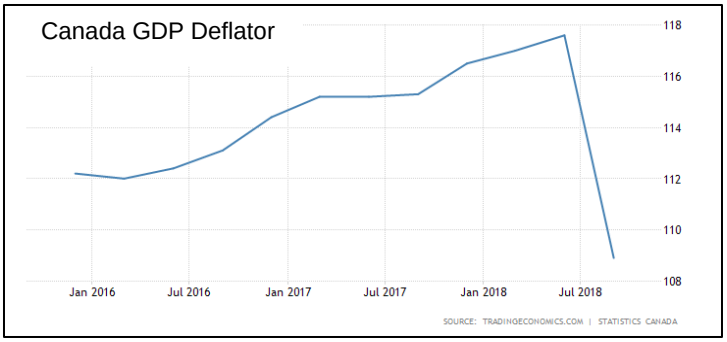
Figure 131: Canada GDP Growth Rate

8.1 CONSUMER PRICE INDEX: OUR PERSPECTIVE

A price index measures the change in the costs of purchasing a fixed basket of goods and services in the current period, compared to a base period, typically month-over-month or year-over-year. The most widely applied measure of inflation/price index is the Consumer Price Index (CPI). Given its pervasive use in setting cost-of-living adjustments, it can be the appropriate metric when calculating the rate of consumer inflation at the national level. Major



components of the CPI include housing, food, and transportation.



Extending the use of the CPI into discussions about the appropriate level of tax and fee rate increases becomes problematic, however, because a government's actual experience with inflation can differ greatly from the CPI. This is because the largest expenditures for governments are typically labor, materials, and contractual services — different factors than those found in the CPI. Spending patterns that are different than those of other economic sectors. A price index that does not reflect the municipal purchasing structure does not truly reflect changes in the cost experience, and thus the purchasing power, of local governments. For instance, the CPI reflects household spending patterns that focus on shelter (27.7 percent of the Statistics Canada CPI basket), transportation (19.5 percent), food (15.5 percent), and recreation (12.9 percent) — none of which registers as leading purchase categories for local governments.

There are two main parts to the MCI (Municipal Cost Index) calculation: the weightings of the expenditure categories (showing the relative importance of items in the index), and the inflation factor used for each component. The inflation factors for expected price changes are based on economic data from two main sources, the Conference Board of Canada (CBOC) and Statistics Canada. The key issue is to match an appropriate inflator from these external sources to the types of expenditures in each budget category. MCI can be used in the following ways:

- To measure the increase in overall municipal expenditures attributed to inflation;
- To allow managers to more closely monitor the increase in spending by expenditure category, thus making inflationary price increases or decreases more visible;
- To provide an indication of the historical, current, and future direction of prices relative to municipal expenditures;
- To explain increased expenditures attributed to inflation when submitting annual budgets.

As mentioned at the beginning of this section, we did not use MCI in the analysis due to the volatility of the inflationary factors.

8.2 FINANCIAL STRATEGY ASSUMPTIONS

The following summarizes the key assumptions used in the preparation of the financial strategy for major assets:

- 3.5% annual operating income increase (property taxation, base scenario)
- 3.5% annual increase in user fees (excluding water) and 3.5% increase in other revenues
- 3.5% annual operating expenditure increase
- 3.5% annual increase in capital replacement costs
- 2021 Canada Community-Building Fund (formerly Gas Tax Fund) of **$427,278** for 2021 as per AMO allocation table. In 2021 there is a top-up amount included, but for the financial forecasting only the base amounts as per AMO allocation table are included for 2022 and 2023 and are extended beyond 2023 with no inflation.

- Existing funding sources, as identified in the 2020 FIR or Financial Statements
- No growth-related capital has been included in the analysis as the financial strategy relates to the replacement of existing assets.
- Capital replacement needs as identified in the previous section of this report

It is important to keep in mind that assumptions may significantly change over time. In addition, capital replacement cost estimates may vary from current projections. As such, there is a need to monitor the financial strategy over time.

8.3 FUNDING REQUIREMENTS

In our efforts to create the best plan moving forward for the Municipality, ISI decided to create two scenarios:

- Capital Plan including infrastructure deficit (backlog)
- Capital Plan (excluding infrastructure deficit)

The financial analysis separates the primarily tax funded assets from the user fee funded water assets, including all related revenues, capital and operating expenditures.

8.3.1 TAX FUNDED ASSETS

This section looks at all assets other than Water which has their own dedicated User Fees. With the projected annual Property Tax increase of 3.5% (on par with inflation), a Capital Plan that will eliminate the deficit over the next 10 years requires the Municipality to make an average annual capital investment of $2,904,170 as compared to the current contribution of $1,416,057. The Municipality is not generating sufficient funds for its projected capital projects and by our calculations would have to increase the property tax annually by 2.7% from the 3.5% base rate to 6.2% per year to cover its operating and projected capital expenditures during the 10-year plan period.

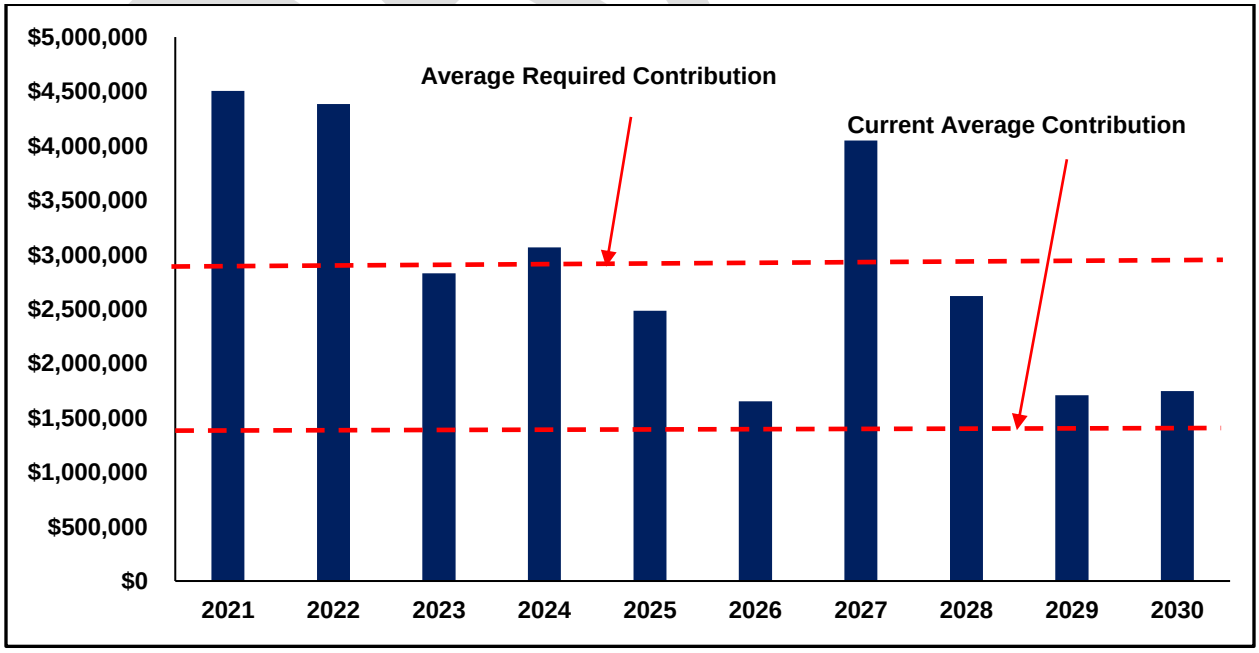


Figure 132: Capital Program Contributions (Required vs. Existing)

Without taking the deficit into consideration, by our calculations the average annual contribution requirement is $1,692,012. With a current contribution to the capital program of $1,416,057, the Municipality would have to increase the property tax annually by 2.2% from the 3.5% base rate to 5.7% per year to cover its operating and projected capital expenditures during the 10-year plan period.

8.3.2 WATER ASSETS

The funding requirements for the Water network are covered in the 2019 Alnwick/Haldimand Water & Wastewater Rate Study. This system is funded through their dedicated user fees, and not property taxes and other revenues. The current water rates need to be increased to achieve self-sustainable water and wastewater systems. A 5% annual rate increase for metered accounts and 3.5% for bulk sales has been suggested for water rates from 2021 through 2029, with a $1.86 million debenture to fund a new well and generator. The total user fee projections for the 2019 - 2029 period are shown in Figure 38. The details of the 50-year analysis are contained in the **2019 Alnwick/Haldimand Water and Wastewater Rate Study**.

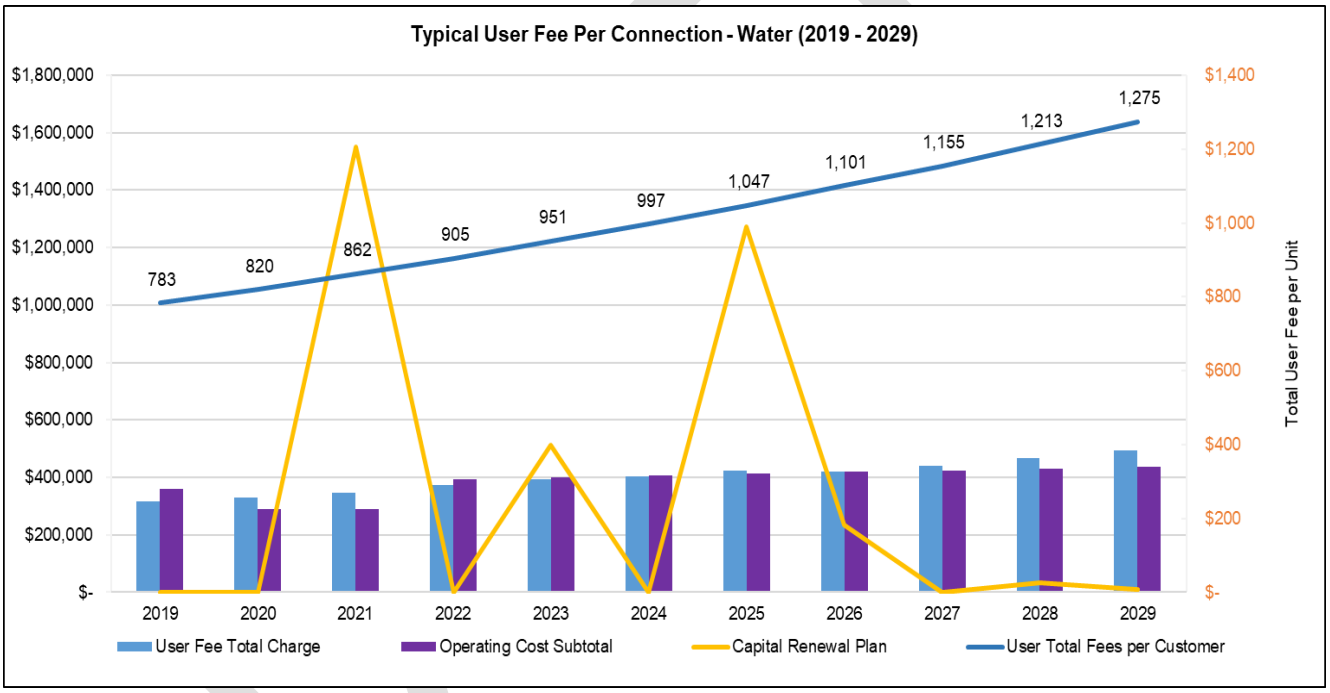


Figure 133: Water/Wastewater User Fee Projections 2019 - 2029

9 FINANCIAL STRATEGIES – THE INFRASTRUCTURE GAP

Financial sustainability requires that a Municipality ensures that there are sufficient resources to support the delivery of services for which the Municipality bears responsibility. Given the need and benefit for further infrastructure investment in order to protect, sustain, and maximize the use of Alnwick/Haldimand's infrastructure assets, a number of options and strategies have been considered. Through the road optimization software, for example, strategies are recommended which allow for an increased deficit on low volume rural roads, while directing capital to more critical non-transportation services. Deficit elimination is outside the financial capability of the

Municipality, but much can be done to ensure non-priority items can be put on the back-burner while critical services remain adequately funded.

9.1 STRATEGY 1: SPECIAL LEVY

For the Township's general infrastructure, the current contributions are insufficient to eliminate the infrastructure deficit over 10 years. One option would be to implement a special infrastructure levy on the property taxes as a surcharge. For example, by applying a special infrastructure levy of 5% annually, the Township will increase the funds available over the 10-year period by approximately $26.4 million. This reflects the significant power of compounding:

The following table is provided for illustrated purposes to help explain the significant potential through a modest levy increase to address the utility infrastructure gap:

5% Special Infrastructure Levy	
2021	$ 334,137
2022	$ 708,371
2023	$ 1,126,519
2024	$ 1,592,737
2025	$ 2,111,550
2026	$ 2,687,882
2027	$ 3,327,092
2028	$ 4,035,011
2029	$ 4,817,982
2030	$ 5,682,906
Total	***$ 26,424,189***
Average increase	***$ 2,642,419***

9.2 STRATEGY 2: RETHINKING INFRASTRUCTURE SERVICES

Optimization
The potential exists to reduce infrastructure costs by determining the most cost-effective options for all capital programs on new or rehabilitated infrastructure by pursuing life cycle cost analysis (discussed earlier in the report). The DOT (Decision Optimization Technology)™ capital planning software will be instrumental in assisting the Township in focusing on preventive maintenance, and optimizing the allocation of the capital budget to determine highest return on investment.

Service Reduction
Recognizing the significance of the infrastructure deficit, the Municipality should consider a services review with the objective of re-evaluating the priorities of the community and cost of services provided with the objective of streamlining and potentially eliminating low priority services.

Long Range Planning
Many municipalities develop rehabilitation and replacement programs on a system-wide program basis versus annual project by project basis. This will allow for improved prioritization and coordination of required work.

Deferred Replacement
The infrastructure deficit can be viewed as hypothetical in some cases, applying conservative engineering lifecycle calculations that may be overly aggressive in comparison to the real-life experience. For example, you might project the life of a building to be 50 years, but many fully functional buildings are more than 100 years old. Due to the limited funds available, some consideration should be given to where the replacement of some assets may be deferred.

9.3 STRATEGY 3: STRATEGIC USE OF DEBT

In some circumstances, it makes good sense to incur debt today rather than take the consequence and cost of allowing assets to deteriorate to a point where replacement or reconstruction would substantially increase cost to the community. The concepts involved with changing the oil in our cars and fixing the roof of our house also apply to preventive maintenance on road networks, for example. Keep a road in good shape with regular maintenance and you will never face a full reconstruction.

Due to the backlog in the tax-supported programs, there is a need to examine the cost/benefit of addressing these needs through the issuance of debt. Using debt strategically can provide capital funding flexibility by allowing certain infrastructure to be built and used before sufficient revenue has accumulated to offset the needed investment. Debt is frequently issued and considered a standard practice in Municipalities for capital projects that are long term in nature and that benefit future taxpayers, thereby spreading the costs across future years. As such, debt promotes inter-generational equity in that infrastructure is paid for by those who use it. With favourable interest rates and significant backlog, the Municipality may wish to consider the need to issue debt to expedite capital replacement.

A debt management policy improves the quality of decisions, identifies policy goals and demonstrates a commitment to long-term financial planning, including a multi-year plan. Adherence to a debt management plan signals to rating agencies and capital markets that the Municipality is well managed and is well positioned to meet its obligations in a timely manner. The Province regulates the amount of debt that Municipalities issue by setting an annual repayment limit for each Municipality (25% of a Municipality's own source revenues). Based on our experience, Municipalities typically establish thresholds below the Provincial limit to take into consideration taxpayer affordability and to ensure flexibility. The Township of Alnwick Haldimand has a 2020 Annual Debt Repayment limit of $1,969,968, of which $139,109 is utilized with existing debt, with another $98,700 of debt charges for the projected debenture to fund the water well project.

In addition to a debt guideline, monitoring also becomes important when considering the idea of the increased use of debt as a funding source to ensure that it is being used in a fiscally responsible manner. Government Finance Officers Association recommends that Municipalities adopt policies that specify appropriate uses for debt.

The following strategies are recommended to determine the most appropriate time to issue debt

- Debt will be proportionate to the Township's tax base and will not put an excessive burden on operating expenditures.
- Outstanding and planned debt levels will not exceed an amount that can be supported by the existing and projected tax revenue base. Debt policies will focus on:
    - projected debt requirement
    - limits and benchmarks

    - term and structure of debt
    - use of reserves to offset debt issuance
- Long-term debt for the replacement and refurbishment of existing capital assets will be reduced and a planned process will be developed whereby an annual contribution will be made to meet lifecycle needs of all assets.

The following policies are recommended to manage debt within the Township:

- Tax Debt Charges as a percentage of Tax Own Source Revenues will not exceed 10%.
- Long-term debt financing will be restricted to specific project types:
    - Increased/new services to residents for new initiatives
    - New, non-recurring infrastructure requirements
    - Projects which are supported by a business plan that shows revenues will cover capital and interest costs
    - Projects where the cost of deferring expenditures exceeds debt servicing costs
    - Project costs not recovered from Development Charges
    - Projects tied to third party matching funding

(Note: These restrictions may have to be phased in to meet short-term budget challenges.)

- The length of the term of debt will not exceed the useful life of the underlying asset.
- The Township will monitor and report on all forms of debt annually.

9.4 STRATEGY 4: USE OF GRANTS

It is well established that the condition of Canada's municipal infrastructure is one of the keys to underpinning, maintaining and enhancing Canada's economic productivity and competitiveness. It is therefore clearly in the national and provincial interests for the federal and provincial government to institute permanent and sustainable infrastructure funding. Along with the strategic use of debt, the Municipality can also apply for the grants available from the Provincial and Federal governments. Some significant components of the infrastructure deficit can be dealt with through close monitoring of grant programs and a careful expression of interest to access these funds.

FEDERAL GOVERNMENT INVESTING IN CANADA

Across the country, people and communities are in need. The middle class and those working hard to join it need the opportunities that come with good, well-paying jobs, and communities need help to maintain, improve and expand the things that make Canada's Townships and cities great places to live.

Investing in Canada's infrastructure builds strong communities and helps to strengthen and grow the middle class, setting the stage for sustained economic growth in the future. In Budget 2016, the government made a down payment on future growth by making immediate investments of $11.9 billion in public transit, green infrastructure and social infrastructure. This 2016 Fall Economic Statement strengthens the government's commitment to long-term growth for the middle class. It proposes an additional investment of $81 billion over 11 years, starting in 2017–18, in public transit, green infrastructure, social infrastructure, transportation that supports trade, Canada's rural and northern communities, and smart cities. The government will also establish a new Canada Infrastructure Bank to provide innovative financing for infrastructure projects, and help more projects get built in Canada, where public capital can be leveraged.

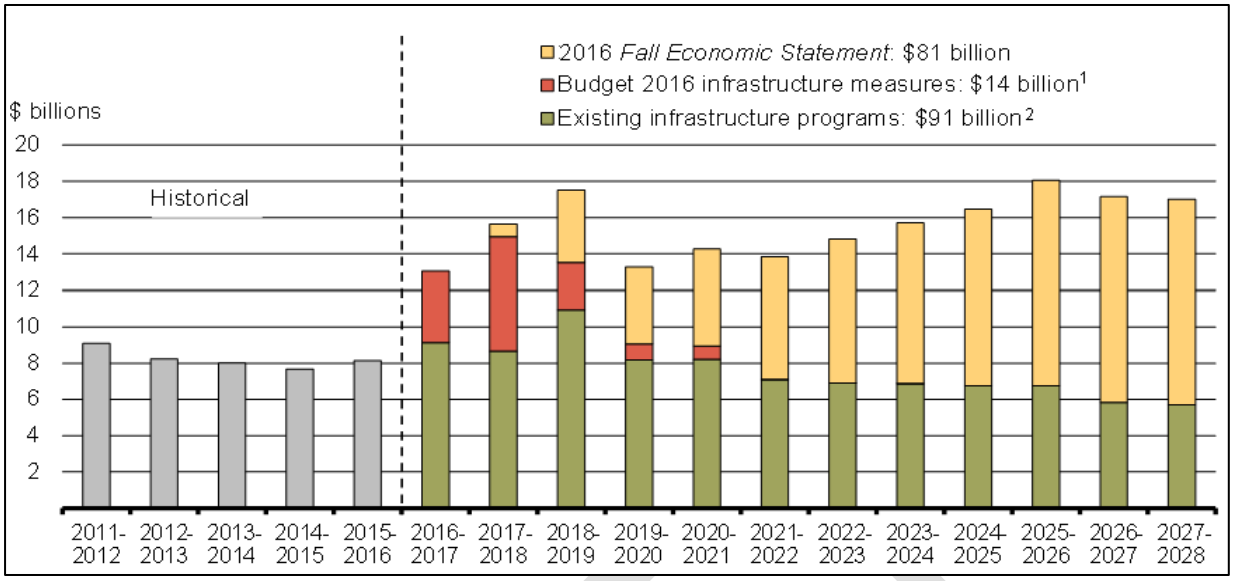


Figure 134: Federal Government Investment

Taking into account existing infrastructure programs, new investments made in Budget 2016 and the additional investments contained in this Fall Economic Statement, the government will make a total investment in Canada's communities of more than $180 billion.

This commitment is unprecedented in Canadian history.

ONTARIO PROVINCIAL GOVERNMENT

As announced in the 2016 Ontario Economic Outlook and Fiscal Review, the Province of Ontario plans to invest more than $160 billion over 12 years, starting in 2014–15.

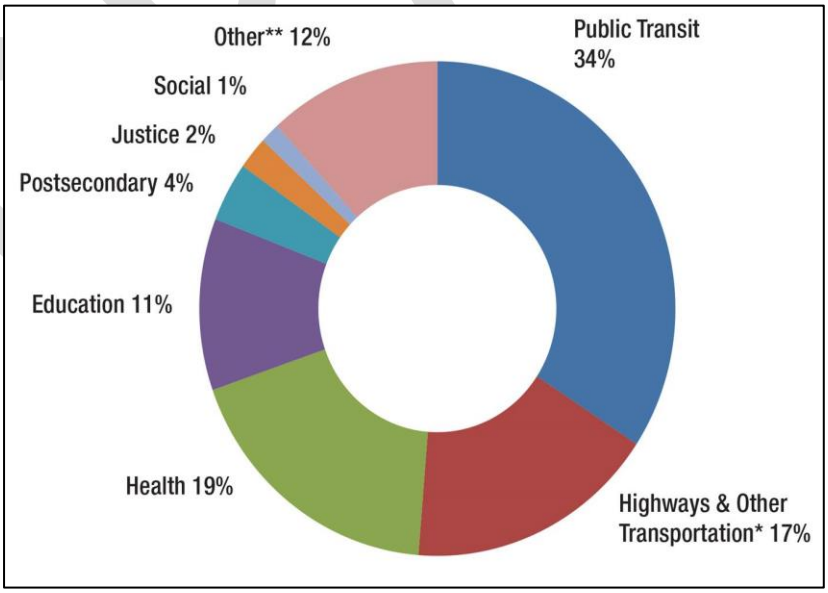


Figure 135: The Province's 12-year infrastructure plan by sector (%)

The infrastructure plan includes investments in Moving Ontario Forward for public transit, highways and other priority infrastructure projects. The infrastructure expenditures table below

outlines all planned investments over 12 years, starting in 2014-15, and shows they touch all key sectors.

Sectors ($M)	2014-15 Actuals	2015-16 Actuals	Outlook 2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	12-Year Total
Public Transit	3,554	3,967	5,381	6,632	8,053	8,528	7,656	6,742	4,983	3,378	2,112	1,807	62,791
Highways & Other Transportation*	2,323	2,372	2,919	3,163	3,248	3,340	2,947	2,582	2,287	2,047	1,966	1,946	31,139
Health	3,568	3,225	3,192	2,745	2,774	2,775	3,062	2,243	2,339	2,816	2,952	1,914	33,603
Education	1,833	1,590	2,561	1,932	1,865	1,808	1,686	1,558	1,434	1,432	1,432	1,396	20,526
Postsecondary	519	624	1,091	1,035	593	450	466	467	468	464	459	456	7,093
Justice	144	150	255	314	566	626	573	396	230	217	216	216	3,903
Social	231	267	814	353	243	183	68	54	52	51	51	51	2,419
Other**	645	556	1,184	1,299	1,936	2,071	1,935	2,072	2,647	3,555	1,680	1,676	21,256
Total Infrastructure Expenditure	12,817	12,751	17,396	17,474	19,277	19,779	18,393	16,113	14,440	13,960	10,869	9,463	182,731
Less: Other Partner Funding & Federal Contributions	1,661	1,931	3,240	2,498	2,331	1,357	1,481	1,300	1,337	1,349	1,293	1,214	20,991
Total	**11,156**	**10,820**	**14,156**	**14,975**	**16,947**	**18,422**	**16,912**	**14,812**	**13,103**	**12,611**	**9,576**	**8,249**	**161,740**

Figure 136: Infrastructure Expenditures Table
(Source: 2016 Ontario Economic Outlook and Fiscal Review)

10 RECOMMENDATIONS

10.1 SOTI RECOMMENDATIONS

The SOTI/Capital Plan identifies a number of asset-specific recommendations. However, there are six recurring recommendations that should be addressed in future strategic asset management initiatives:

1. Develop, through more detailed analysis, a plan for allocating the additional funds to the operating and/or capital budgets, as required, in order to successfully develop, implement, and maintain an approved asset management plan;
2. Develop a policy and implement a strategy to reach long-term sustainable funding for each of the assets covered in this SOTI Report;
3. Implement a comprehensive budget structure along service delivery lines, so that service managers can adequately know what the true total cost of their service is (including asset management, operations, capital, and borrowing costs).
4. Review the selection and use of rehabilitation strategies on life-cycle costing and on a return-on-investment (ROI) basis.
5. Review operating and maintenance practices, balancing least life-cycle cost against level of service and risk exposure, on a business-case basis using InfraGuide Best Practices and other industry sources;
6. Provide regular updates to the SOTI Report Card and Analysis

10.2 CAPITAL PLAN RECOMMENDATIONS

1. Asset condition assessment of capital assets should be considered wherever feasible. The application of a standard life expectancy of an asset reflects a financial approach (PSAB 3150). Age-based condition assessment has the least level of confidence for building a capital plan.
2. The Township needs to build a definitive policy with respect to it's infrastructure deficit.
3. The Township of Alnwick/Haldimand should release its infrastructure policy, strategy and intention as it pertains to the infrastructure deficit, including communications, to the general public in order to gain stakeholder support for tough decisions.
4. The Township should proactively define organizational responsibilities to maintain the asset inventory including proposed and actual project cost information, updating the data as assets are acquired or betterments are added to existing assets and projects are started and completed. In this manner, the accuracy of future Capital Plans will increase over time.
5. The Township should consider establishing as policy the following guiding principles, that it be:
    a) **Customer Focused:** To have clearly defined Levels of Service and applying asset management practices to maintain the confidence of residents in how the Township of Alnwick/Haldimand assets are managed.
    b) **Forward Looking**: To make the appropriate decisions and provisions to better enable its assets to meet future challenges, including changing demographics and populations, customer expectations, legislative requirements, technological and environmental factors.
    c) **Integrated System Focused**: Evaluate an asset in terms of its role and value within the context of the greater system, as opposed to examining individual assets in isolation
    d) **Risk-based**: To manage the asset risk associated with attaining the agreed levels of service by focusing resources, expenditures, and priorities based upon risk assessments and the corresponding cost/benefit recognizing that public safety is the priority.
    e) **Value-Based/Affordable**: To choose practices, interventions, and operations that aim at reducing the life cycle cost of asset ownership, while satisfying agreed levels of service. Decisions are based on balancing service levels, risks, and costs.
    f) **Holistic**: To take a comprehensive approach that looks at the “big picture” and considers the combined impact of managing all aspects of the asset life cycle.
    g) **Sustainable**: The Township will make the appropriate decisions and provisions to better enable its’ assets to meet future challenges, including population growth, people expectations, legislative requirements, technological and environmental factors, without compromising the ability of future generations to meet their own needs.
    h) **Optimal**: The Township will make informed decisions between competing factors such as service delivery, asset quality & value, cost, and risk by determining which option will deliver the optimal lifecycle value.
6. To meet the goals and objectives of this policy, senior management could consider:
    a) The creation and maintenance of a Comprehensive Asset Management (CAM) governance structure to lead the development of AM tools and practices and to oversee their application across the organization.
    b) Adopt a Comprehensive Asset Management Strategy (AMS) to:

- Establish, document and continually adhere to industry recognized asset management protocols;
- Develop asset management knowledge and competencies aligned with recognized competency frameworks;
- Entrench lifecycle costing when evaluating competing asset investment needs across the Township assets;
- Monitor the performance of the assets and track the effectiveness of AM practices with a view to continuous improvement;

10.3 LEVEL OF SERVICE RECOMMENDATIONS

1. We recommend that the Township incorporate a Level of Service analysis prior to resolving the infrastructure deficit in order to maximize the impact of their capital investments with the objective to:
    - Refine levels of service that balance customer expectations with risk, affordability and timing constraints as it pertains to the Township's unique requirements;
    - Adopt risk-based decision-making processes that consider the likelihood of asset failure and the consequence of a failure with regards to impacts on safety and levels of service;
2. To assist in better establishing Levels of Service, the Township should consider collecting technical performance measures required to provide information on:
    - the types of failure
    - the number of customers affected
    - the duration of the failure
    - the severity of the failure
3. To support decision-making for effective management of the assets, the Township should consider technical performance measurement and monitoring, undertaken by the Township such as:
    - Assessing the effectiveness of the operational, maintenance and capital works program
    - Review and refinement of maintenance and rehabilitation strategies and standards
    - Assistance in strategic decision-making through definition of remaining life, based on the measure being assessed

10.4 FINANCIAL STRATEGY RECOMMENDATIONS

A financial strategy to support the asset management plan is a dynamic document that should be updated and re-evaluated on an ongoing basis. The Township should give due consideration to the following points:

1. The Township has insufficient funds from existing sources to proactively manage its infrastructure and will need to prioritize its requirements to maximizing the impact of existing financial resources.
2. The Township has a growing infrastructure deficit which is serious considering its population and tax base. A special infrastructure levy will help the Municipality to reduce the gap over time and should be taken into consideration.
3. In the event that the Township implements an infrastructure levy, the excess funds

should be transferred into a reserve so that the Township has some flexibility to prioritize and sustain future infrastructure and service level requirements, and have the ability to match funds with grant programs.

4. The Township needs to be proactive in reviewing and capitalizing on the upcoming Provincial and Federal programs, as the Township will need financial assistance to close its infrastructure deficit. It should seek government grants to be able to undertake the capital projects outlined in this Asset Management Plan.
5. The Township needs to be proactive in reviewing funding options including Infrastructure Ontario Lending Policies, Private Public Partnerships, user fees and other funding options to have an understanding of financing options.
6. The Township needs to embrace the principles of Asset Management to formulate assumptions, projections, and strategies going forward. The Plan should be modified and updated on an ongoing basis.
7. The Township should track and build awareness of the results of its projections on current operating and capital spending and funding levels with the objective of fine-tuning the forecasting process.
8. The Township should continue the analysis and examination of key financial goals and strategies that guide future priorities and expenditures.

11 CONCLUSION

The vast majority of smaller Canadian municipalities do not have sufficient tax base to gain control over their infrastructure deficit. Without corrective action over the next 10 years, these communities will see a deterioration in the level of service being offered to its residents. Increased taxes and/or deteriorating levels of services often trigger a migration to larger municipalities, further undermining the smaller community's tax base. Although Provincial and Federal governments are now committing to substantially increased investment in infrastructure, much of it ends up in major urban centers where the greatest number of citizens are served.

At Alnwick/Haldimand, ISI worked with the CAO, Troy Gilmour, who was responsive in providing ISI with information from the Township. The information we received was, by in large, accurate and well organized. The overall state of the linear infrastructure at the Municipality is in line with other, similarly sized municipalities in this Province. As highlighted in the Report Card, the current state of the linear infrastructure, based on available condition rating and age analysis, presents a picture of the Township's linear assets to require substantial work. The Township should continue to be proactive in their strategies, to extend asset useful life and avoid major rehabilitation/reconstruction or replacement costs.

It is highly recommended that the Township of Alnwick/Haldimand embrace the principles of Asset Management. Managing existing infrastructure, doing the right thing, at the right time, involves knowing and implementing the most cost-effective maintenance, repair, rehabilitation, or replacement activity at the right time throughout the entire lifecycle of the asset. Beyond cost savings, assets need to be viewed in terms of their ability to enhance quality, function, capacity, and safety of the service being provided.

The process of implementing Asset Management is rife with challenge. It requires clear direction from Council, significant cross-departmental cooperation, allocating of time, energy, and resource to assume new responsibilities, consultation with the community, and working with constrained budgets to balance priorities. Because infrastructure management deals with assets that have

long lifespans, it may take years before a substantial financial return on investment (ROI) becomes apparent. Still, managing existing, capital-intensive public-sector infrastructure assets could provide very significant benefits (i.e. 20 – 40% reductions in life cycle costs).

Through Asset Management, smaller municipalities have the best opportunity to build a strategy for self-sufficiency. A municipal council's first order of business is to capitalize on the significant cost savings and lifecycle gain associated with preventive maintenance. A second initiative would be to use advanced analytical tools to attain the highest possible return, both from a financial and socio-economic perspective, on capital expenditures.

Finally, the Township will likely be faced with difficult decisions over the next years, and the infrastructure deficit will continue to widen without corrective action. Only by stakeholder buy-in on a practical and implementable capital plan can communities stem their infrastructure deficit, maintain a quality of life and plot a course for the future with confidence. The Council should put together a public communication program to engage the community in discussing the true cost of services and the assets required to provide those services. Community and stakeholder buy-in for an implementable asset management plan and service levels in line with public expectations and willingness to pay are critical to the success of the program.

APPENDIX A - DETAILED LIST OF CAPITAL PROJECTS

A detailed list of capital project for each asset type is provided under a separate cover.