4.0 Infrastructure Report Card

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Infrastructure Report Card

The Township of Armstrong

1. Each asset category was rated on two key, equally weighted (50/50) dimensions: **Condition vs. Performance**, and **Funding vs. Need**.
2. See the "***What condition is it in***?" section details on the grade of each asset category on the Condition vs. Performance dimension.
3. See the "***How do we reach sustainability***?" section for details on the grade of each asset category on the Funding vs. Need dimension.
4. The 'Overall Rating' below is the average of the two ratings.

Asset Category	Condition vs. Performance	Funding vs. Need	Overall Grade	Comments
Road Network	**F** (1.2 Stars)	**F** (1.0 Stars)	**F**	The majority, 94%, of the township's road network is in critical condition, with the remaining 6% in fair to excellent condition. The average annual revenue required to sustain Armstrong's paved road network is approximately **$411,000**. Based on Armstrong's current annual funding of **$70,000**, there is an annual **deficit of $341,000**.
Bridges & Culverts	**A** (4.9 Stars)	**F** (0.0 Stars)	**D+**	Based on age analysis only, 80% of the township's bridges & culverts are in good to excellent condition, with the remaining 20% in critical condition. The average annual revenue required to sustain Armstrong's bridges & culverts is **$47,000**. Based on Armstrong's current annual funding of **$0**, there is an annual **deficit of $47,000**.
Water Network	**D** (2.0 Stars)	**F** (1.0 Stars)	**F**	Approximately 93% of the township's water mains are in critical condition, where 100% of its facilities are in fair condition. The average annual revenue required to sustain Armstrong's water network is approximately **$92,000**. Based on the township's current annual funding of **$0**, there is an annual **deficit of $92,000**.
Sanitary Sewer Network	**B** (4.1 Stars)	**F** (0.0 Stars)	**D**	Based on age data analysis alone, 100% of the township's sanitary sewer mains, forcemains, and treatment facilities are in good to excellent condition. The average annual revenue required to sustain Armstrong's sanitary sewer network is approximately **$188,000**. Based on the township's current annual funding of **$0**, there is an annual **deficit of $188,000**.
Storm Sewer Network	**C+** (3.8 Stars)	**F** (0.0 Stars)	**F**	Based on age analysis only, 100% of the township's storm sewer mains are in fair to good condition. The average annual revenue required to sustain Armstrong's storm sewer network is approximately **$23,000**. Based on Armstrong's current annual funding of **$0**, there is an annual **deficit of $23,000**.

Asset Category	Condition vs. Performance	Funding vs. Need	Overall Grade	Comments
Buildings	**C** (2.9 Stars)	**F** (0.0 Stars)	**F**	Based on age analysis only, approximately 57% of the township's facilities are critical to poor condition, while the remainder are in good to excellent condition. The average annual revenue required to sustain Armstrong's facilities is **$96,000**. Based on the township's current annual funding of **$0**, there is an annual **deficit of $96,000**.
Land Improvements	**D** (2.1 Stars)	**F** (0.0 Stars)	**F**	Nearly 54% of the township's land improvements are in fair condition, with the remaining in critical condition. The average annual revenue required to sustain Armstrong's land improvements is approximately **$36,000**. Based on the township's current annual funding of **$0**, there is an annual **deficit of $36,000**.
Machinery & Equipment	**F** (1.4 Stars)	**F** (0.0 Stars)	**F**	Approximately 82% of the township's equipment is in critical to poor condition. The average annual revenue required to sustain Armstrong's equipment is approximately **$158,000**. Based on Armstrong's current annual funding of **$0**, there is an annual **deficit of $158,000**.
Vehicles	**F** (1.0 Stars)	**F** (0.0 Stars)	**F**	100% of the township's vehicles is in critical condition based on age data only. The average annual revenue required to sustain Armstrong's vehicles is approximately **$182,000**. Based on Red Rock's current annual funding of **$0**, there is an annual **deficit of $182,000**.

5.0 Desired Levels of Service

Desired levels of service are high level indicators, comprising many factors, as listed below, which establish defined quality thresholds at which municipal services should be supplied to the community. They support the organisation's strategic goals and are based on customer expectations, statutory requirements, standards, and the financial capacity of a township to deliver those levels of service.

Levels of Service are used:

- to inform customers of the proposed type and level of service to be offered;
- to identify the costs and benefits of the services offered;
- to assess suitability, affordability and equity of the services offered;
- as a measure of the effectiveness of the asset management plan
- as a focus for the AM strategies developed to deliver the required level of service

In order for a township to establish a desired level of service, it will be important to review the key factors involved in the delivery of that service, and the interactions between those factors. In addition, it will be important to establish some key performance metrics and track them over an annual cycle to gain a better understanding of the current level of service supplied.

Within this first Asset Management Plan, key factors affecting level of service will be outlined below and some key performance indicators for each asset type will be outlined for further review. This will provide a framework and starting point from which the township can determine future desired levels of service for each infrastructure class.

5.1 Key factors that influence a level of service:

- Strategic and Corporate Goals
- Legislative Requirements
- Expected Asset Performance
- Community Expectations
- Availability of Finances

5.1.1 Strategic and Corporate Goals

Infrastructure levels of service can be influenced by strategic and corporate goals. Strategic plans spell out where an organization wants to go, how it's going to get there, and helps decide how and where to allocate resources, ensuring alignment to the strategic priorities and objectives . It will help identify priorities and guide how municipal tax dollars and revenues are spent into the future. The level of importance that a community's vision is dependent upon infrastructure, will ultimately affect the levels of service provided or those levels that it ultimately aspires to deliver.

5.1.2 Legislative Requirements

Infrastructure levels of service are directly influenced by many legislative and regulatory requirements. For instance, the Safe Drinking Water Act, the Minimum Maintenance Standards for municipal highways, building codes, and the Accessibility for Ontarians with Disabilities Act are all legislative requirements that prevent levels of service from declining below a certain standard.

5.1.3 Expected Asset Performance

A level of service will be affected by current asset condition, and performance and limitations in regards to safety, capacity, and the ability to meet regulatory and environmental requirements. In addition, the design life of the asset, the maintenance items required, the rehabilitation or replacement schedule of the asset, and the total costs, are all critical factors that will affect the level of service that can be provided.

5.1.4 Community Expectations

Levels of services are directly related to the expectations that the general public has from the infrastructure. For example, the public will have a qualitative opinion on what an acceptable road looks like, and a quantitative one on how long it should take to travel between two locations. Infrastructure costs

are projected to increase dramatically in the future, therefore it is essential that the public is not only consulted, but also be educated, and ultimately make choices with respect to the service levels that they wish to pay for.

5.1.5 Availability of Finances

Availability of finances will ultimately control all aspects of a desired level of service. Ideally, these funds must be sufficient to achieve corporate goals, meet legislative requirements, address an asset's life cycle needs, and meet community expectations. Levels of service will be dictated by availability of funds or elected officials' ability to increase funds, or the community's willingness to pay.

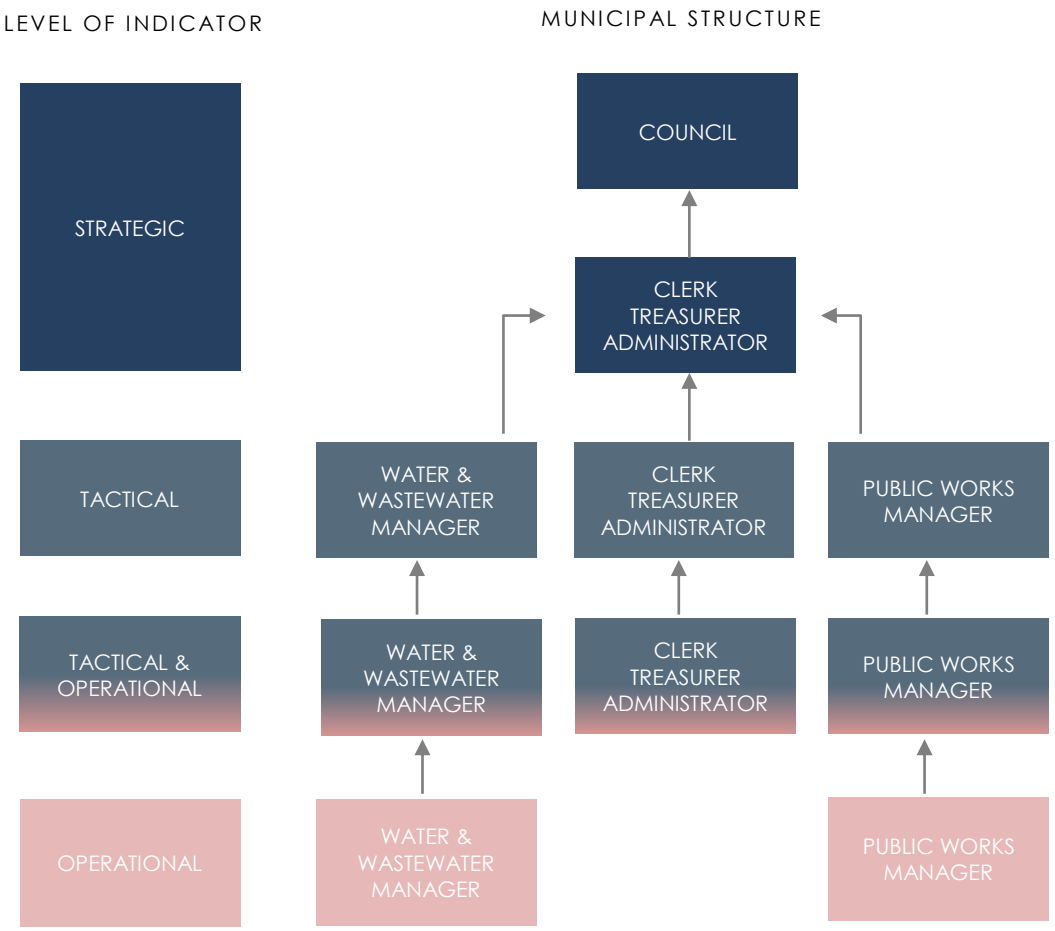
5.2 Key Performance Indicators

Performance measures or key performance indicators (KPIs) that track levels of service should be specific, measurable, achievable, relevant, and timebound (SMART). Many good performance measures can be established and tracked through the CityWide suite of software products. In this way, through automation, results can be reviewed on an annual basis and adjustments can be made to the overall asset management plan, including the desired level of service targets.

In establishing measures, a good rule of thumb to remember is that maintenance activities ensure the performance of an asset and prevent premature aging, whereas rehab activities extend the life of an asset. Replacement activities, by definition, renew the life of an asset. In addition, these activities are constrained by resource availability (in particular, finances) and strategic plan objectives. Therefore, performance measures should not just be established for operating and maintenance activities, but also for the strategic, financial, and tactical levels of the asset management program. This will assist all levels of program delivery to review their performance as part of the overall level of service provided.

This is a very similar approach to the "balanced score card" methodology, in which financial and non-financial measures are established and reviewed to determine whether current performance meets expectations. The "balanced score card", by design, links day to day operations activities to tactical and strategic priorities in order to achieve an overall goal, or in this case, a desired level of service.

The structure of accountability and level of indicator with this type of process is represented in the following table, modified from the InfraGuide's best practice document, "Developing Indicators and Benchmarks" published in April 2003.



As a note, a caution should be raised over developing too many performance indicators that may result in data overload and lack of clarity. It is better to develop a select few that focus in on the targets of the asset management plan.

Outlined below for each infrastructure class is a suggested service description, suggested service scope, and suggested performance indicators. These should be reviewed and updated in each iteration of the AMP.

5.3 Transportation Services

5.3.1 Service Description

The township's transportation network comprises gravel are paved roads. The transport network also includes 3 bridges, 2 large culverts, sidewalk, and street lights.

Together, the above infrastructure enables the township to deliver transportation and pedestrian facility services and give people a range of options for moving about in a safe and efficient manner.

5.3.2 Scope of Services

- **Movement** – providing for the movement of people and goods.
- **Access** – providing access to residential, commercial, and industrial properties and other community amenities.
- **Recreation** –providing for recreational use, such as walking, cycling, or special events such as parades.

5.3.3 Performance Indicators (reported annually)

Performance Indicators (reported annually)	
Strategic Indicators	■ percentage of total reinvestment compared to asset replacement value ■ completion of strategic plan objectives (related to transportation)
Financial Indicators	■ annual revenues compared to annual expenditures ■ annual replacement value depreciation compared to annual expenditures ■ total cost of borrowing compared to total cost of service ■ revenue required to maintain annual network growth
Tactical Indicators	■ percentage of road network rehabilitated / reconstructed ■ value of bridge / large culvert structures rehabilitated or reconstructed ■ overall road condition index as a percentage of desired condition index ■ overall bridge condition index as a percentage of desired condition index ■ annual adjustment in condition indexes ■ annual percentage of network growth ■ percent of paved road lane km where the condition is rated poor or critical ■ number of bridge / large culvert structures where the condition is rated poor or critical ■ percentage of road network replacement value spent on operations and maintenance ■ percentage of bridge / large culvert structures replacement value spent on operations and maintenance
Operational Indicators	■ percentage of road network inspected within last 5 years ■ percentage of bridge / large culvert structures inspected within last two years ■ operating costs for paved roads per lane km ■ operating costs for gravel roads per lane km ■ operating costs for bridge / large culvert structures per square metre ■ number of customer requests received annually ■ percentage of customer requests responded to within 24 hours

5.4 Water / Sanitary / Storm Networks

5.4.1 Service Description

The township's water distribution network comprises 11km of water main, valves, hydrants and a water treatment plant. The sanitary waste water network comprises 8 km of sanitary sewer main, man holes and a large pump station. The storm water network comprises 2.3km of storm main and catch basins.

Together, the above infrastructure enables the township to deliver a potable water distribution service, and a waste water and storm water collection service to the residents of the township.

5.4.2 Scope of services

- The provision of clean safe drinking water through a distribution network of water mains and pumps.
- The removal of waste water through a collection network of sanitary sewer mains.
- The removal of storm water through a collection network of storm sewer mains, and catch basins

5.4.3 Performance Indicators (reported annually)

Performance Indicators (reported annually)	
Strategic Indicators	■ Percentage of total reinvestment compared to asset replacement value ■ Completion of strategic plan objectives (related water / sanitary / storm)
Financial Indicators	■ Annual revenues compared to annual expenditures ■ Annual replacement value depreciation compared to annual expenditures ■ Total cost of borrowing compared to total cost of service ■ Revenue required to maintain annual network growth ■ Lost revenue from system outages
Tactical Indicators	■ Percentage of water / sanitary / storm network rehabilitated / reconstructed ■ Overall water / sanitary / storm network condition index as a percentage of desired condition index ■ Annual adjustment in condition indexes ■ Annual percentage of growth in water / sanitary / storm network ■ Percentage of mains where the condition is rated poor or critical for each network ■ Percentage of water / sanitary / storm network replacement value spent on operations and maintenance
Operational Indicators	■ Percentage of water / sanitary / storm network inspected ■ Operating costs for the collection of wastewater per kilometre of main. ■ Number of wastewater main backups per 100 kilometres of main ■ Operating costs for storm water management (collection, treatment, and disposal) per kilometre of drainage system. ■ Operating costs for the distribution/ transmission of drinking water per kilometre of water distribution pipe. ■ Number of days when a boil water advisory issued by the medical officer of health, applicable to a municipal water supply, was in effect. ■ Number of water main breaks per 100 kilometres of water distribution pipe in a year. ■ Number of customer requests received annually per water / sanitary / storm networks ■ Percentage of customer requests responded to within 24 hours per water / sanitary / storm network

5.5 Buildings and Facilities

5.5.1 Service Description

The Township's buildings and facilities enable the township to perform administrative functions and also provide social, cultural, and recreational amenities for the community at large.

5.5.2 Scope of services

- Administrative (offices and work yards)
- Social (airport and fire hall)
- Recreational (arenas, pool and recreation centres)

5.5.3 Performance Indicators (reported annually)

Performance Indicators (reported annually)	
Strategic Indicators	■ Percentage of total reinvestment compared to asset replacement value ■ Completion of strategic plan objectives (related to facilities)
Financial Indicators	■ Annual revenues compared to annual expenditures ■ Annual replacement value depreciation compared to annual expenditures ■ Repair and maintenance cost per square metre ■ Energy, utility and water cost per square metre
Tactical Indicators	■ Percentage of component value replaced ■ Overall facility condition index as a percentage of desired condition index ■ Annual adjustment in condition indexes ■ Annual percentage of new facilities (square metre) ■ Percent of facilities rated poor or critical ■ Percentage of facilities replacement value spent on operations and maintenance
Operational Indicators	■ Percentage of facilities inspected within the last 5 years ■ Number/type of service requests ■ Percentage of customer requests responded to within 24 hours

5.7 Vehicles (Rolling Stock)

5.7.1 Service Description

The township's diverse fleet of vehicles provides support to multiple departments as part of their delivery of various public programs and services to the citizens.

5.7.2 Performance Indicators (reported annually)

Performance Indicators (reported annually)	
Strategic Indicators	■ Percentage of total reinvestment compared to asset replacement value ■ Completion of strategic plan objectives (related to fleet)
Financial Indicators	■ Annual revenues compared to annual expenditures ■ Annual replacement value depreciation compared to annual expenditures ■ Operating and maintenance cost per fleet category ■ Fuel costs per fleet category
Tactical Indicators	■ Percentage of all vehicles replaced ■ Average age of fleet vehicles ■ Percent of vehicles rated poor or critical ■ Percentage of fleet replacement value spent on operations and maintenance
Operational Indicators	■ Average downtime per fleet category ■ Average utilization per fleet category and/or each vehicle ■ Ratio of preventative maintenance repairs vs reactive repairs ■ Percent of vehicles that received preventative maintenance ■ Number/type of service requests ■ Percentage of customer requests responded to within 24 hours

6.0 Asset Management Strategy

6.1 Objective

To outline and establish a set of planned actions, based on best practice, that will enable the assets to provide a desired and sustainable level of service, while managing risk, at the lowest life cycle cost.

The Asset Management Strategy will develop an implementation process that can be applied to the needs identification and prioritization of renewal, rehabilitation, and maintenance activities. This will assist in the production of a 10 year plan, including growth projections, to ensure the best overall health and performance of the township's infrastructure.

This section includes an overview of condition assessment techniques for each asset class; the life cycle interventions required, including interventions with the best ROI; and prioritization techniques, including risk, to determine which priority projects should move forward into the budget first.

6.2 Non-Infrastructure Solutions and Requirements

The township should explore, as requested through the provincial requirements, which non-infrastructure solutions should be incorporated into the budgets for the road, water, sewer (sanitary and storm), and bridges & culverts programs. Non- Infrastructure solutions are such items as studies, policies, condition assessments, consultation exercises, etc., that could potentially extend the life of assets or lower total asset program costs in the future.

Typical solutions for a township include linking the asset management plan to the strategic plan, growth and demand management studies, infrastructure master plans, better integrated infrastructure and land use planning, public consultation on levels of service, and condition assessment programs. As part of future asset management plans, a review of these requirements should take place, and a portion of the capital budget should be dedicated for these items in each programs budget.

It is recommended, under this category of solutions, that the township implement holistic condition assessment programs for their road, water, sanitary, and storm sewer networks. This will lead to higher understanding of infrastructure needs, enhanced budget prioritization methodologies, and a clearer path of what is required to achieve sustainable infrastructure programs.

6.3 Condition Assessment Programs

The foundation of good asset management practice is based on having comprehensive and reliable information on the current condition of the infrastructure. Municipalities need to have a clear understanding regarding performance and condition of their assets, as all management decisions regarding future expenditures and field activities should be based on this knowledge. An incomplete understanding about an asset may lead to its premature failure or premature replacement.

Some benefits of holistic condition assessment programs within the overall asset management process are listed below:

- Understanding of overall network condition leads to better management practices
- Allows for the establishment of rehabilitation programs
- Prevents future failures and provides liability protection
- Potential reduction in operation / maintenance costs
- Accurate current asset valuation
- Allows for the establishment of risk assessment programs
- Establishes proactive repair schedules and preventive maintenance programs
- Avoids unnecessary expenditures

- Extends asset service life therefore improving level of service
- Improves financial transparency and accountability
- Enables accurate asset reporting which, in turn, enables better decision making

Condition assessment can involve different forms of analysis such as subjective opinion, mathematical models, or variations thereof, and can be completed through a very detailed or very cursory approach.

When establishing the condition assessment of an entire asset class, the cursory approach (metrics such as good, fair, poor, critical) is used. This will be a less expensive approach when applied to thousands of assets, yet will still provide up to date information, and will allow for detailed assessment or follow up inspections on those assets captured as poor or critical condition later.

The following section outlines condition assessment programs available for road, bridge, sewer, and water networks that would be useful for the township.

6.3.1 Pavement Network Inspections

Typical industry pavement inspections are performed by consulting firms using specialised assessment vehicles equipped with various electronic sensors and data capture equipment. The vehicles will drive the entire road network and typically collect two different types of inspection data – surface distress data and roughness data.

Surface distress data involves the collection of multiple industry standard surface distresses, which are captured either electronically, using sensing detection equipment mounted on the van, or visually, by the van's inspection crew. Examples of surface distresses are:

- **For asphalt surfaces**
  alligator cracking; distortion; excessive crown; flushing; longitudinal cracking; map cracking; patching; edge cracking; potholes; ravelling; rippling; transverse cracking; wheel track rutting

- **For concrete surfaces**
  coarse aggregate loss; corner 'C' and 'D' cracking; distortion; joint faulting; joint sealant loss; joint spalling; linear cracking; patching; polishing; potholes; ravelling; scaling; transverse cracking

Roughness data capture involves the measurement of the roughness of the road, measured by lasers that are mounted on the inspection van's bumper, calibrated to an international roughness index.

Most firms will deliver this data to the client in a database format complete with engineering algorithms and weighting factors to produce an overall condition index for each segment of roadway. This type of scoring database is ideal for upload into the CityWide software database, in order to tag each road with a present condition and then further life cycle analysis to determine what activity should be completed on which road, in what timeframe, and to calculate the cost for the work will be completed within the CityWide system.

The above process is an excellent way to capture road condition as the inspection trucks will provide detailed surface and roughness data for each road segment, and often include video or street imagery. A very rough industry estimate of cost would be about $100 per centreline km of road.

Another option for a cursory level of condition assessment is for municipal road crews to perform simple windshield surveys as part of their regular patrol. Many municipalities have created data collection inspection forms to assist this process and to standardize what presence of defects would constitute a good, fair, poor, or critical score. Lacking any other data for the complete road network, this can still be seen as a good method and will assist greatly with the overall management of the road network. The CityWide Works software has a road patrol component built in that could capture this type of inspection data during road patrols in the field, enabling later analysis of rehabilitation and replacement needs for budget development.

It is recommended that the township establish a pavement condition assessment program and that a portion of capital funding is dedicated to this.

6.3.2 Bridges & Culverts (greater than 3m) Inspections

Ontario municipalities are mandated by the Ministry of Transportation to inspect all structures that have a span of 3 metres or more, according to the OSIM (Ontario Structure Inspection Manual). At present, in the township, there are 138 structures that meet this criterion.

Structure inspections must be performed by, or under the guidance of, a structural engineer, must be performed on a biennial basis (once every two years), and include such information as structure type, number of spans, span lengths, other key attribute data, detailed photo images, and structure element by element inspection, rating and recommendations for repair, rehabilitation, and replacement.

The best approach to develop a 10 year needs list for the township's structure portfolio would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, and rehabilitation and replacement requirements report as part of the overall assignment. In addition to refining the overall needs requirements, the structural engineer should identify those structures that will require more detailed investigations and non-destructive testing techniques. Examples of these investigations are:

- Detailed deck condition survey
- Non-destructive delamination survey of asphalt covered decks
- Substructure condition survey
- Detailed coating condition survey
- Underwater investigation
- Fatigue investigation
- Structure evaluation

Through the OSIM recommendations and additional detailed investigations, a 10 year needs list will be developed for the township's bridges.

The 10 year needs list developed could then be further prioritized using risk management techniques to better allocate resources. Also, the results of the OSIM inspection for each structure, whether BCI (bridge condition index) or general condition (good, fair, poor, critical) should be entered into the CityWide software to update results and analysis for the development of the budget.

6.3.3 Sewer Network Inspections (Sanitary & Storm)

The most popular and practical type of sanitary and storm sewer assessment is the use of Closed Circuit Television Video (CCTV). The process involves a small robotic crawler vehicle with a CCTV camera attached that is lowered down a maintenance hole into the sewer main to be inspected. The vehicle and camera then travels the length of the pipe providing a live video feed to a truck on the road above where a technician / inspector records defects and information regarding the pipe. A wide range of construction or deterioration problems can be captured including open/displaced joints, presence of roots, infiltration & inflow, cracking, fracturing, exfiltration, collapse, deformation of pipe and more. Therefore, sewer CCTV inspection is a very good tool for locating and evaluating structural defects and general condition of underground pipes.

Even though CCTV is an excellent option for inspection of sewers it is a fairly costly process and does take significant time to inspect a large volume of pipes.

Another option in the industry today is the use of Zoom Camera equipment. This is very similar to traditional CCTV, however, a crawler vehicle is not used but in it's a place a camera is lowered down a maintenance hole attached to a pole like piece of equipment. The camera is then rotated towards each connecting pipe and the operator above progressively zooms in to record all defects and information about each pipe. The downside to this technique is the further down the pipe the image is zoomed, the less clarity is available to accurately record defects and measurement. The upside is the process is far quicker and significantly less expensive and an assessment of the manhole can be provided as well. Also, it is important to note that 80% of pipe deficiencies generally occur within 20 metres of each manhole. The following is a list of advantages of utilizing Zoom Camera technology:

- A time and cost efficient way of examining sewer systems;
- Problem areas can be quickly targeted;
- Can be complemented by a conventional camera (CCTV), if required afterwards;
- In a normal environment, 20 to 30 manholes can be inspected in a single day, covering more than 1,500 meters of pipe;
- Contrary to the conventional camera approach, cleaning and upstream flow control is not required prior to inspection;
- Normally detects 80% of pipe deficiencies, as most deficiencies generally occur within 20 meters of manholes.

The following table is based on general industry costs for traditional CCTV inspection and Zoom Camera inspection; however, costs should be verified through local contractors. It is for illustrative purposes only but supplies a general idea of the cost to inspect Armstrong's entire sanitary and storm networks.

Sanitary and Sewer Inspection Cost Estimates

Sewer Network	Assessment Activity	Cost	Metres of Main / # of Manholes	**Total**
Sanitary	Full CCTV	$10 (per m)	8,000 m	**$80,000**
	Zoom	$300 (per mh)	106 manholes	**$31,800**
Storm	Full CCTV	$10 (per m)	2,300 m	**$23,000**
	Zoom	$300 (Per mh)	29 manholes (estimated)*	**$8,700**

**manholes estimated by using one manhole per 80 metres of main*

It can be seen from the above table that there is a significant cost savings achieved through the use of Zoom Camera technology. A good industry trend and best practice is to inspect the entire network using Zoom Camera technology and follow up on the poor and critical rated pipes with more detail using a full CCTV inspection. In this way, inspection expenditures are kept to a minimum, however, an accurate assessment on whether to rehabilitate or replace pipes will be provided for those with the greatest need.

It is recommended that the township establish a sewer condition assessment program and that a portion of capital funding is dedicated to this.

In addition to receiving a video and defect report of each pipe's CCTV or Zoom camera inspection, many companies can now provide a database of the inspection results, complete with scoring matrixes that provide an overall general condition score for each pipe segment that has been assessed. Typically pipes are scored from 1 – 5, with 1 being a relatively new pipe and 5 being a pipe at the end of its design life. This type of scoring database is ideal for upload into the CityWide software database, in order to tag each pipe with a present condition and then further life cycle analysis to determine what activity should be done to which pipe, in what timeframe, and to calculate the cost for the work will be completed by the CityWide system.

6.3.4 Water network inspections

Unlike sewer mains, it is very difficult to inspect water mains from the inside due to the high pressure flow of water constantly underway within the water network. Physical inspections require a disruption of service to residents, can be an expensive exercise, and are time consuming to set up. It is recommended practice that physical inspection of water mains typically only occurs for high risk, large transmission mains within the system, and only when there is a requirement. There are a number of high tech inspection techniques in

the industry for large diameter pipes but these should be researched first for applicability as they are quite expensive. Examples are:

- Remote eddy field current (RFEC)
- Ultrasonic and acoustic techniques
- Impact echo (IE)
- Georadar

For the majority of pipes within the distribution network gathering key information in regards to the main and its environment can supply the best method to determine a general condition. Key data that could be used, along with weighting factors, to determine an overall condition score are listed below.

- Age
- Material Type
- Breaks
- Hydrant Flow Inspections
- Soil Condition

Understanding the age of the pipe will determine useful life remaining, however, water mains fail for many other reasons than just age. The pipe material is important to know as different pipe types have different design lives and different deterioration profiles. Keeping a water main break history is one of the best analysis tools to predict future pipe failures and to assist with programming rehabilitation and replacement schedules. Also, most municipalities perform hydrant flow tests for fire flow prevention purposes. The readings from these tests can also help determine condition of the associated water main. If a hydrant has a relatively poor flow condition it could be indicative of a high degree of encrustation within the attached water main, which could then be flagged as a candidate for cleaning or possibly lining. Finally, soil condition is important to understand as certain soil types can be very aggressive at causing deterioration on certain pipe types.

It is recommended that the township develop a rating system for the mains within the distribution network based on the availability of key data, and that funds are budgeted for this development.

Also, it is recommended that the township utilize the CityWide Works application to track water main break work orders and hydrant flow inspection readings as a starting point to develop a future scoring database for each water main.

6.3.5 Facility inspections

The most popular and practical type of facility assessment involves qualified groups of trained industry professionals (engineers or architects) performing an analysis of the condition of a group of facilities, and their components, that may vary in terms of age, design, construction methods, and materials. This analysis can be done by walk-through inspection, mathematical modeling, or a combination of both. But the most accurate way of determining the condition requires a walk-through to collect baseline data.

The following 5 asset classifications are typically inspected:

- **Site Components –** property around the facility and includes the outdoor components such as utilities, signs, stairways, walkways, parking lots, fencing, courtyards and landscaping.
- **Structural Components –** physical components such as the foundations, walls, doors, windows, roofs.
- **Electrical Components –** all components that use or conduct electricity such as wiring, lighting, electric heaters, and fire alarm systems
- **Mechanical Components –** components that convey and utilize all non-electrical utilities within a facility such as gas pipes, furnaces, boilers, plumbing, ventilation, and fire extinguishing systems
- **Vertical movement –** components used for moving people between floors of buildings such as elevators, escalators and stair lifts.

The data collection on the above components typically includes: type and category of component; estimated age; current condition; estimated repair, rehabilitation or replacement date; and estimated cost for the repair, rehabilitation or replacement.

Once collected this type of information can be uploaded into the CityWide software database in order for short and long term repair, rehabilitation and replacement reports to be generated to assist with programming the short and long term maintenance and capital budgets.

In addition, reports can be generated for each facility that accumulate all current repair, rehabilitation and replacement requirements and generate a facility condition index (FCI) for the overall facility. This allows senior management to assess the overall state of the housing portfolio and determine which facilities have the greatest overall needs.

The FCI of a facility is represented as a percentage and is calculated by taking the total renewal costs of components in a given year and dividing that figure by the total replacement value of the facility itself. A high FCI value reflects a high renewal requirement and therefore a poor condition facility.

A facility with an FCI of less than 5% is in good condition, between 5% and 10% is in fair condition, between 10% and 30% poor condition, and over 30% is considered critical condition.

$$\text{FCI (Facility Condition Index)} = \frac{\text{Renewal Requirement in a Given Year}}{\text{Replacement Value of an Asset}}$$

Good < 5%	Fair 5% - 10%	Poor 10% - 30%	Critical > 30%

6.3.7 Fleet (Rolling Stock) Inspections and Maintenance

The typical approach to optimizing the maintenance expenditures of a corporate fleet of vehicles is through routine vehicle inspections, routine vehicle servicing, and an established routine preventative maintenance program.

Most, if not all, makes and models of vehicles are supplied with maintenance manuals that define the appropriate schedules and routines for typical maintenance and servicing and also more detailed restoration or rehabilitation protocols.

The primary goal of good vehicle maintenance is to avoid or mitigate the consequence of failure of equipment or parts. An established preventative maintenance program serves to ensure this, as it will consist of scheduled inspections and follow up repairs of vehicles and equipment in order to decrease breakdowns and excessive downtimes.

A good preventative maintenance program will include partial or complete overhauls of equipment at specific periods, including oil changes, lubrications, fluid changes and so on. In addition, workers can record equipment or part deterioration so they can schedule to replace or repair worn parts before they fail. The ideal preventative maintenance program would move further and further away from reactive repairs and instead towards the prevention of all equipment failure before it occurs.

Once a good preventative maintenance program is defined and scheduled for various categories and types of vehicles it becomes essential to have good software tools to track the scheduling and performance of the overall program. There are municipal maintenance software programs, such as CityWide, that are ideal for this purpose as they are designed to enable public works departments to prioritize, schedule and track projects including preventative maintenance schedules. In addition these software applications typically calculate resources utilized, inventory consumed, as well as direct and indirect labour, and will provide full management reporting.

It is recommended that a preventative maintenance routine is defined and established for all fleet vehicles and that a software application such as Citywide is utilized for the overall management of the program.

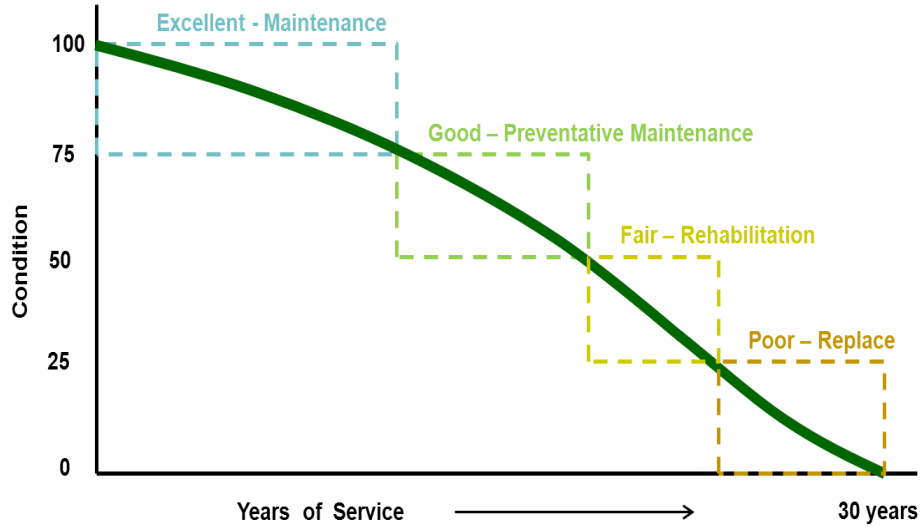
6.4 AM Strategy – Life Cycle Analysis Framework

An industry review was conducted to determine which life cycle activities can be applied at the appropriate time in an asset's life, to provide the greatest additional life at the lowest cost. In the asset management industry, this is simply put as doing the right thing to the right asset at the right time. If these techniques are applied across entire asset networks or portfolios (e.g., the entire road network), the township could gain the best overall asset condition while expending the lowest total cost for those programs.

6.4.1 Paved Roads

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for paved roads. With future updates of this Asset Management Strategy, the township may wish to run the same analysis with a detailed review of township activities used for roads and the associated local costs for those work activities. All of this information can be input into the CityWide software suite in order to perform updated financial analysis as more detailed information becomes available.

The following diagram depicts a general deterioration profile of a road with a 30 year life.



As shown above, during the road's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; preventative maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied to also coincide approximately with the condition state of the asset as shown below:

Asset Condition and Related Work Activity: Paved Roads

Condition	Condition Range	Work Activity
Excellent condition (Maintenance only phase)	100-76	■ maintenance only
Good Condition (Preventative maintenance phase)	75 - 51	■ crack sealing ■ emulsions
Fair Condition (Rehabilitation phase)	50 -26	■ resurface - mill & pave ■ resurface - asphalt overlay ■ single & double surface treatment (for rural roads)
Poor Condition (Reconstruction phase)	25 - 1	■ reconstruct - pulverize and pave ■ reconstruct - full surface and base reconstruction
Critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

With future updates of this Asset Management Strategy the township may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the township's work program. Also note: when adjusting these thresholds, it actually adjusts the level of service provided and ultimately changes the amount of money required. These threshold and condition ranges can be easily updated with the CityWide software suite and an updated financial analysis can be calculated. These adjustments will be an important component of future Asset Management Plans, as the Province requires each township to present various management options within the financing plan.

The table below outlines the costs for various road activities, the added life obtained for each, the condition range at which they should be applied, and the cost of 1 year added life for each (cost of activity / added life) in order to present an apples to apples comparison.

Road Lifecycle Activity Options

Treatment	Average Unit Cost (per sq. m)	Added Life (Years)	Condition Range	Cost Of Activity/Added Life
Urban Reconstruction	$205	30	25 - 0	$6.83
Urban Resurfacing	$84	15	50 - 26	$5.60
Rural Reconstruction	$135	30	25 - 0	$4.50
Rural Resurfacing	$40	15	50 - 26	$2.67
Double Surface Treatment	$25	10	50 - 26	$2.50
Routing & Crack Sealing (P.M)	$2	3	75 - 51	$0.67

As can be seen in the table above, preventative maintenance activities such as routing and crack sealing have the lowest associated cost (per sq. m) in order to obtain one year of added life. Of course, preventative maintenance activities can only be applied to a road at a relatively early point in the life cycle. It is recommended that the township engage in an active preventative maintenance program for all paved roads and that a portion of the maintenance budget is allocated to this.

Also, rehabilitation activities, such as urban and rural resurfacing or double surface treatments (tar and chip) for rural roads have a lower cost to obtain each year of added life than full reconstruction activities. It is recommended, if not in place already, that the township engages in an active rehabilitation program for urban and rural paved roads and that a portion of the capital budget is dedicated to this.

Of course, in order to implement the above programs it will be important to also establish a general condition score for each road segment, established through standard condition assessment protocols as previously described.

It is important to note that a "worst first" budget approach, whereby no life cycle activities other than reconstruction at the end of a roads life are applied, will result in the most costly method of managing a road network overall.

6.4.2 Gravel Roads

The life cycle activities required for these roads are quite different from paved roads. Gravel roads require a cycle of perpetual maintenance, including general re-grading, reshaping of the crown and cross section, gravel spot and section replacement, dust abatement and ditch clearing and cleaning.

Gravel roads can require frequent maintenance, especially after wet periods and when accommodating increased traffic. Wheel motion shoves material to the outside (as well as in-between travelled lanes), leading to rutting, reduced water-runoff, and eventual road destruction if unchecked. This deterioration process is prevented if interrupted early enough, simple re-grading is sufficient, with material being pushed back into the proper profile.

As a high proportion of gravel roads can have a significant impact on the maintenance budget, it is recommended that with further updates of this asset management plan the township study the traffic volumes and maintenance requirements in more detail for its gravel road network.

Similar studies elsewhere have found converting certain roadways to paved roads can be very cost beneficial especially if frequent maintenance is required due to higher traffic volumes. Roads within the gravel network should be ranked and rated using the following criteria:

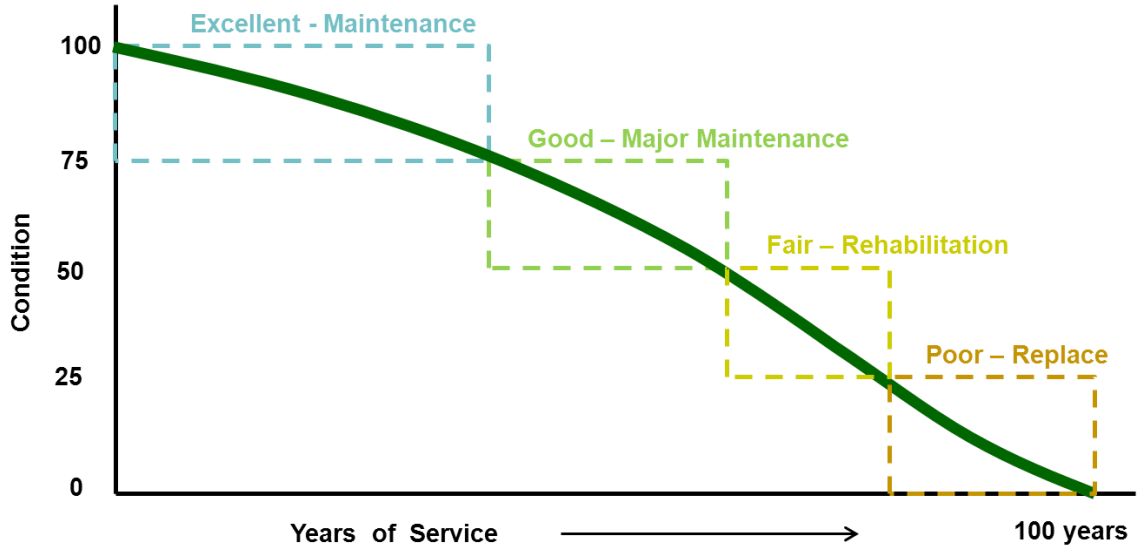
- Usage - traffic volumes and type of traffic
- Functional importance of the roadway
- Known safety issues
- Frequency of maintenance and overall expenditures required

Through the above type of analysis, a program could be introduced to convert certain gravel roadways into paved roads, reducing overall costs, and be brought forward into the long range budget.

6.4.3 Sanitary and Storm Sewers

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for sanitary and storm sewer rehabilitation and replacement. With future updates of this asset management strategy, the township may wish to run the same analysis with a detailed review of township activities used for sewer mains and the associated local costs for those work activities. All of this information can be input into the CityWide software suite in order to perform updated financial analysis as more detailed information becomes available.

The following diagram depicts a general deterioration profile of a sewer main with a 100 year life.



As shown above, during the sewer main's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied also coincide approximately with the condition state of the asset as shown below:

Asset Condition and Related Work Activity: Sewer Main

Condition	Condition Range	Work Activity
Excellent condition (Maintenance only phase)	100-76	■ maintenance only (cleaning & flushing etc.)
Good Condition (Preventative maintenance phase)	75 - 51	■ mahhole repairs ■ small pipe section repairs
Fair Condition (Rehabilitation phase)	50 -26	■ structural relining
Poor Condition (Reconstruction phase)	25 - 1	■ pipe replacement
Critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

With future updates of this Asset Management Strategy the township may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the township's work program. Also note: when adjusting these thresholds, it actually adjusts the level of service provided and ultimately changes the amount of money required. These threshold and condition ranges can be easily updated with the CityWide software suite and an updated financial analysis can be calculated. These adjustments will be an important component of future Asset Management Plans, as the province requires each township to present various management options within the financing plan.

The table below outlines the costs, by pipe diameter, for various sewer main rehabilitation (lining) and replacement activities. The columns display the added life obtained for each activity, the condition range at which they should be applied, and the cost of 1 year added life for each (cost of activity / added life) in order to present an apples to apples comparison.

Sewer Main Lifecycle Activity Options

Category	Cost (per m)	Added Life	Condition Range	1 year Added Life Cost (Cost / Added Life)
Structural Rehab (m)				
0 - 325mm	$174.69	75	50 - 75	$2.33
325 - 625mm	$283.92	75	50 - 75	$3.79
625 - 925mm	$1,857.11	75	50 - 75	$24.76
> 925mm	$1,771.34	75	50 - 75	$23.62
Replacement (m)				
	$475.00	100	76 - 100	$4.75
325 - 625mm	$725.00	100	76 - 100	$7.25
625 - 925mm	$900.00	100	76 - 100	$9.00
> 925mm	$1,475.00	100	76 - 100	$14.75

As can be seen in the above table, structural rehabilitation or lining of sewer mains is an extremely cost effective industry activity and solution for pipes with a diameter less than 625mm. The unit cost of lining is approximately one third of replacement and the cost to obtain one year of added life is half the cost. Structural lining has been proven through industry testing to have a design life (useful life) of 75 years, however, it is believed that liners will probably obtain 100 years of life (the same as a new pipe).

For sewer mains with diameters greater than 625mm specialized liners are required and therefore the costs are no longer effective. It should be noted, however, that the industry is continually expanding its technology in this area and therefore future costs should be further reviewed for change and possible price reductions.

It is recommended, if not in place already, that the township engage in an active structural lining program for sanitary and storm sewer mains and that a portion of the capital budget be dedicated to this.

In order to implement the above, it will be important to also establish a condition assessment program to establish a condition score for each sewer main within the sanitary and storm collection networks, and therefore identify which pipes are good candidates for structural lining.

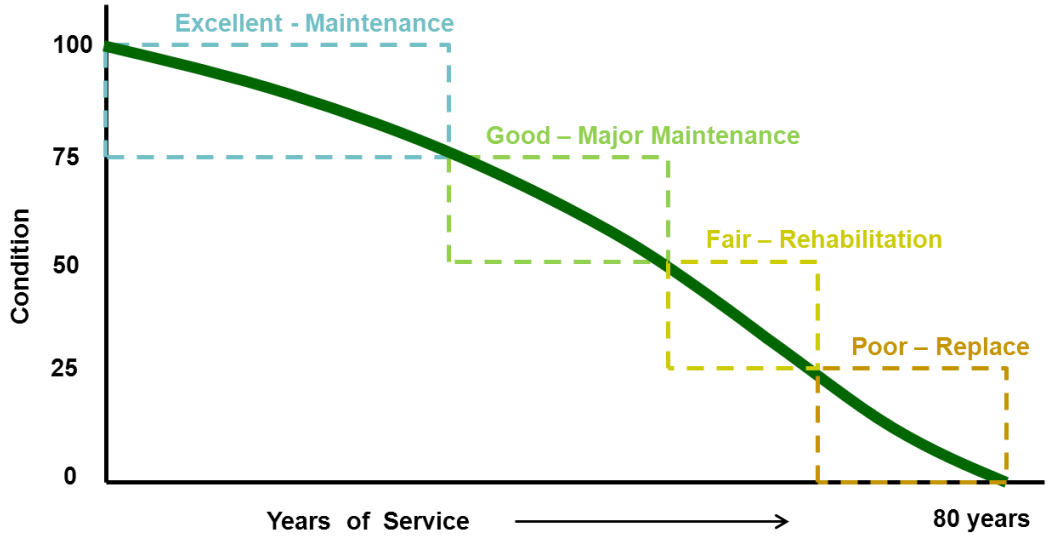
6.4.4 Bridges & Culverts (greater than 3m span)

The best approach to develop a 10 year needs list for the township's bridge structure portfolio would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, a rehabilitation and replacement requirements report and identify additional detailed inspections as required. This approach is described in more detail within the "Bridges & Culverts (greater than 3m) Inspections" section above.

6.4.5 Water Network

As with roads and sewers above, the following analysis has been conducted at a fairly high level, using industry standard activities and costs for water main rehabilitation and replacement.

The following diagram depicts a general deterioration profile of a water main with an 80 year life.



As shown above, during the water main's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied also coincide approximately with the condition state of the asset as shown below:

Asset Condition and Related Work Activity: Water Main

Condition	Condition Range	Work Activity
Excellent condition (Maintenance only phase)	100-76	■ maintenance only (cleaning & flushing etc.)
Good Condition (Preventative maintenance phase)	75 - 51	■ water main break repairs ■ small pipe section repairs
Fair Condition (Rehabilitation phase)	50 -26	■ structural water main relining
Poor Condition (Reconstruction phase)	25 - 1	■ pipe replacement
Critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

Water main Lifecycle Activity Option				
Category	Cost	Added Life	Condition Range	Cost of Activity / Added Life
Structural Rehab (m)				
0.000 - 0.150m	$209.70	50	50 - 75	$4.19
0.150 - 0.300m	$315.00	50	50 - 75	$6.30
0.300 - 0.400m	$630.00	50	50 - 75	$12.60
0.400 - 0.700m	$1,500.00	50	50 - 75	$30.00
0.700 m - & +	$2,000.00	50	50 - 75	$40.00
Replacement (m)				
0.000 - 0.150m	$233.00	80	76 - 100	$2.91
0.150 - 0.300m	$350.00	80	76 - 100	$4.38
0.300 - 0.400m	$700.00	80	76 - 100	$8.75
0.400 - 0.700m	$1,500.00	80	76 - 100	$18.75
0.700 m - & +	$2,000.00	80	76 - 100	$25.00

Water rehab technologies still require some digging (known as low dig technologies, due to lack of access) and are actually more expensive on a life cycle basis. However, if the road above the water main is in good condition lining avoids the cost of road reconstruction still resulting in a cost effective solution.

It should be noted, that the industry is continually expanding its technology in this area and therefore future costs should be further reviewed for change and possible price reductions.

At this time, it is recommended that the township only utilize water main structural lining when the road above requires rehab or no work.

6.4.6 Buildings and Facilities

The best approach to develop a 10 year needs list for the township's facility portfolio would be to have the engineers or architects who perform the facility inspections to also develop a complete portfolio maintenance requirements report and rehabilitation and replacement requirements report, and also identify additional detailed inspections and follow up studies as required. This may be performed as a separate assignment once all individual facility audits / inspections are complete. Of course, if the inspection data is housed or uploaded into the CityWide software, then these reports can be produced automatically from the system.

The above reports could be considered the beginning of a 10 year maintenance and capital plan, however, within the facilities industry there are other key factors that should be considered to determine over all priorities and future expenditures. Some examples would be functional / legislative requirements, energy conservation programs and upgrades, customer complaints and health and safety concerns, and also customer expectations balanced with willingness to pay initiatives.

Legislative requirements:

Acts to consider as part of the 10 year plan would be:

Accessibility for Ontarians with Disabilities Act By January 2012, all public sector in Ontario were required to comply with the customer service standard under the Accessibility for Ontarians with Disabilities Act, 2005 (AODA). This means that each organization will have to establish policies, practices and procedures on providing goods and services to people with disabilities.

The Building Code Act (BCA) and the Ontario Building Code (OBC) govern the construction, demolition, and renovation of buildings by setting certain minimum performance and safety standards.

The initial 10 year requirements listings produced from the facility audits / inspections should be reviewed to ensure capital replacements and upgrades are compliant with industry standards and legislation and project prioritisations and estimates should be adjusted accordingly.

Energy Conservation

There are significant savings to be achieved within a facility portfolio through the implementation of energy conservation programs and the associated industry incentives available upon the market. Some examples would be:

Mechanical & Structural components

- Improve mechanical systems by replacing old inefficient systems (e.g HVAC, boilers) with new high efficiency systems; investigate if incentives for these improvements are available from utilities, federal government, etc.
- Investigate the tightness and insulation of the building envelope in all properties and develop programs for improvement
- Reduce solar gain through windows with awnings or landscaping.
- Replace/upgrade all toilets with high efficiency toilets

Electrical components

- Install occupancy sensors
- Implement energy efficiency lighting using compact fluorescent light bulbs and install timers where appropriate to control outside lights
- Install fully programmable thermostats within all housing units

Energy conservation should be studied in detail for the entire facilties portfolio and upgrade and replacement programs should be implemented through the capital program as part of the 10 year plan.

Customer expectation and affordability or willingness to pay

As discussed within the "Desired Levels of Service" section of this AMP, levels of service are directly related to the expectations of the customer and also their ability to pay for a level of service.

Community facilities, such as recreation centres, in-door pools, arenas, etc. are infrastructure service areas where customer surveys can be conducted to gain a better sense of what customer expectations are and to assist in the establishment of a standard level of provision or service. Information could be collected on: safety; security; esthetics; environment; comfort; affordability; cleanliness; functional use of space; etc. This would require a much more detailed review, however, the establishment of a level of service based on customer needs and expectations, while still balancing affordability, would directly affect the prioritization of programs and projects brought forward into the 10 year facility budget.

It is recommended that the township develop a life cycle framework for the facility portfolio based on a detailed review of the above factors and that the results are brought forward into future iterations of this AMP.

6.4.8 Vehicles (Rolling Stock)

Life Cycle Requirements

The best approach to develop a 10 year needs list for the township's vehicles would first be through a defined preventative maintenance program as described in the "Fleet inspections and maintenance section", and secondly through an optimized life cycle vehicle replacement schedule. As previously described, the preventative maintenance program would serve to determine budget requirements for operating and minor capital expenditures for part renewal and major refurbishments and rehabilitations. An optimized vehicle replacement program will ensure a vehicle is replaced at the correct point in time in order to minimize overall cost of ownership, minimize costly repairs and downtime, while maximizing potential re-sale value. There is significant benchmarking information available within the Fleet industry in regards to vehicle life cycles which can be used to assist in this process. Once appropriate replacement schedules are established the short and long term budgets can be funded accordingly.

Fleet Utilization

One of the most critical factors in managing a fleet of vehicles and the associated costs is utilization. Over utilized vehicles may be used for additional shifts or operated in demanding environments while other vehicles are significantly under-utilized. To ensure preventative maintenance programs and vehicle replacement schedules are optimized, vehicle utilization must be managed and tracked.

A good performance indicator to assist with managing fleet utilisation is tracking engine hours of actual vehicle usage, whether it's being driven or not, as kilometres driven is not always a meaningful way to assess whether a vehicle is being utilized fully. Better management of utilisation can lower costs by reducing preventative maintenance for some vehicles, selling certain vehicles, encouraging vehicle pooling, outsourcing the use of certain vehicle types, and encouraging the use of employee vehicles.

Green Fleets

Due to the significant increase of fuel costs many fleet management groups are increasingly looking towards the greening of their fleets to lower future operating and maintenance costs. The City of London, UK, defines a green fleet "as one that does its best to minimize fuel consumption and exhaust emissions. It also seeks to minimize the amount of traffic it generates by utilizing vehicles efficiently and by using alternatives wherever possible". This area would require an individually tailored study for any township to project what type of savings could be achieved over the long term.

The above reports could be considered the beginning of a 10 year maintenance and capital plan; however, further work would be required to assimilate functional improvements and requirements into the long term plan.

6.5 Growth and Demand

Typically a township will have specific plans associated with population growth. It is essential that the asset management strategy should address not only the existing infrastructure, as above, but must include the impact of projected growth on defined project schedules and funding requirements. Projects would include the funding of the construction of new infrastructure, and/or the expansion of existing infrastructure to meet new demands. The township should enter these projects into the CityWide software in order to be included within the short and long term budgets as required.

6.6 Project Prioritization

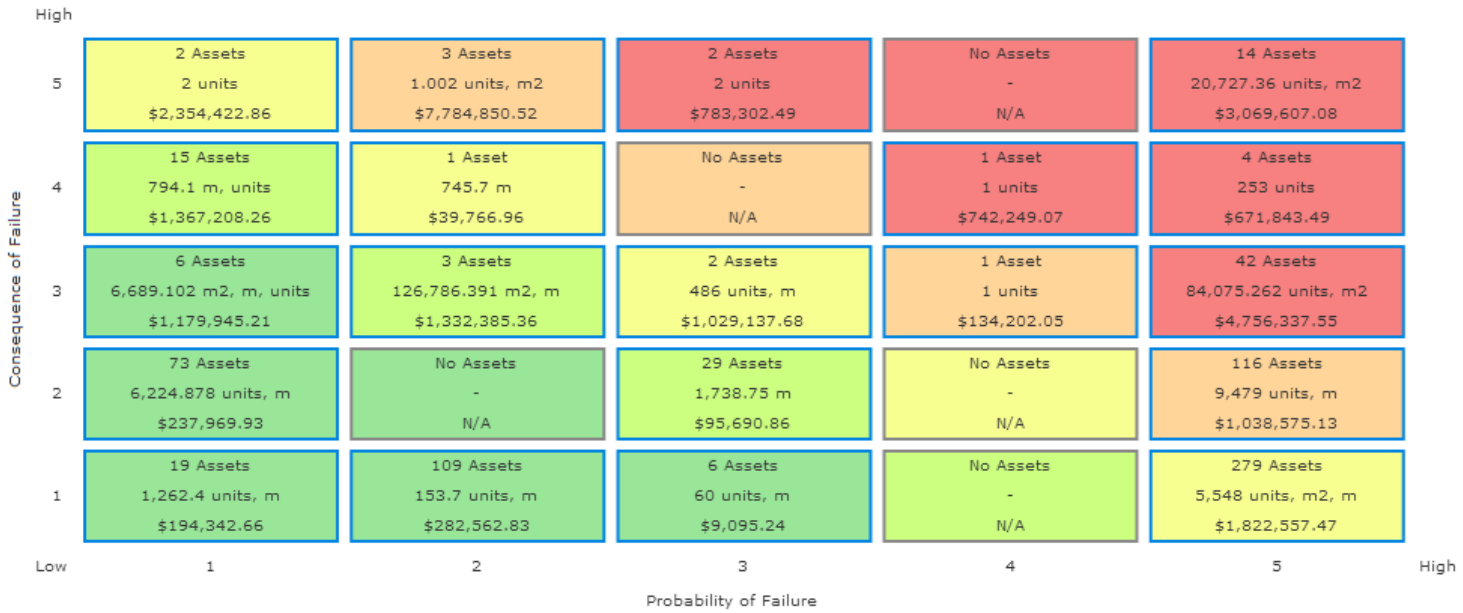
The above techniques and processes when established for the road, water, sewer networks and bridges will supply a significant listing of potential projects. Typically the infrastructure needs will exceed available resources and therefore project prioritization parameters must be developed to ensure the right projects come forward into the short and long range budgets. An important method of project prioritization is to rank each project, or each piece of infrastructure, on the basis of how much risk it represents to the organization.

6.6.1 Risk Matrix and Scoring Methodology

Risk within the infrastructure industry is often defined as the probability (likelihood) of failure multiplied by the consequence of that failure.

RISK = LIKELIHOOD OF FAILURE **x** CONSEQUENCE OF FAILURE

The likelihood of failure relates to the current condition state of each asset, whether they are in excellent, good, fair, poor or critical condition, as this is a good indicator regarding their future risk of failure. The consequence of failure relates to the magnitude, or overall effect, that an asset's failure will cause. For instance, a small diameter water main break in a sub division may cause a few customers to have no water service for a few hours, whereby a large trunk water main break outside a hospital could have disastrous effects and would be a front page news item. The following table represents the scoring matrix for risk:



All of the township's assets analyzed within this asset management plan have been given both a likelihood of failure score and a consequence of failure score within the CityWide software.

The following risk scores have been developed at a high level for each asset class within the CityWide software system. It is recommended that the township undertake a detailed study to develop a more tailored suite of risk scores, particularly in regards to the consequence of failure, and that this be updated within the CityWide software with future updates to this Asset Management Plan.

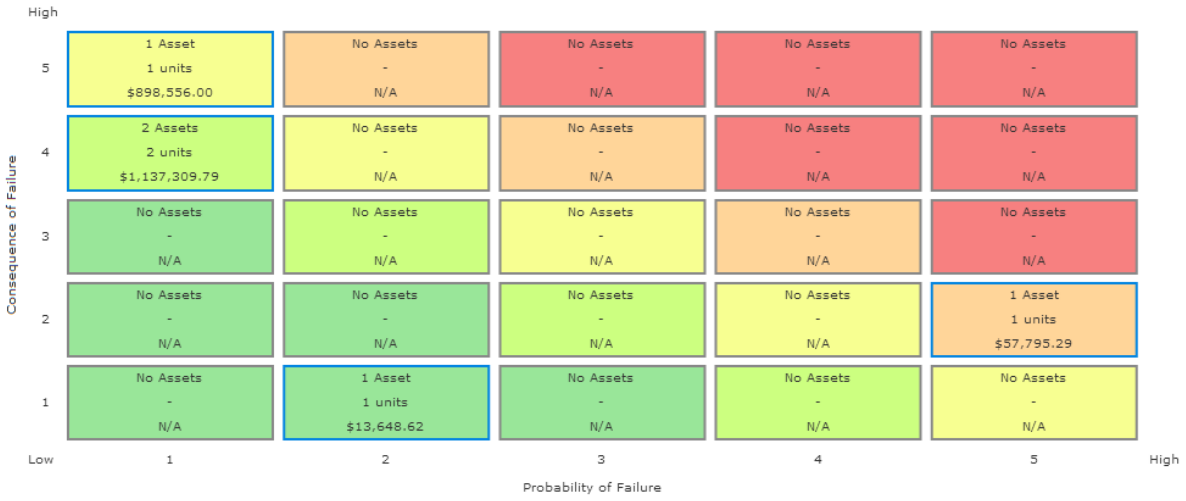
The current scores that will determine budget prioritization currently within the system are as follows:

All assets:
The Likelihood of Failure score is based on the condition of the assets:

Likelihood of Failure: **All Assets**	
Asset condition	Likelihood of failure
Excellent condition	Score of 1
Good condition	Score of 2
Fair condition	Score of 3
Poor condition	Score of 4
Critical condition	Score of 5

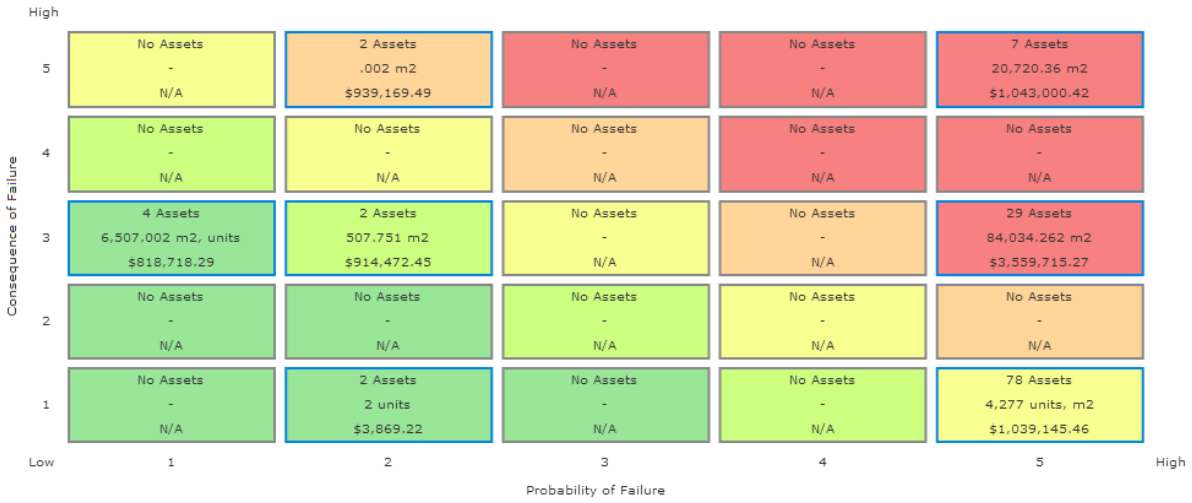
Bridges (based on valuation):
The consequence of failure score for this initial AMP is based upon the replacement value of the structure. The higher the value, probably the larger the structure and therefore probably the higher the consequential risk of failure:

Consequence of Failure: **Bridges**	
Replacement Value	Consequence of failure
Up to $50k	Score of 1
$51 to $100k	Score of 2
$101 to $400k	Score of 3
$401 to $750k	Score of 4
$751k and over	Score of 5



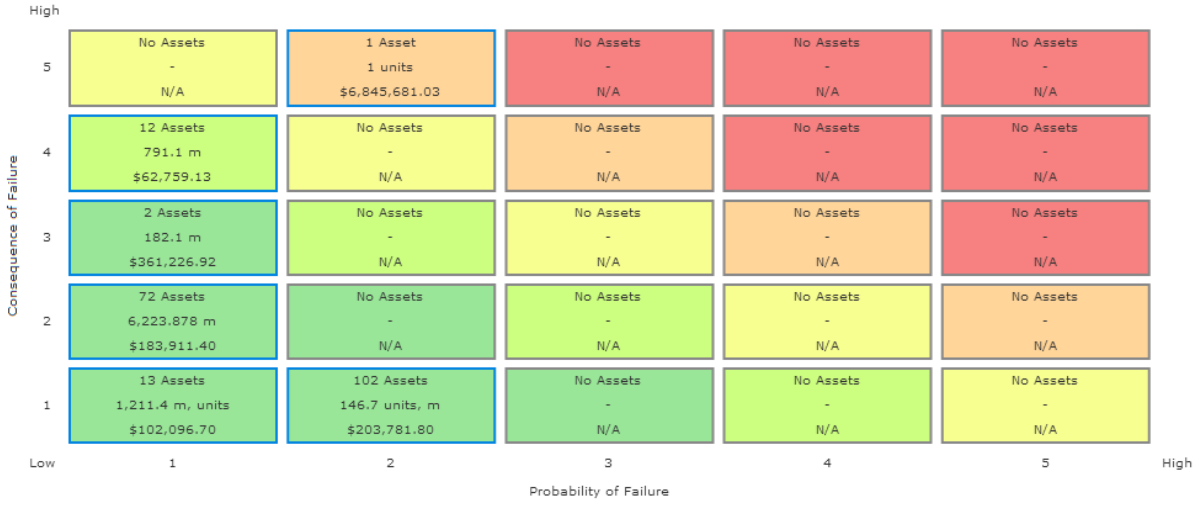
Roads (based on classification):
The consequence of failure score for this initial AMP is based upon the road classification as this will reflect traffic volumes and number of people affected.

Consequence of Failure: **Roads**	
Road Classification	Consequence of failure
Gravel	Score of 1
LCB	Score of 3
HCB	Score of 5



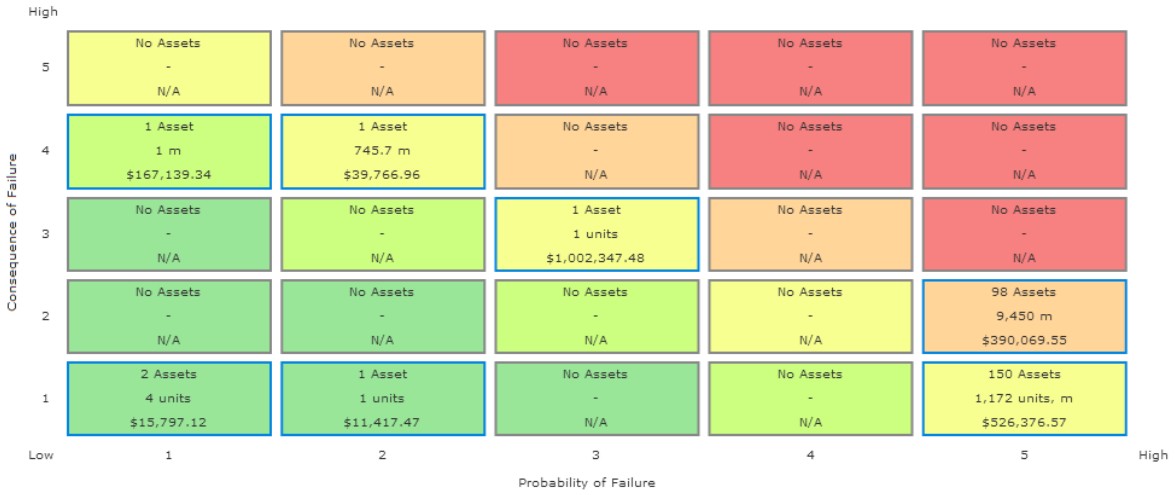
Sanitary Sewer (based on diameter):
The consequence of failure score for this initial AMP is based upon pipe diameter as this will reflect potential upstream service area affected. In time the Township should track pipe diameter against the inventory of pipes within the CityWide software.

Consequence of Failure: **Sanitary Sewer**	
Pipe Diameter	Consequence of failure
Less than 150mm	Score of 1
151-250mm	Score of 2
251-350mm	Score of 3
351-550mm	Score of 4
551mm and over	Score of 5



Water (based on diameter):
The consequence of failure score for this initial AMP is based upon pipe diameter as this will reflect potential service area affected. In time the Township should track pipe diameter against the inventory of pipes within the CityWide software.

Consequence of Failure: **Water**	
Pipe Diameter	Consequence of Failure
Less than 100mm	Score of 1
101 – 150mm	Score of 2
151 – 200mm	Score of 3
201 – 300mm	Score of 4
301 and over	Score of 5

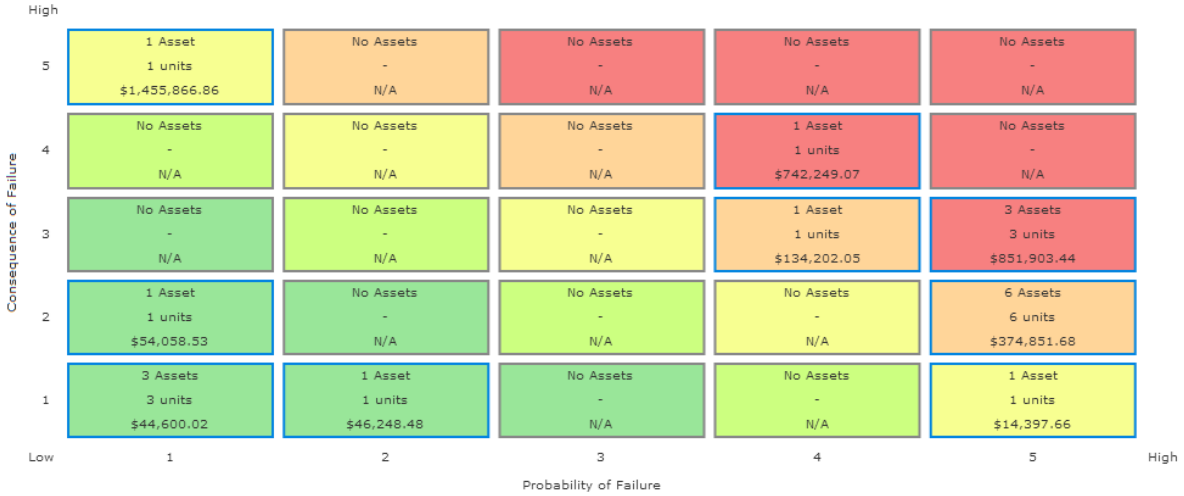


Storm Sewer (based on diameter):
The consequence of failure score for this initial AMP is based upon pipe diameter as this will reflect potential upstream service area affected. In time the Township should track pipe diameter against the inventory of pipes within the CityWide software.

Consequence of Failure: **Storm Sewer**	
Replacement Value	Consequence of failure
Less than 200mm	Score of 1
201 – 500mm	Score of 2
501 – 800mm	Score of 3
801 – 1,000mm	Score of 4
1,001mm and over	Score of 5

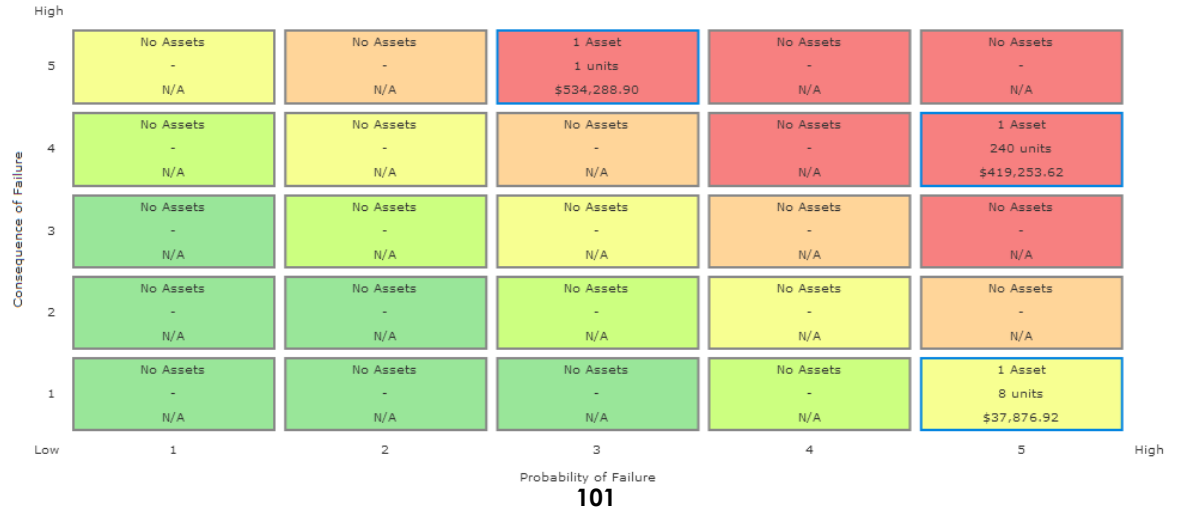
Buildings: (based on valuation):
The consequence of failure score for this initial AMP is based upon the replacement value of the facility component. The higher the value, probably the larger and more important the component to the overall function of the facility and therefore probably the higher the consequential risk of failure:

Consequence of Failure: **Facilities**	
Replacement Value	Consequence of failure
Up to $50k	Score of 1
$51k to $100k	Score of 2
$101k to $450k	Score of 3
$451k to $1 million	Score of 4
Over $1 million	Score of 5



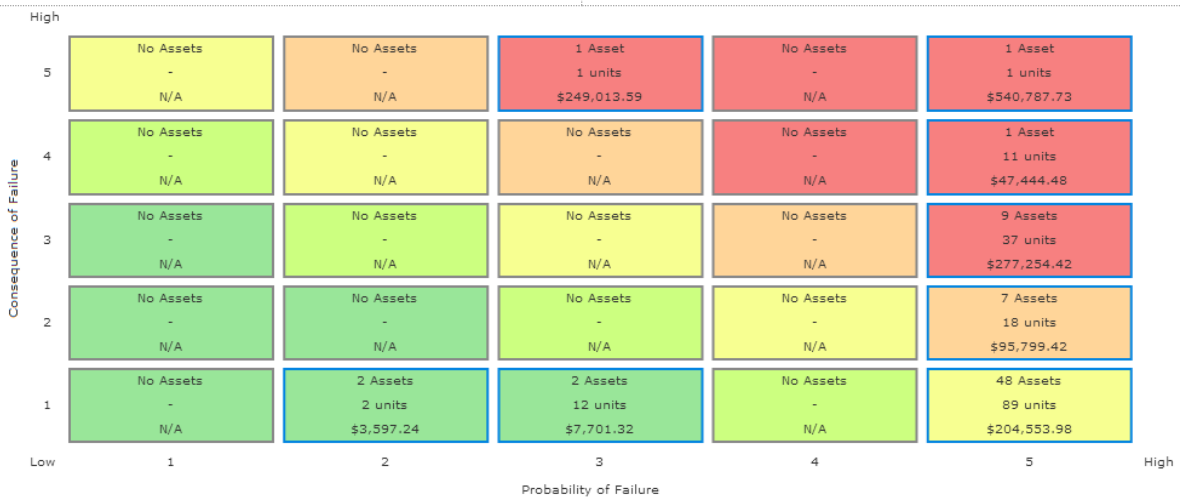
Land Improvements: (based on valuation):
The consequence of failure score for this initial AMP is based upon the replacement value of the asset or component. The higher the value, probably the larger and more important the component and therefore probably the higher the consequential risk of failure:

Consequence of Failure: **Land Improvements**	
Replacement Value	Consequence of failure
Up to $50k	Score of 1
$51k to $100k	Score of 2
$101k to $200k	Score of 3
$201k to $500k	Score of 4
Over $500k	Score of 5



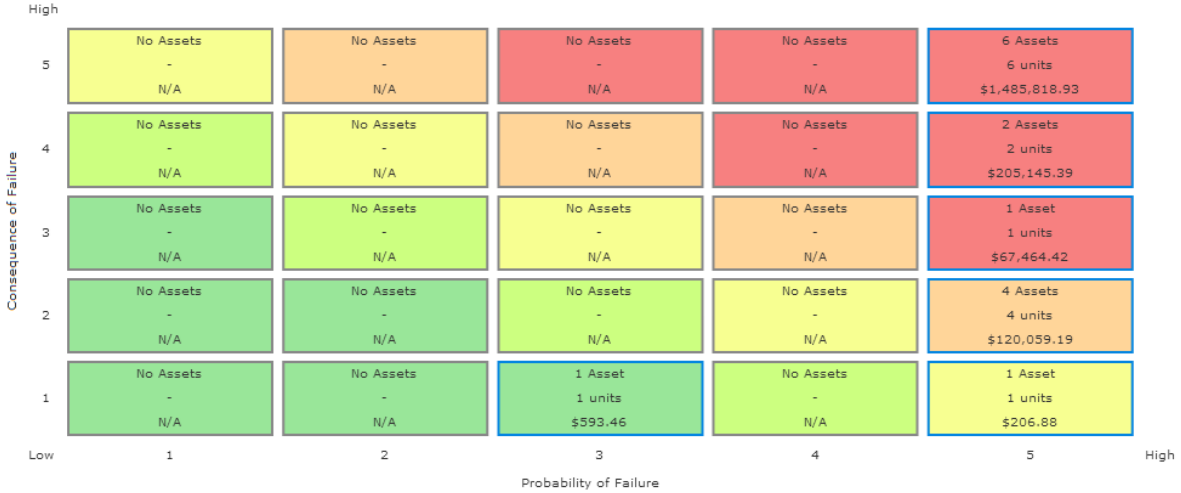
Machinery & Equipment: (based on valuation):
The consequence of failure score for this initial AMP is based upon the replacement value of the asset or component. The higher the value, probably the larger and more important the component and therefore probably the higher the consequential risk of failure:

Consequence of Failure: **Equipment**	
Replacement Value	Consequence of failure
Up to $10k	Score of 1
$11k to $20k	Score of 2
$21k to $40k	Score of 3
$41k to $80k	Score of 4
Over $80k	Score of 5



Vehicles: (based on valuation):
The consequence of failure score for this initial AMP is based upon the replacement value of the asset or component. The higher the value, probably the larger and more important the component and therefore probably the higher the consequential risk of failure:

Consequence of Failure: **Rolling Stock**	
Replacement Value	Consequence of failure
Up to $20k	Score of 1
$21k to $40k	Score of 2
$41k to $80k	Score of 3
$81k to $150k	Score of 4
Over $150k	Score of 5

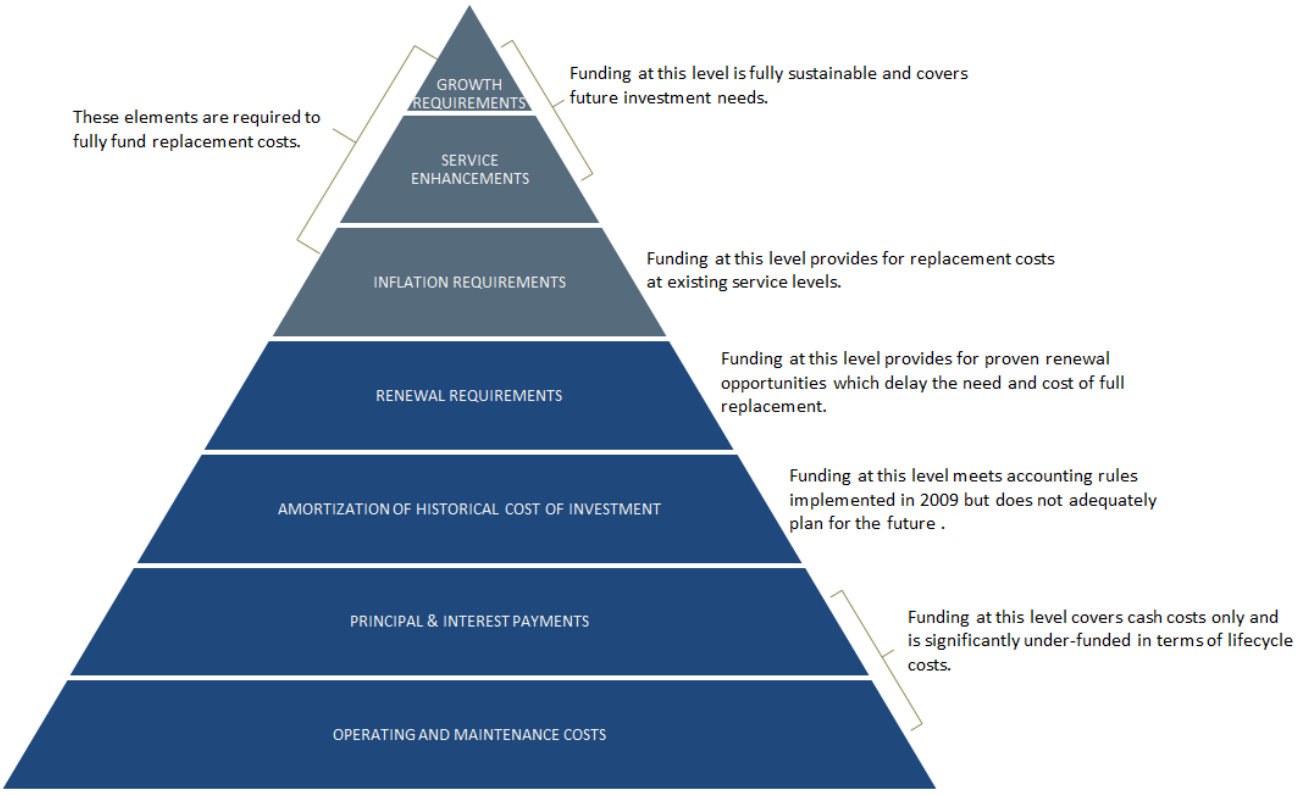


7.0 Financial Strategy

7.1 General overview of financial plan requirements

In order for an AMP to be effectively put into action, it must be integrated with financial planning and long-term budgeting. The development of a comprehensive financial plan will allow the Township of Armstrong to identify the financial resources required for sustainable asset management based on existing asset inventories, desired levels of service, and projected growth requirements.

The following pyramid depicts the various cost elements and resulting funding levels that should be incorporated into AMPs that are based on best practices.



This report develops such a financial plan by presenting several scenarios for consideration and culminating with final recommendations. As outlined below, the scenarios presented model different combinations of the following components:

a) the financial requirements (as documented in the SOTI section of this report) for:
- existing assets
- existing service levels
- requirements of contemplated changes in service levels (none identified for this plan)
- requirements of anticipated growth (none identified for this plan)

b) use of traditional sources of municipal funds:
- tax levies
- user fees
- reserves
- debt
- development charges

c) use of non-traditional sources of municipal funds:
- reallocated budgets
- partnerships
- procurement methods

d) use of senior government funds:
- gas tax
- grants (not included in this plan due to Provincial requirements for firm commitments)

If the financial plan component of an AMP results in a funding shortfall, the Province requires the inclusion of a specific plan as to how the impact of the shortfall will be managed. In determining the legitimacy of a funding shortfall, the Province may evaluate a township's approach to the following:

e) in order to reduce financial requirements, consideration has been given to revising service levels downward

f) all asset management and financial strategies have been considered. For example:
- if a zero debt policy is in place, is it warranted? If not, the use of debt should be considered.
- do user fees reflect the cost of the applicable service? If not, increased user fees should be considered.

This AMP includes recommendations that avoid long-term funding deficits.

7.2 Financial information relating to the Township of Armstrong's AMP

7.2.1 Funding objective

We have developed scenarios that would enable the Township of Armstrong to achieve full funding within 5 to 15 years for the following assets:

a) **Tax funded assets**: Road Network; Bridges & Culverts; Storm Sewer Network; Buildings; Equipment; Land Improvements; Vehicles

b) **Rate funded assets:** Sanitary Sewer Network; Water Network

Note: For the purposes of this AMP, we have excluded the category of gravel roads since gravel roads are a perpetual maintenance asset and end of life replacement calculations do not normally apply. If gravel roads are maintained properly, they, in essence, could last forever.

For each scenario developed we have included strategies, where applicable, regarding the use of tax revenues, user fees, reserves and debt.

7.3 Tax funded assets

7.3.1 Current funding position

Tables 1 and 2 outline, by asset category, the Township of Armstrong's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by taxes.

Table 1. Summary of Infrastructure Requirements & Current Funding Available						
Asset Category	Average Annual Investment Required	2014 Annual Funding Available				Annual Deficit/Surplus
		Taxes	Gas Tax	Other	Total Funding Available	
Road Network	411,000	0	70,000	0	70,000	341,000
Bridges & Culverts	47,000	0	0	0	0	47,000
Storm Sewer Network	23,000	0	0	0	0	23,000
Buildings	96,000	0	0	0	0	96,000
Land Improvements	36,000	0	0	0	0	36,000
Equipment	158,000	0	0	0	0	158,000
Vehicles	182,000	0	0	0	0	182,000
Total	**953,000**	**0**	**70,000**	**0**	**70,000**	**883,000**

7.3.2 Recommendations for full funding

The average annual investment requirement for the above categories is $953,000. Annual revenue currently allocated to these assets for capital purposes is $70,000 leaving an annual deficit of $883,000. To put it another way, these infrastructure categories are currently funded at 7.3% of their long-term requirements.

In 2014, the Township of Armstrong has annual tax revenues of $1,063,000. As illustrated in table 2, without consideration of any other sources of revenue, full funding would require the following tax change over time:

Table 2. Tax Change Required for Full Funding	
Asset Category	Tax Change Required for Full Funding
Road Network	32.1%
Bridges & Culverts	4.4%
Storm Sewer Network	2.2%
Buildings	9.0 %
Land Improvements	3.4%
Equipment	14.9%
Vehicles	17.1%
Total	**83.1%**

As illustrated in table 9, the Township of Armstrong's debt payments for these asset categories will be decreasing by $46,000 from 2014 to 2018 (5 years) and by $46,000 from 2014 to 2023 (10 years). Our recommendations include capturing those decreases in cost and allocating them to the infrastructure deficit outlined above.

Table 3 outlines this concept and presents a number of options:

Table 3. Effect of Reallocating Decreases in Debt Costs						
	Without Reallocation of Decreasing Debt Costs			With Reallocation of Decreasing Debt Costs		
	5 Years	10 Years	15 Years	5 Years	10 Years	15 Years
Infrastructure Deficit as Outlined in Table 1	883,000	883,000	883,000	883,000	883,000	883,000
Change in Debt Costs	N/A	N/A	N/A	-46,000	-46,000	-46,000
Resulting Infrastructure Deficit	**883,000**	**883,000**	**883,000**	**837,000**	**837,000**	**837,000**
Resulting Tax Increase Required:						
Total Over Time	**83.1%**	**83.1%**	**83.1%**	**78.7%**	**78.7%**	**78.7%**
Annually	16.6%	8.3%	5.5%	15.7%	7.9%	5.2%

Considering all of the above information, we recommend the 15 year option in table 3 that includes the reallocations. This involves full funding being achieved over 15 years by:

a) when realized, reallocating the debt cost reductions of $46,000 to the infrastructure deficit as outlined above.
b) increasing tax revenues by 5.2% each year for the next 15 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
c) allocating the $70,000 of gas tax revenue to the paved roads category.
d) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this funding cannot be incorporated into the AMP unless there are firm commitments in place.
2. We realize that raising tax revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.

Although this option achieves full funding on an annual basis in 15 years and provides financial sustainability over the period modeled (to 2050), the recommendations do require prioritizing capital projects to fit the resulting annual funding available. As of 2014, age based data shows a pent up investment demand of $5,640,000 for paved roads, $58,000 for bridges & culverts, $0 for storm sewers, $1,068,000 for buildings, $457,000 for land improvements, $1,078,000 for equipment, and $1,879,000 for vehicles. Prioritizing future projects will require the age based data to be replaced by condition based data. Although our recommendations include no further use of debt, the results of the condition based analysis may require otherwise.

7.4 Rate funded assets

7.4.1 Current funding position

Tables 4 and 5 outline, by asset category, the Township of Armstrong's average annual asset investment requirements, current funding positions and funding increases required to achieve full funding on assets funded by rates.

Table 4. Summary of Infrastructure Requirements & Current Funding Available

Asset Category	Average Annual Investment Required	2014 Annual Funding Available				Annual Deficit/Surplus
		Rates	Less: Allocated to Operations	Other	Total Funding Available	
Sanitary Sewer Network	188,000	140,000	-140,000	0	0	188,000
Water Network	92,000	272,000	-272,000	0	0	92,000
Total	**280,000**	**412,000**	**-412,000**	**0**	**0**	**280,000**

7.4.2 Recommendations for full funding

The average annual investment requirement for sanitary services and water services is $260,000. Annual revenue currently allocated to these assets for capital purposes is $0 leaving an annual deficit of $260,000. To put it another way, these infrastructure categories are currently funded at 0% of their long-term requirements.

In 2014, the Township of Armstrong has annual sanitary revenues of $140,000 and annual water revenues of $272,000. As illustrated in table 5, without consideration of any other sources of revenue, full funding would require the following increases over time:

Table 5. Rate Increases Required for Full Funding

Asset Category	Rate Increase Required for Full Funding
Sanitary Sewer Network	134.3%
Water Network	33.8%

As illustrated in table 9, the Township of Armstrong's debt payments for sanitary services will be decreasing by $13,000 from 2014 to 2018 (5 years) and by $136,000 from 2014 to 2023 (10 years). For water services, the amounts are $0 and $0 respectively. Our recommendations include capturing those decreases in cost and allocating them to the applicable infrastructure deficit.

Tables 6a and 6b outline the above concept and present a number of options:

Table 6a. Without Change in Debt Costs				
	Sanitary Sewer Network		Water Network	
	5 Years	10 Years	5 Years	10 Years
Infrastructure Deficit as Outlined in Table 4	188,000	188,000	92,000	92,000
Change in Debt Costs	N/a	n/a	N/A	n/a
Resulting Infrastructure Deficit	**188,000**	**188,000**	**72,000**	**72,000**
Resulting Rate Increase Required:				
Total Over Time	**134.3%**	**134.3%**	**33.8%**	**33.8%**
Annually	26.7%	13.4%	6.8%	3.4%

Table 6b. With Change in Debt Costs				
	Sanitary Sewer Network		Water Network	
	5 Years	10 Years	5 Years	10 Years
Infrastructure Deficit as Outlined in Table 4	188,000	188,000	72,000	72,000
Change in Debt Costs	-13,000	-136,000	0	0
Resulting Infrastructure Deficit	**175,000**	**52,000**	**72,000**	**72,000**
Resulting Rate Increase Required:				
Total Over Time	**125.0%**	**37.1%**	**33.8%**	**33.8%**
Annually	25.0%	3.7%	6.8%	3.4%

Considering all of the above information, we recommend the 10 year option in table 6 that includes the reallocations. This involves full funding being achieved over 10 years by:

d) when realized, reallocating the debt cost reductions of $136,000 for sanitary services to the applicable infrastructure deficit.
e) increasing rate revenues by 3.7% for sanitary services and 3.4% for water services each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
f) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this funding cannot be incorporated into an AMP unless there are firm commitments in place.
2. We realize that raising rate revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.
3. Any increase in rates required for operations would be in addition to the above recommendations.

Although this option achieves full funding on an annual basis in 10 years and provides financial sustainability over the period modeled (to 2050), the recommendations do require prioritizing capital projects to fit the resulting annual funding available. As of 2014, age based data shows a pent up investment demand of $0 for sanitary services and $752,000 for water services. Prioritizing future projects will require the age based data to be replaced by condition based data. Although our recommendations include no further use of debt, the results of the condition based analysis may require otherwise.

7.5 Use of debt

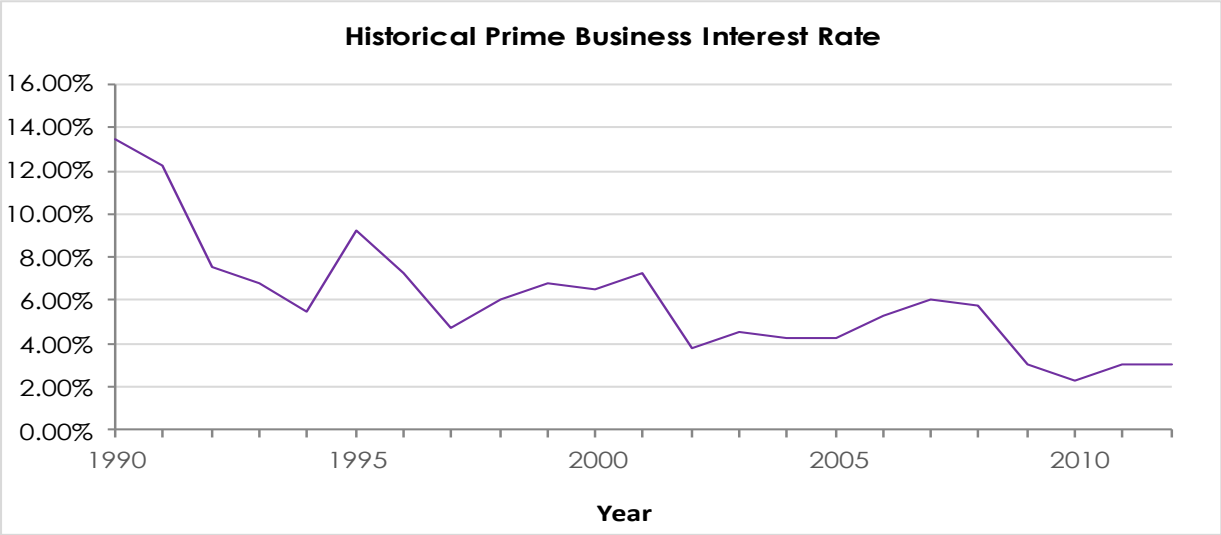
For reference purposes, table 7 outlines the premium paid on a project if financed by debt. For example, a $1M project financed at 3.0%[1] over 15 years would result in a 26% premium or $260,000 of increased costs due to interest payments. For simplicity, the table does not take into account the time value of money or the effect of inflation on delayed projects.

Table 7. Total Interest Paid as a % of Project Costs

Interest Rate	Number of Years Financed					
	5	10	15	20	25	30
7.0%	22%	42%	65%	89%	115%	142%
6.5%	20%	39%	60%	82%	105%	130%
6.0%	19%	36%	54%	74%	96%	118%
5.5%	17%	33%	49%	67%	86%	106%
5.0%	15%	30%	45%	60%	77%	95%
4.5%	14%	26%	40%	54%	69%	84%
4.0%	12%	23%	35%	47%	60%	73%
3.5%	11%	20%	30%	41%	52%	63%
3.0%	9%	17%	26%	34%	44%	53%
2.5%	8%	14%	21%	28%	36%	43%
2.0%	6%	11%	17%	22%	28%	34%
1.5%	5%	8%	12%	16%	21%	25%
1.0%	3%	6%	8%	11%	14%	16%
0.5%	2%	3%	4%	5%	7%	8%
0.0%	0%	0%	0%	0%	0%	0%

It should be noted that current interest rates are near all-time lows. Sustainable funding models that include debt need to incorporate the risk of rising interest rates. The following graph shows where historical lending rates have been:

[1] Current municipal Infrastructure Ontario rates for 15 year money is 3.2%.



As illustrated in table 7, a change in 15 year rates from 3% to 6% would change the premium from 26% to 54%. Such a change would have a significant impact on a financial plan.

Tables 8 and 9 outline how the Township of Armstrong has historically used debt for investing in the asset categories as listed. There is currently $838,000 of debt outstanding for the assets covered by this AMP. In terms of overall debt capacity, the Township of Armstrong currently has $838,000 of total outstanding debt and $182,000 of total annual principal and interest payment commitments. These principal and interest payments are well within its provincially prescribed annual maximum of $334,249.

Table 8. Overview of Use of Debt

Asset Category	Current Debt Outstanding	Use Of Debt in the Last Five Years				
		2010	2011	2012	2013	2014
Road Network	0	0	0	0	0	0
Bridges & Culverts	0	0	0	0	0	0
Storm Sewer Network	0	0	0	0	0	0
Buildings	0	0	0	0	0	0
Equipment	86,000	0	0	0	210,000	0
Land Improvements	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0
Total Tax Funded	86,000	0	0	0	210,000	0
Sanitary Sewer Network	752,000	0	0	1,162,000	0	0
Water Network	0	0	0	0	0	0
Total rate Funded	752,000	0	0	1,162,000	0	0
Total AMP Debt	838,000	0	0	1,162,000	210,000	0
Non AMP Debt	0	0	0	0	0	0
Overall Total	**838,000**	**0**	**0**	**1,162,000**	**210,000**	**0**

Table 9. Overview of Debt Costs

Asset Category	Principal & Interest Payments in the Next Five and Ten Years					
	2014	2015	2016	2017	2018	2023
Road Network	0	0	0	0	0	0
Bridges & Culverts	0	0	0	0	0	0
Storm Sewer Network	0	0	0	0	0	0
Buildings	0	0	0	0	0	0
Equipment	46,000	44,000	45,000	0	0	0
Land Improvements	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0
Total Tax Funded	46,000	44,000	45,000	0	0	0
Sanitary Sewer Network	136,000	132,000	130,000	126,000	123,000	0
Water Network	0	0	0	0	0	0
Total Rate Funded	136,000	132,000	130,000	126,000	123,000	0
Total Amp Debt	182,000	176,000	175,000	126,000	123,000	0
Non Amp Debt	0	0	0	0	0	0
Overall Total	**182,000**	**176,000**	**175,000**	**126,000**	**123,000**	**0**

The revenue options outlined in this plan allow the Township of Armstrong to fully fund its long-term infrastructure requirements without further use of debt. However, as explained in sections 7.3.2 and 7.4.2, the recommended condition rating analysis may require otherwise.

7.6 Use of reserves

7.6.1 Available reserves

Reserves play a critical role in long-term financial planning. The benefits of having reserves available for infrastructure planning include:

- the ability to stabilize tax rates when dealing with variable and sometimes uncontrollable factors
- financing one-time or short-term investments
- accumulating the funding for significant future infrastructure investments
- managing the use of debt
- normalizing infrastructure funding requirements

By infrastructure category, table 10 outlines the details of the reserves currently available to the Township of Armstrong.

Table 10. Summary of Reserves Available

Asset Category	Balance at December 31, 2012
Road Network	0
Bridges & Culverts	0
Storm Sewer Network	0
Buildings	0
Equipment	0
Land Improvements	0
Vehicles	0
Total Tax Funded	**0**
Water Network	0
Sanitary Sewer Network	0
Total Rate Funded	**0**

There is considerable debate in the municipal sector as to the appropriate level of reserves that a township should have on hand. There is no clear guideline that has gained wide acceptance. Factors that municipalities should take into account when determining their capital reserve requirements include:

- breadth of services provided
- age and condition of infrastructure
- use and level of debt
- economic conditions and outlook
- internal reserve and debt policies.

Although there are no reserves available for use by applicable asset categories during the phase-in period to full funding, the Township of Armstrong's judicious use of debt in the past allows the scenarios to assume that, if required, available debt capacity can be used for high priority and emergency infrastructure investments in the short to medium-term.

7.6.2 Recommendation

As the Township of Armstrong updates its AMP and expands it to include other asset categories, we recommend that future planning should include determining what its long-term reserve balance requirements are and a plan to achieve such balances.

8.0 Appendix A: Report Card Calculations

Key Calculations

1. "Weighted, unadjusted star rating":

(% of assets in given condition) x (potential star rating)

2. "Adjusted star rating"

(weighted, unadjsted star rating) x (% of total replacement value)

3. "Overall Rating"

$$\frac{\textit{(Condition vs. Performance star rating)} + \textit{(Funding vs. Need star rating)}}{2}$$

Grade Cuttoffs

1. Conditions vs Performance

Letter Grade	Star Rating
F	0
D	2
D+	2.5
C	2.9
C+	3.5
B	3.9
B+	4.5
A	4.9
A	5

2. Funding vs Need

Funding %	Star rating	Grade
0.0%	0	F
25.0%	1	F
46.0%	1.9	D
61.0%	2.9	C
76.0%	3.9	B
91.0%	4.9	A
100.0%	5	A

Road Network: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$6,897,092	Segment replacement value	$6,897,092	Segment value as a % of total category replacement value	100.0%

Segment	Condition	Letter grade	Star rating	Quantities (m2) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Road base, surface, and sidewalks (excludes gravel and appurtenances)	Excellent	A	5	6,500	6%	0.28	1.2
	Good	B	4	508	0%	0.02	
	Fair	C	3		0%	0.00	
	Poor	D	2		0%	0.00	
	Critical	F	1	108,955	94%	0.94	
			Totals	**115,962**	**100%**	**1.24**	

Category star rating	Category letter grade
1.2	F

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$411,000	$70,000	17.0%	$341,000			0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
1.2	0.0	0.6	F

Bridges & Culverts: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$2,107,309	Segment replacement value	$2,035,865	Segment value as a % of total category replacement value	96.6%

Segment	Condition	Letter grade	Star rating	Units in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Bridges	Excellent	A	5	3	100%	5.00	4.8
	Good	B	4		0%	0.00	
	Fair	C	3		0%	0.00	
	Poor	D	2		0%	0.00	
	Critical	F	1		0%	0.00	
			Totals	**3**	**100%**	**5.00**	

Total category replacement value	$2,107,309	Segment replacement value	$71,444	Segment value as a % of total category replacement value	3.4%

Segment	Condition	Letter grade	Star rating	Units in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Culverts	Excellent	A	5		0%	0.00	0.1
	Good	B	4	1	50%	2.00	
	Fair	C	3		0%	0.00	
	Poor	D	2		0%	0.00	
	Critical	F	1	1	50%	0.50	
			Totals	**2**	**100%**	**2.50**	

Category star rating	Category letter grade
4.9	A

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$47,000	$0	0.0%	$47,000			0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
4.9	0.0	2.5	D+

Water Network: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$2,152,914	Segment replacement value	$610,606	Segment value as a % of total category replacement value	28.4%

Segment	Condition	Letter grade	Star rating	Quantity (m) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Mains	Excellent	A	5		0%	0.00	0.3
	Good	B	4	746	7%	0.27	
	Fair	C	3		0%	0.00	
	Poor	D	2		0%	0.00	
	Critical	F	1	10,486	93%	0.93	
			Totals	**11,232**	**100%**	**1.20**	

Total category replacement value	$2,152,914	Segment replacement value	$1,002,347	Segment value as a % of total category replacement value	46.6%

Segment	Condition	Letter grade	Star rating	Quantity ($) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Facilities	Excellent	A	5		0%	0.00	1.4
	Good	B	4		0%	0.00	
	Fair	C	3	$1,002,347	100%	3.00	
	Poor	D	2		0%	0.00	
	Critical	F	1		0%	0.00	
			Totals	**$1,002,347**	**100%**	**3.00**	

Total category replacement value	$2,152,914	Segment replacement value	$539,961	Segment value as a % of total category replacement value	25.1%

Segment	Condition	Letter grade	Star rating	Units in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Appurtenances	Excellent	A	5	4	3%	0.1	0.3
	Good	B	4	1	1%	0.0	
	Fair	C	3	0	0%	0.0	
	Poor	D	2	0	0%	0.0	
	Critical	F	1	136	96%	1.0	
			Totals	**141**	**100%**	**1.1**	

Category star rating	Category letter grade
2.0	**D**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$92,000	$0	0.0%	$92,000			**0.0**	**F**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.0	0.0	**1.0**	**F**

Sanitary Network: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$7,759,457	Segment replacement value	$696,711	Segment value as a % of total category replacement value	9.0%

Segment	Condition	Letter grade	Star rating	Quantity (m) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Mains	Excellent	A	5	8,403	99%	4.97	0.4
	Good	B	4	46	1%	0.02	
	Fair	C	3		0%	0.00	
	Poor	D	2		0%	0.00	
	Critical	F	1		0%	0.00	
			Totals	**8,449**	**100%**	**4.99**	

Total category replacement value	$7,759,457	Segment replacement value	$6,845,681	Segment value as a % of total category replacement value	88.2%

Segment	Condition	Letter grade	Star rating	Quantities ($) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Facilities	Excellent	A	5		0%	0.00	3.5
	Good	B	4	$6,845,681	100%	4.00	
	Fair	C	3		0%	0.00	
	Poor	D	2		0%	0.00	
	Critical	F	1		0%	0.00	
			Totals	**$6,845,681**	**100%**	**4.00**	

Total category replacement value	$7,759,457	Segment replacement value	$217,065	Segment value as a % of total category replacement value	2.8%

Segment	Condition	Letter grade	Star rating	Units in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Appurtenances	Excellent	A	5	5	5%	0.2	0.1
	Good	B	4	101	95%	3.8	
	Fair	C	3	0	0%	0.0	
	Poor	D	2	0	0%	0.0	
	Critical	F	1	0	0%	0.0	
			Totals	**106**	**100%**	**4.0**	

Category star rating	Category letter grade
4.1	B

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$188,000	$0	0.0%	$188,000			0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
4.1	0.0	2.0	D

Storm Network: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$573,044	Segment replacement value	$541,195	Segment value as a % of total category replacement value	94.4%

Segment	Condition	Letter grade	Star rating	Quantities (m) given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Mains	Excellent	A	5		0%	0.00	3.8
	Good	B	4	126,279	98%	3.93	
	Fair	C	3	2,271	2%	0.05	
	Poor	D	2		0%	0.00	
	Critical	F	1		0%	0.00	
			Totals	**128,549**	**100%**	**3.98**	

Category star rating	Category letter grade
3.8	C+

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$23,000	$0	0.0%	$23,000			0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
3.8	0.0	1.9	F

Buildings: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$3,718,378	Segment replacement value	$3,718,378	Segment value as a % of total category replacement value	100.0%

Segment 1 (of 1)	Condition	Letter grade	Star rating	Replacement Cost ($) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Buildings	Excellent	A	5	1,554,525	42%	2.1	2.9
	Good	B	4	46,248	1%	0.0	
	Fair	C	3		0%	0.0	
	Poor	D	2	876,451	24%	0.5	
	Critical	F	1	1,241,153	33%	0.3	
			Totals	**3,718,377**	**100%**	**2.9**	

Category star rating	Category letter grade
2.9	**C**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$96,000	$0	0.0%	$96,000			**0.0**	**F**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.9	0.0	**1.5**	**F**

Land Improvements: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$991,420	Segment replacement value	$991,420	Segment value as a % of total category replacement value	100.0%

Segment 1 (of 1)	Condition	Letter grade	Star rating	Replacement Cost ($) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Land Improvements	Excellent	A	5		0%	0.0	2.1
	Good	B	4		0%	0.0	
	Fair	C	3	534,289	54%	1.6	
	Poor	D	2		0%	0.0	
	Critical	F	1	457,131	46%	0.5	
			Totals	**991,420**	**100%**	**2.1**	

Category star rating	Category letter grade
2.1	D

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$36,000	$0	0.0%	$36,000			0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.1	0.0	1.0	F

Machinery & Equipment: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$1,426,154	Segment replacement value	$1,426,154	Segment value as a % of total category replacement value	100.0%

Segment 1 (of 1)	Condition	Letter grade	Star rating	Replacement Cost ($) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Machinery & Equipment	Excellent	A	5		0%	0.0	1.4
	Good	B	4	3,597	0%	0.0	
	Fair	C	3	256,715	18%	0.5	
	Poor	D	2		0%	0.0	
	Critical	F	1	1,165,840	82%	0.8	
			Totals	**1,426,152**	**100%**	**1.4**	

Category star rating	Category letter grade
1.4	**F**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit			Category star rating	Category letter grade
$158,000	$0	0.0%	$158,000			**0.0**	**F**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
1.4	0.0	**0.7**	**F**

Vehicles: Township of Armstrong

1. Condition vs. Performance

Total category replacement value	$1,879,289	Segment replacement value	$1,879,289	Segment value as a % of total category replacement value	100.0%

Segment 1 (of 1)	Condition	Letter grade	Star rating	Replacement Cost ($) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Vehicles	Excellent	A	5		0%	0.0	1.0
	Good	B	4		0%	0.0	
	Fair	C	3	593	0%	0.0	
	Poor	D	2		0%	0.0	
	Critical	F	1	1,878,695	100%	1.0	
			Totals	**1,879,288**	**100%**	**1.0**	

Category star rating	Category letter grade
1.0	F

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit		
$182,000	$0	0.0%	$182,000		

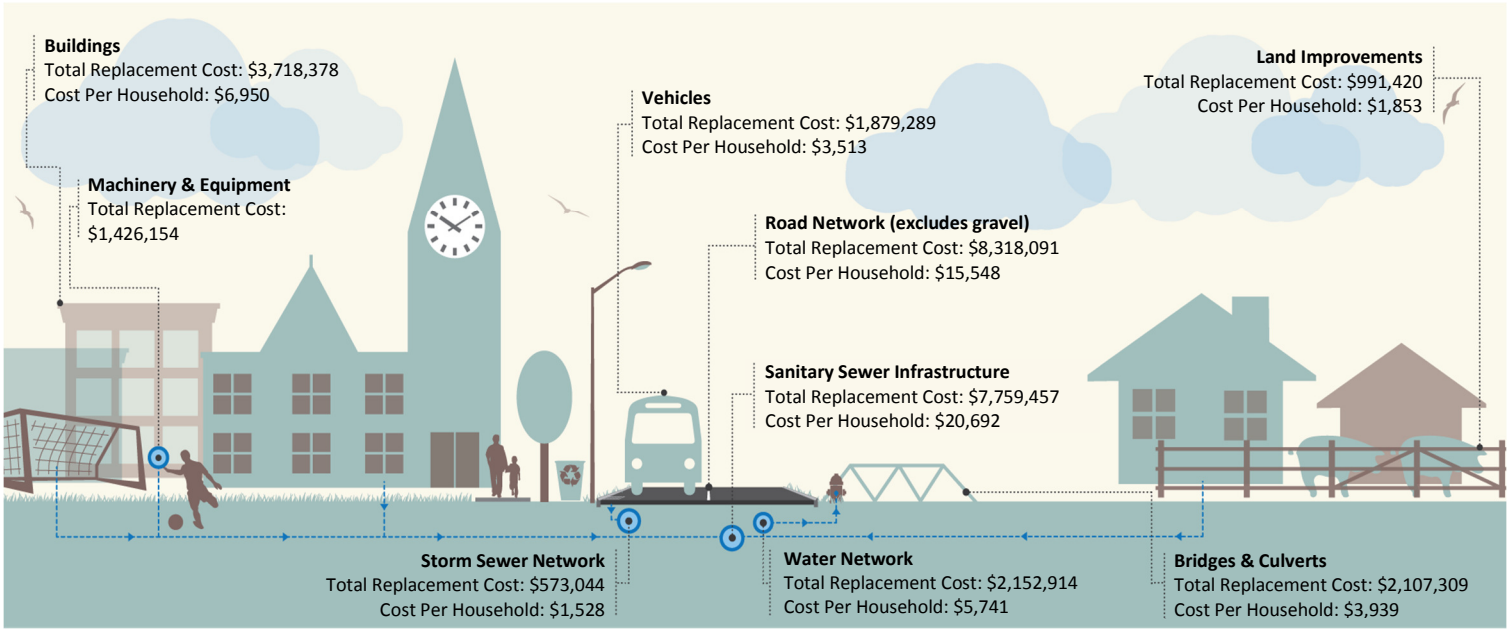
Category star rating	Category letter grade
0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
1.0	0.0	0.5	F

Infrastructure Replacement Cost Per Household

Total: $62,430 per household



Daily Investment Required Per Household for Infrastructure Sustainability