TOWNSHIP OF NORTH DUMFRIES

# Asset Management Plan – Core Assets

**Final Report**

June 2022 – 22-2403

# Table of Contents

## Figures



## Tables

## Appendices

# 1.0 Introduction

The Township of North Dumfries (Township) is updating its 2013 Asset Management Plan (AMP) in alignment with Ontario Regulation (O. Reg.) 588/17: Asset Management Planning for Municipal Infrastructure for its core asset categories (roads, bridges and culverts and stormwater) and as amended by O.Reg. 193/21. The AMP documents the Township's assets and strategies based on known information at the time of writing the report. It is a snapshot of a period in time, in this case, in 2022. Assets will continue to deteriorate and investment will be required to improve the condition extend the useful life of the infrastructure.

The AMP is intended to be a medium to long-term focused document for Township staff to use during decision-making processes, including budgeting, and to assist in strategic planning.

## 1.1 Asset Management Overview

Asset management is a process of making the best possible decisions regarding the creation, maintenance, renewal, rehabilitation, disposal, expansion and procurement of infrastructure assets. The objective of asset management is to maximize the benefits of the assets, minimize risk and provide satisfactory levels of service to the public in a sustainable manner. It considers risks related to the lifecycle of the assets and requires a multi-disciplinary team of planning, finance, engineering, technology, maintenance and operations.

Asset management considers the full lifecycle of the infrastructure, not just the initial cost for designing and constructing the asset, but the operations and maintenance each and every year.

Asset management is an integrated approach that municipalities can use to make informed decisions about their infrastructure. At its core, asset management is about delivering services to communities in a sustainable way. The essential questions for asset management, as described in the InfraGuide: Managing Infrastructure Assets (October 2005), are:

1. What do you have and where is it?
2. What is it worth?
3. What is its condition and expected remaining service life?
4. What is the level of service expectation, and what needs to be done?
5. When do you need to do it?
6. How much will it cost and what is the acceptable level of risk(s)?
7. How do you ensure long-term affordability?

These seven essential questions align to four phases of asset management: asset inventory, condition, levels of service (LOS) and analysis and strategy development. These questions align with O.Reg. 588/17 and ISO55000.

## 1.2 Scope of the AMP

The AMP is a tool for managing the full lifecycle of physical assets that support the delivery of the Township's services that meet the required levels of service. It provides a long-term perspective to support decision making regarding repairs, rehabilitation and replacement of the assets and managing risks.

The core assets owned by the Township and included in the AMP are:

- Roads (Chapter 2);
- Stormwater Management (Chapter 3); and
- Bridges and Culverts (Chapter 4).

### Regulatory Alignment

The 2022 AMP is an update to the 2013 AMP which requires alignment with the new regulation, O. Reg. 588/17 and as amended by O.Reg. 193/21. The regulation requires the following four phases of compliance:

1. By July 2019: Municipalities to have a strategic asset management policy.
2. By July 2022: All core assets to be covered in the asset management plan with current Level of Service (LOS). Core assets include water, wastewater, stormwater, roads and bridges/culverts.
3. By July 2024: All assets owned by the municipality to be covered in the AMP. Non-core assets include buildings, fleet and equipment as well as green infrastructure assets.
4. By July 2025: Municipalities will have approved proposed LOS and the lifecycle management and financial strategy for 10-year period to achieve the proposed LOS.

This AMP includes current LOS for core assets owned by the Township which meets phase 2 compliance. Future updates will need to include current LOS for non-core assets, proposed (target) levels of service for core and non-core assets and lifecycle management and financial strategy for 10-year period to achieve the proposed LOS. Future updates will also need to include green infrastructure assets (i.e., natural assets) owned by the Township and further assessment on infrastructure vulnerability to the impacts of climate change.

## 1.3 State of Local Infrastructure

Each section of the State of Local Infrastructure sets out the following information:

- A summary of the assets in the category;
- The replacement cost of the assets in the category;

- The average age of the assets in the category, determined by assessing the average age of the components of the assets;
- The information available on the condition of the assets in the category; and
- A description of the Township's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.

## 1.4 Levels of Service

The current and proposed Levels of Service (LOS) are described in terms of technical metrics and qualitative descriptions for each asset type. These measures are prescribed for core assets within O. Reg. 588/17.

LOS are presented in Figure 1 and defined as follows:

- Community LOS: LOS that the organization provides to the community, intended to be customer-focused, providing a qualitative description of scope and quality; and
- Technical LOS: LOS that the asset is capable of providing to the Township which is further measured by the performance of the asset, providing technical metrics that support the delivery of LOS.

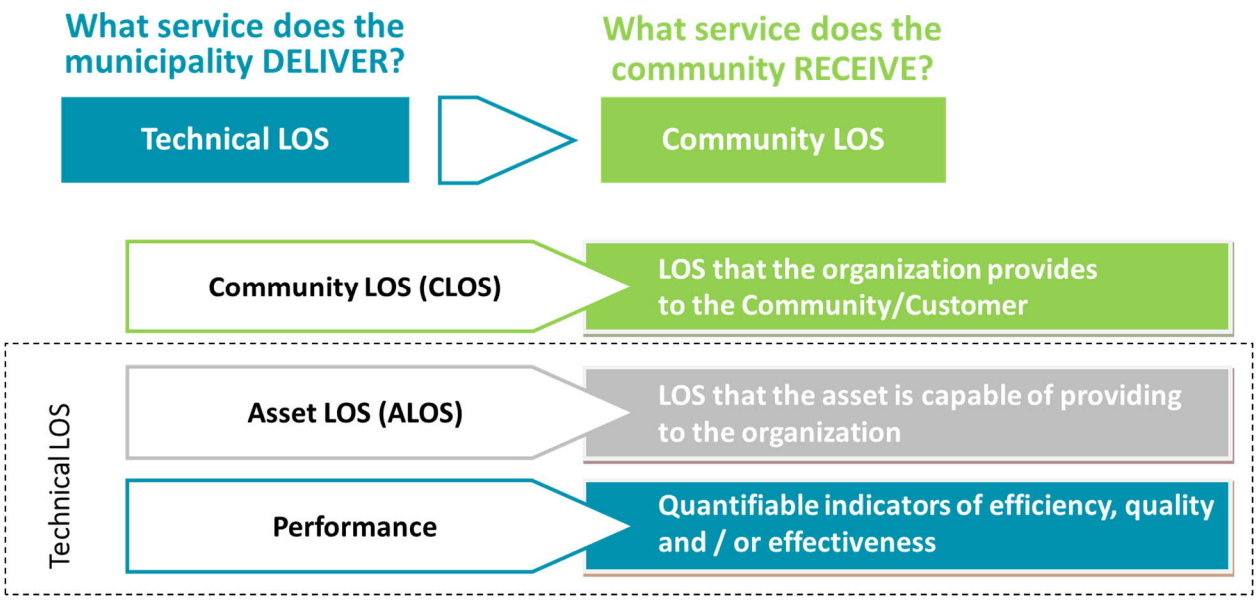



**Figure 1: Levels of Service (Community LOS, Technical LOS and Performance)**

## 1.5 Risk Assessment

In determining the lifecycle activities for each asset category and identifying the priority activities, the risks associated with the options are to be considered. The risk rating for each asset within the asset category generates a risk profile for the entire asset category.

The assets with the highest risk rating help identify the priorities for the municipality. As part of assessing risk, this methodology considers the factors that increase the likelihood of a hazard occurring (or non-delivery of service) and the consequence. Figure 2 presents a risk "heat map" plotting likelihood and consequence.

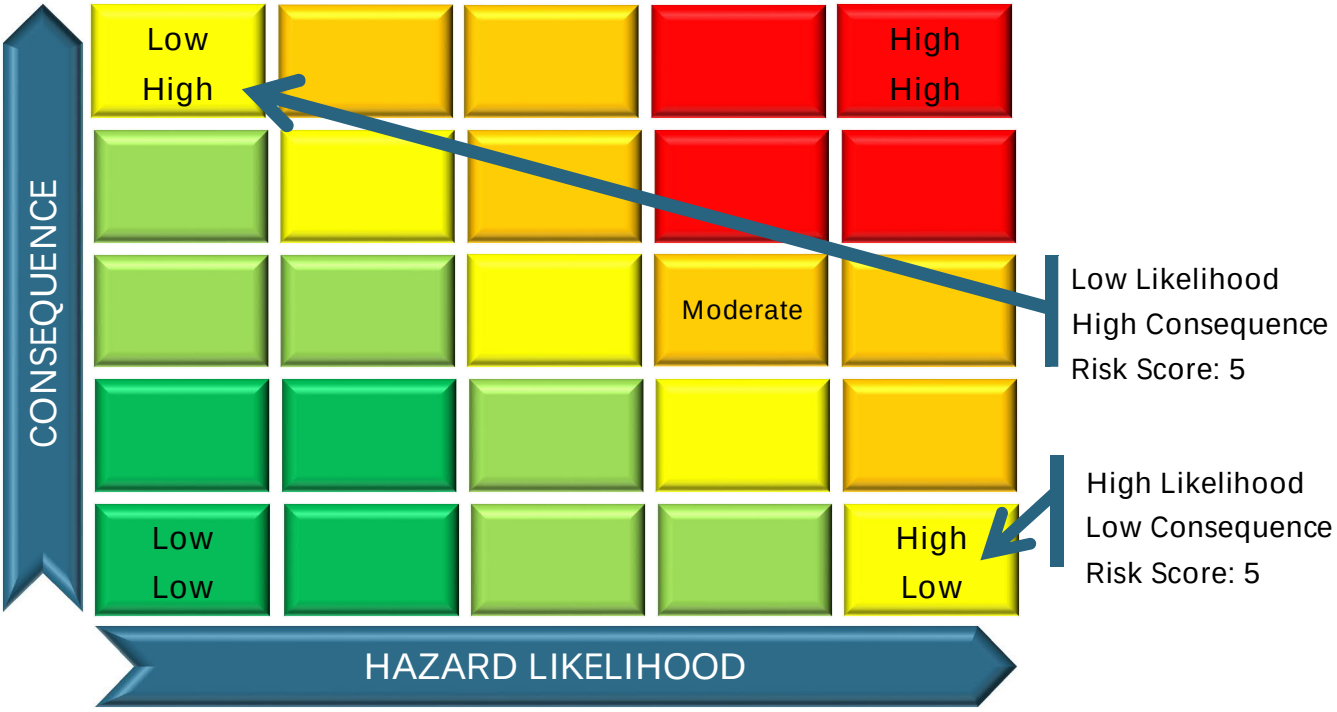



**Figure 2: Risk Heat Map**

A priority rating has been developed based on the calculated risk rating and displayed in Figure 2 in a 5 by 5 matrix. High risks are shown in the red zone (risk rating 17 to 25), Moderate risks are shown in the orange zone (risk ratings of 10 to 16) and Low risks are in the green and yellow zone (risk ratings of 1 to 9).

The approach and methodology to risk assessment is presented in following sections. A risk profile for each asset category is presented in the corresponding asset category chapters.

### 1.5.1 Risk Methodology Approach

Risk is the likelihood and magnitude of a negative scenario (hazard) occurring that limits the ability of the asset to deliver the service. Risk is the consideration of asset failure and the consequence of the failure.

**RISK = LIKELIHOOD OF OCCURRENCE x CONSEQUENCE**

The consequence considers the severity of the impact, vulnerability of the asset, and exposure to the negative scenario.

Applying the methodology of a score of 1 to 5 for the likelihood and the consequence, the maximum risk rating is 25 (high).

### 1.5.2 Calculation of Likelihood of Occurrence

The factors that contribute to the likelihood of failure include:

- A – Condition of the asset;
- B – Performance (reliability); and
- C – Vulnerability to climate change.

Table 1 provides a description of these factors.

**Table 1: Likelihood Factors**

| Factors | Low (1) | Moderate (3) | High (5) |
|---|---|---|---|
| A – Condition | Very Good (1) | Good (2); Fair (3) | Poor (4); Very Poor (5) |
| B – Performance | Always Reliable | Usually Reliable | Not Reliable |
| C – Climate Change | No or limited impact, quick recovery or mitigation in place | Limited impact with slower recovery; mitigation plan not in place | Moderate or high impact; no or limited mitigation plan |

By separating condition and performance as two separate factors, there is an opportunity to consider assets in Poor condition that may still be performing well, compared to those that are not performing, as well as Good condition assets that may not be reliable. The climate change factor brings into consideration assets that are vulnerable to climate change scenarios such as intense rainfall, increased temperatures, extreme weather and drought. The climate change rating includes any mitigation activities in the scoring which reduces the risk and lowers the score.

Therefore, the likelihood of failure is (A + B + C)/3 (i.e., the average of the factors, assuming they are equally weighted).

### 1.5.3 Calculation of Consequence

The question to consider when calculating consequence is: What increases the impact of non-delivery (or failure of the asset)?

The factors that contribute to the consequence rating include:

- D – Impact or severity
- E – Importance of the asset in delivering service.

Both impact and importance contribute to the consequence and will be multiplied by the likelihood of occurrence. The two ratings are added together for a maximum consequence score of 5. See **Table 2** for the description of consequence factors.

**Table 2: Consequence Factors**

| Factors | Low | Moderate | High |
|---|---|---|---|
| D – Impact | Low or no impact (0) | Moderate impact (1) | High impact (2) |
| E – Importance of the asset in delivering service | Low importance (1) | Moderate importance (2) | High importance (3) |

### 1.5.4 Calculation of Risk

The risk calculation for each of the assets is determined as follows.

RISK = LIKELIHOOD OF OCCURRENCE X CONSEQUENCE

RISK = (A + B + C)/3 x (D + E)

Where A = Condition

B = Performance

C = Climate Change

D = Impact

E = Importance of the asset

## 1.6 Lifecycle Activities

The lifecycle activities include activities that can be undertaken over an asset's useful life. These activities, under O. Reg. 588/17, are defined to include constructing, maintaining, renewing, operating and decommissioning of assets and all engineering and design work associated with these activities. Further, Building Together – Guide for Municipal Asset Management Plans (Ministry of Infrastructure) categorizes lifecycle activities into the following categories: non-infrastructure solutions, maintenance, renewal/rehabilitation, replacement, disposal, and expansion activities. Lifecycle activities have been identified for each of the asset categories considered within this AMP.

## 1.7 Growth

The 2021 population of the Township was 10,619, which is in the category of "less than 25,000" as established in O. Reg. 588/17.

In reference to the Township of North Dumfries Official Plan, November 2018, the population and employment forecasts for the Township are as follows:

- As of 2006, the Township had approximately 9,200 residents and the Township should plan to accommodate 16,000 residents by 2031.
- As of 2006, the Township had approximately an employment population of 6,080 and the Township should plan to accommodate an employment population of 8,700 by 2031.

Growth related assumptions and its impact on the lifecycle of the core assets is presented in Table 3.

**Table 3: Growth Related Impacts on Lifecycle of Assets**

| Asset Category | Growth Impact Assumptions | How Assumptions Relate to Lifecycle of Assets |
|---|---|---|
| Roads | • Increased traffic in development areas | • Potential increase in road maintenance costs, capital expenditures for new roads |
| Bridges and Culverts | • Increased usage of bridge crossings by vehicles in the area | • Potential traffic volume delays and mitigation required<br>• Load considerations and regularly scheduled maintenance checks |
| Stormwater | • Increased service demands and expansion of network<br>• Increased storm runoff volumes from urbanization | • Potential increase in capital plan budget due to increase in service network size and capacity |

# 2.0 Roads

## 2.1 State of Local Infrastructure

The Township owns and maintains a road network which includes paved and unpaved road assets, as well as sidewalks and streetlights.

The information related to the road assets is based on the Township of North Dumfries Roads State of the Infrastructure Study 2022, completed by Dillon Consulting Limited. This document can be referenced for further information.

### 2.1.1 Road Assets

The Township owns and maintains 167.58 km of paved and unpaved road assets. In previously completed road needs studies, the asset inventory was classified as Urban, Semi-Urban, and Rural, with each defined as follows:

a) Urban: Roads having curb and gutter and storm sewer drainage
b) Semi-Urban: Roads without curb and gutter in built-up urban areas
c) Rural: Roads without curb and gutter outside built-up urban areas.

A brief summary of the assets is presented in Table 4, including total length and construction materials.

**Table 4: Summary of Road Assets**

| Roadside Environment | Construction Material | Total Length (km) | Total Lane Km |
|---|---|---|---|
| Urban | High Class Bituminous (Asphalt) | 15.25 | 30.50 |
| Semi-Urban | High Class Bituminous (Asphalt) | 29.86 | 59.73 |
| | Gravel | 0.37 | 0.74 |
| Rural | High Class Bituminous (Asphalt)) | 96.04 | 192.09 |
| | Low Class Bituminous (Tar and Chip | 0.60 | 1.20 |
| | Gravel | 25.46 | 50.92 |
| | **Total** | 167.58 | 335.17 |

#### 2.1.1.1 Replacement Cost

Replacement costs for road segments were developed from the estimates provided in the 2016 State of the Infrastructure – Roads study, completed by 4 Roads Management Services Inc. The 2016 estimates were inflated to 2022 dollars by assuming a 3% average annual inflation. This inflation rate was determined using monthly consumer price index (CPI) data from the Bank of Canada (which resulted in an inflation rate of 2.62%) and rounding up to 3% for contingency, as the price index for commodities

such as asphalt has been known historically to be slightly higher. A summary of the replacements costs by roadside environment and material are presented in Table 5. The estimated road replacement cost in 2022 dollars is $131.4 million.

**Table 5: Road Replacement Cost (2022 Dollars)**

| Roadside Environment | Construction Material | Replacement Costs (2022) |
|---|---|---|
| Urban | High Class Bituminous (Asphalt) | $26,880,881 |
| Semi-Urban | High Class Bituminous (Asphalt) | $17,914,761 |
| | Gravel | $182,186 |
| Rural | High Class Bituminous (Asphalt) | $73,669,645 |
| | Low Class Bituminous (Tar and Chip) | $195,906 |
| | Gravel | $12,531,883 |
| **Total Asset Inventory Replacement Cost (2022)** | | **$131,375,262** |

### 2.1.1.2 Average Age

Based on available construction year information, the average age of the road network was calculated by roadside environment and material. The average age of road assets is 22.4 years, presented in Table 6 by the average age for separate categories and materials of the roads.

**Table 6: Average Age of Road Assets**

| Roadside Environment | Construction Material | Average Age (years) |
|---|---|---|
| Urban | High Class Bituminous (Asphalt) | 18.1 |
| Semi-Urban | High Class Bituminous (Asphalt) | 24.6 |
| | Gravel | 23.7 |
| Rural | High Class Bituminous (Asphalt) | 23.3 |
| | Low Class Bituminous (Tar and Chip) | 26.0 |
| | Gravel | 20.8 |
| **Average Total Asset Inventory Age (Years)** | | **22.4** |

A summary of the age distribution for the road assets, by material type and length, is highlighted in Figure 3.

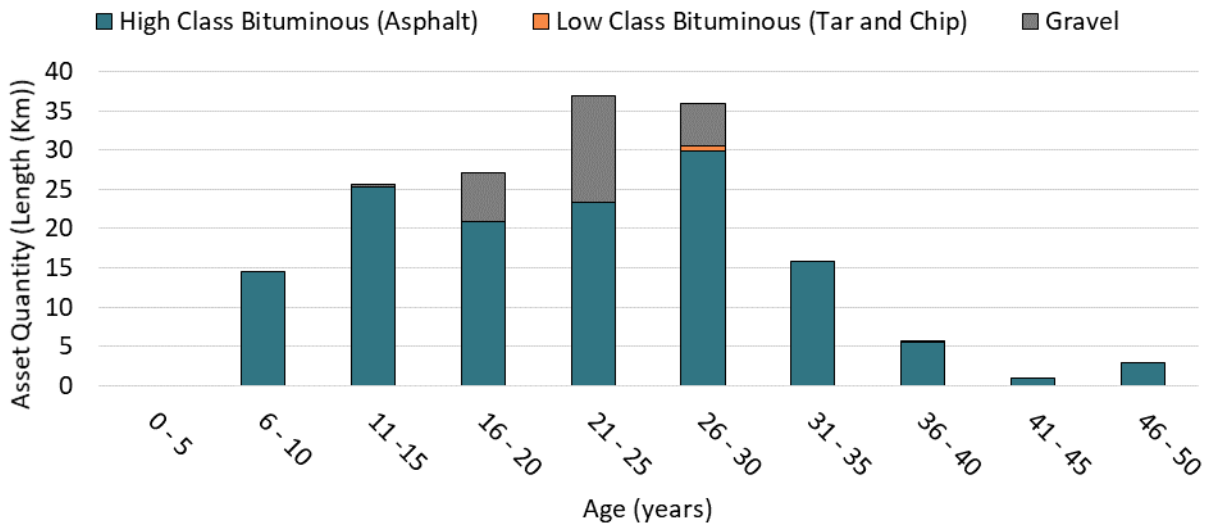



**Figure 3: Age Distribution of Road Assets (2022)**

### *2.1.1.3* Expected Useful Life

The expected useful life of the road assets is used to estimate the replacement schedule. The expected useful life values for each type of road surface within the network were provided and confirmed by the Township, and are summarized in Table 7.

**Table 7: Expected Useful Life for Road Surfaces**

| Road Type | Road Classifications | Material Types | Expected Useful Life (years) | Average Remaining Useful Life (Years) |
|---|---|---|---|---|
| Collector | Class 3 and Class 4 highway | Gravel, High Class Bituminous (Asphalt) | 40 | 18 |
| Local | Class 5 and Class 6 highway | Gravel, High Class Bituminous (Asphalt), Low Class Bituminous (Tar and Chip) | 40 | 17 |

Based on O. Reg. 588/17, the road classifications are:

- Arterial road - Class 1 and Class 2 highway;
- Collector road - Class 3 and Class 4 highway; and,
- Local road - Class 5 and Class 6 highway.

These classes of road are determined in the table under Section 1 of Ontario Regulation 239/02 (Minimum Maintenance Standards for Municipal Highways) made under the Municipal Act, 2001 based on average daily traffic counts and speed limit. The Township's road network includes collector and local road types. The Township does not have any arterial roads.

### Recommendation

It is recommended that in the next AMP update that the Township inventory and assign separate expected useful lives to both the road surface and the road base, as the road surface has a shorter useful life (e.g. 15 years) and the road base has a longer useful life (e.g. 75 years). This approach will more accurately reflect the operating experience of the road network in the Township.

## 2.1.2 Sidewalks

The Township maintains 30,000 m of sidewalks throughout the municipality adjacent to the road network and as walkways. The total length of sidewalk can be categorized by the following:

- 540 m are adjacent to schools;
- 6,920 m are on Regional Roads;
- 1,310 m are adjacent to Township property;
- 285 m are in Centennial Park;
- 340 m are in the Downtown Core; and
- Remaining 20,605 m on all other Township streets.

### 2.1.2.1 Replacement Cost

It was assumed that the entire sidewalk network consists of concrete segments. Excluding the sidewalk on the Regional Roads (6,920 m) due to a pre-existing agreement with the Region of Waterloo, there is a total of 23,080 m of sidewalk within the Township that, when replaced, would need to be funded by the Township. At an assumed 1.5 m width, this equates to 34,620 $m^2$ of sidewalk.

The replacement cost of each $m^2$ of sidewalk is estimated to \$80/$m^2$. This includes the removals and installation of the concrete surface and granular base. The total estimated replacement cost for all sidewalks that the Township is responsible for funding replacement is \$2,769,600.

### 2.1.2.2 Average Age

The average age of the existing sidewalks is estimated to be 15 years.

### 2.1.2.3 Expected Useful Life

The expected useful life of each sidewalk segment is 40 years for concrete sidewalks.

## 2.1.3 Streetlights

The Township has a total of 564 streetlights which are 437 traditional streetlights and 127 decorative streetlights. The majority of the decorative streetlights are located within the Nith River Way neighbourhood, Community of Roseville and the Maple Manor estate subdivision.

### 2.1.3.1 Replacement Cost

The total replacement cost for all the streetlights in the Township in 2022 Dollars is $3,292,500, based on per unit costs of $5,500 for a traditional streetlight and $7,000 for a decorative streetlight. These unit costs include wiring, materials and installation.

### 2.1.3.2 Average Age

All the traditional streetlights were converted to LED in 2017 so the fixtures are 5 years old, while the poles are estimated to be an average of 40 years old. The average age of the complete decorative streetlights is estimated to be 35 years old.

### 2.1.3.3 Expected Useful Life

The expected useful life traditional streetlight poles is dependent on material (80 years for concrete, 70 years for steel and 30 years for wood) and decorative streetlight poles is 70 years. The expected useful life of streetlight fixtures and luminaries is 30 years.

## 2.2 Condition – Roads

A road condition assessment was most recently completed by Dillon Consulting Limited in 2022 with results and analysis documented in the Township of North Dumfries Roads State of Infrastructure Study 2022 report. The condition categories used as a part of that study were based on the level of service defined in ASTM manuals relative to the value of the Pavement Condition Index (PCI), as shown in Table 8 below. PCI takes into account the physical condition of the road (e.g. cracking, potholes) measured by a visual inspection. A new road is assigned a PCI of 100, and over time, as the road ages and through wear and tear, the PCI number drops to 0, which is the worst possible condition.

**Table 8: Condition Categories**

| Pavement Condition Index | Condition Category |
|---|---|
| 85 to 100 | Very Good |
| 70 to 85 | Good |
| 56 to 70 | Fair |
| 40 to 55 | Poor |
| Less than 40 | Very Poor |

These values should be considered as guidelines for replacement activities which should also consider other needs in the Township's overall capital program. (For example, roads can be improved in conjunction with adjacent segments for a continuous section, or in consideration of other work being done in the roadway, such as replacement of culverts or pipe).

In reference to guideline SP-024 published in August 1989 by the Ministry of Transportation (Manual for condition rating of flexible pavements – Distress manifestations), there are eight categories for flexible pavement rating as presented in Table 9. Pavement Condition Rating (PCR) is an assessment of overall pavement performance, both functionally and structurally. It is derived from serviceability based on evaluation of pavement riding comfort and of pavement surface distresses.

**Table 9: Description of Pavement Condition Rating (MTO SP-024)**

| Pavement Condition Rating | Description of Pavement | Rideability Description |
|---|---|---|
| 90 to 100 | Excellent condition with few cracks | Excellent with few areas of slight distortion |
| 75 to 90 | Good condition with frequent very slight or slight cracking | Good with few slightly rough and uneven sections |
| 65 to 75 | Fairly good condition with slight cracking, slight or very slight dishing and a few areas of slight alligatoring | Fairly good with intermittent rough and uneven sections |
| 50 to 65 | Fair condition with intermittent moderate and frequent slight cracking, and with intermittent slight or moderate alligatoring and dishing | Fair and surface is slightly rough and uneven |
| 40 to 50 | Poor to fair condition with frequent moderate cracking and dishing, and intermittent moderate alligatoring | Poor to fair and surface is moderately rough and uneven |
| 30 to 40 | Poor to fair condition with frequent moderate alligatoring and extensive moderate cracking and dishing | Poor to fair and surface is moderately rough and uneven |
| 20 to 30 | Poor condition with moderate alligatoring and extensive severe cracking and dishing | Poor and the surface is very rough and uneven |
| 0 to 20 | Poor to very poor condition with extensive sever cracking, alligatoring and dishing | Poor and surface is very rough and uneven |

A summary of the Township's overall roadway condition is shown in Table 10.

**Table 10: Condition of Road Network**

| PCI Range | Condition Categories | Length of Road (km) | Percentage of Total Road Network |
|---|---|---|---|
| Greater than 85 | Very Good | 30.9 | 19% |
| 70 to 85 | Good | 37.5 | 22% |
| 56 to 70 | Fair | 25.5 | 15% |
| 40 to 55 | Poor | 39.7 | 24% |
| Less than 40 | Very Poor | 33.9 | 20% |
| | Total | 167.5 | 100% |

Based on the 2022 roadway evaluations, the average PCI value for the entire road network is 63. This places the overall road network in the "Fair" category.

## 2.3 Current Levels of Service – Roads

Levels of service for road assets are outlined in Table 4 of O.Reg. 588/17. Table 11 and Table 12 outline the Township's current community and technical LOS for the roads.

**Table 11: Community Level of Service – Roads**

| Service Attribute | Community Levels of Service (Qualitative Description) | Community LOS |
|---|---|---|
| **Scope** | Description, which may include maps, of the road network in the Municipality and its level of connectivity. | The roads in the Township are intended to serve local and through traffic in urban and rural settings, throughout the Township. A map of the road network can be found in **Appendix A**. |
| **Quality** | Description or images that illustrate the different levels of road class pavement condition. | Pavement condition was assessed in 2022. The road segment surfaces were visually assessed using the TotalPave software and a PCI score which is between 0 and 100 was given to each segment. PCI of 100 is new condition and as the asset ages and the road condition deteriorates, the PCI score gets lower where PCI of 40 is very poor. A map by PCI score can be found in **Appendix A**. |

**Table 12: Technical Level of Service – Roads**

| Service Attribute | Technical Levels of Service (Technical Metrics) | Technical LOS |
|---|---|---|
| **Scope** | Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the Municipality. | The number of lane-kilometres of roads as a proportion of square kilometres of land area of the Township is in **Table 13** below. |
| **Quality** | For paved roads in the Municipality, the average pavement condition index value. | The technical metric for the condition of roads is the Pavement Condition Index (PCI). The average PCI value for the paved surfaces is 63. |
| | For unpaved roads in the Municipality, the average surface condition (e.g., Excellent, Good, Fair or Poor). | The average surface condition for the unpaved roads is Good. |

See **Table 13** for roadway type length of lane kilometres and proportion per square kilometer of area.

**Table 13: Proportion of Lane Kilometers**

| Street Type | Length of Lane-Kilometers | Lane-Kilometers as Proportion of sq. km of Land Area |
|---|---|---|
| Collector | 231.4 km | 1.2 km per 1 $km^2$ |
| Local | 103.8 km | 0.55 km per 1 $km^2$ |

## 2.4 Current Performance – Roads

Asset performance measures were determined in consultation with the Township, which provide relevant metrics against which the Township can gauge the performance of their assets. The performance measures for roads, and their current values are shown in Table 14.

**Table 14: Road Performance Measures**

| Asset Performance Measures | Current Value |
|---|---|
| Roads with load restrictions | Seasonal road restrictions across the entire Township |
| Percentage of roads in Fair or Better condition | 53% |

## 2.5 Risk Assessment – Roads

The risk ratings for the assets in the road network follow the following risk methodology and approach, presented in Section 1.1. The Road Risk Profile can be seen below in Figure 4.

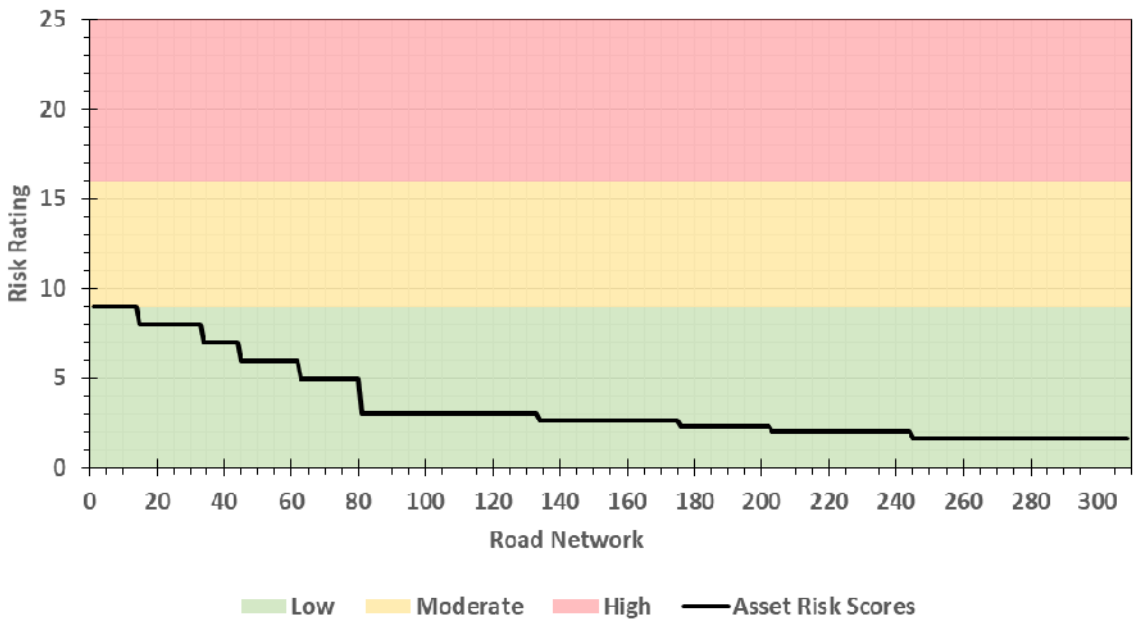



**Figure 4: Road Risk Profile**

In analyzing the different road segments based on age and the performance condition index it was shown that there are no road segments with the moderate risk score (9 to 16) or the highest risk rating (above 16). All 309 road segments are currently in the lowest risk score (0-9).

It is important to highlight that the risk rating is used to inform the capital plan and the development of the capital plan takes into account other factors in addition to risk rating, such as scheduling, accessibility during construction and availability of funding.

### 2.5.1 Performance

The road performance rating for individual assets were assumed to be 'Always Reliable' as there were no roads indicated otherwise.

### 2.5.2 Importance

Road segment importance was determined based on the street type. Moderate (2) importance roads are collector roads and low (1) importance roads are local roads.

## 2.6 Lifecycle Activities – Roads

The following section describes the lifecycle activities that can be implemented within the asset management strategy for road assets. The primary lifecycle activities after construction include reconstruction, rehabilitation, and maintenance.

The lifecycle activities presented below are consistent with best practices for road asset management and maintenance, and with the recommendations in the 2016 study. Additional description and details of the lifecycle activities can be found within the report.

### Construction

The initial lifecycle activity of a road asset is its construction. The road asset should be constructed to adhere to applicable requirements, codes, and design guidelines. Design of the road asset should consider the level of service expected to be provided by that particular road asset, such as the anticipated speed or volume of traffic. Varying factors in construction include: the road classification, surface type, and roadside environment (e.g., rural, urban).

### Reconstruction

Reconstruction lifecycle activities include works that encompass the full surface of a road segment. Reconstruction activities include:

- Full reconstruction (Varying cost and difficulty for rural, semi-urban, and urban roads);
    - Potential adjustments to existing storm sewer, manholes, catch basins, etc. (semi-urban and urban roads only); and
- Urban paving (typically more costly than paving for semi-urban and rural roads).

Selection of a reconstruction activity will depend on multiple factors, such as:

- Lifecycle stage of the asset (previous lifecycle activities undertaken);
- Condition and type of wear on road surface;
- Road surface material;
- Condition of underlying road base; and
- Roadside environment.

### Rehabilitation

Rehabilitation lifecycle activities include works that encompass the full surface of a road segment. Rehabilitation activities include:

- Hot mix resurfacing (50 mm – 100 mm);
- Full depth pulverize and pave (100 mm – 150 mm); and
- Full depth removal and pave.

Selection of a reconstruction activity will depend on multiple factors, such as:

- Lifecycle stage of the asset (previous lifecycle activities undertaken);
- Condition and type of wear on road surface;
- Road surface material;

- Condition of underlying road base; and
- Roadside environment.

### Maintenance

Maintenance lifecycle activities are smaller in scale than reconstruction or rehabilitation and can be used to address localized issues on the road surface ("spot maintenance"), or to improve or maintain road asset-adjacent components ("specific maintenance"). A spot maintenance activity is typically appropriate when the location for maintenance is less than 60 m in length. Specific maintenance activities are not length based, and address maintenance to non-road surface components. The types of maintenance under each of these categories can include:

- Specific Maintenance
    - Ditching improvements
    - Edge widening
    - Installation of sub drain
- Spot Maintenance
    - Ditch Spot Location
    - Paving Patch
    - Spot repair (paved or gravel road).

Crack sealing can be used on an ad-hoc basis, typically on better condition roads where the severity of the cracks is minimal. Where cracks are more advanced or widespread, more comprehensive maintenance or improvement works will be required.

### Decommissioning/Disposal

Disposal activities can include the removal from service of a road segment. These activities can be implemented when a road segment has been determined to be no longer required. A road may be removed from service by removal and disposal of the asset components, or establishment of a barricade to prevent continued usage of the asset. Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at an appropriate or approved facility.

## 2.7 Asset Management Strategy – Roads

The asset management strategy for the road assets seeks to use the lifecycle activities in a manner that will achieve cost-effective and sustainable management of the road assets. The road assets will deteriorate on a non-linear basis, and the lifecycle activities can be implemented at varying stages within an assets deterioration.

The condition and usage of the road assets is a key driver in the determination of lifecycle activities to use. The condition was determined in 2022 as part of this State of the Infrastructure Study for North Dumfries' road network, and should continue to be updated by the Township. Condition of the roads can be completed on scheduled basis wherein the entirety of the network is reviewed in annual portions over a defined duration (example five years). A variety of methods can be implemented for undertaking condition assessment of roads, including visual inspection and street scan technology. A condition rating program can also be implemented that considers the importance or risk of a road segment, and prioritizes frequency and timing of condition assessments to higher usage or higher importance roads. A condition assessment program is recommended for the Township.

Maintenance works should be undertaken throughout the lifecycle of an asset. Selection of the appropriate maintenance activity will depend on the type of deterioration being experienced on the asset, and the condition of the asset. Some activities, such as crack sealing, are best utilized on a road segment that is generally in "Good" condition. As the road segment continues to deteriorate, maintenance activities may become a less preferred option.

Rehabilitation activities should be undertaken on an asset when it has deteriorated past the point where maintenance activities would be adequate to address condition issues. Selection of the appropriate rehabilitation activity will depend on the road surface material, stage in lifecycle, and severity and type of deterioration.

In general, the current strategy for the road assets at the Township is to allow the road surface asset to degrade near to the end of its expected lifecycle, and reconstruct the road surface when required. The road base has a much longer expected useful life than the road surface, and is dealt with as required during road works. The requirement for reconstruction of the road base is determined through a combination of staff knowledge of the road condition, and conducting boreholes to assess the viability of the road base. The Township does not currently undertake boreholes for every road segment to be reconstructed.

As for gravel roads, it is recommended that the gravel roads be graded regularly, and gravel applied annually. Localized repairs and maintenance should also be completed where required. Reconstruction of these roads may be required if condition is found to have deteriorated, however the expected lifespan is long.

## 2.8 Scenario Analysis

To understand the needs and projected capital work on the road network within the next 10-years, the reconstruction, rehabilitation and maintenance of the road surface were reviewed to determine the required budget and to understand the impact on the overall network condition. In this analysis, it was assumed that the roads anticipated to be rehabilitated or reconstructed in 2022 were complete and the

PCI rating for those roads was reset to 100. The roads that were set to be reconstructed or rehabilitated in 2022 can be found in Table 15.

**Table 15: Roads Paved in 2022**

| Asset Code | Street | From Street | To Street | Improvement Year |
|---|---|---|---|---|
| 1446773 | Maple Manor Rd | Misty Maple Trail | Silver Maple Cres | 2022 |
| 1446937 | Bute St | McCrae Street | Bute Street Bend | 2022 |
| 1446824 | Sheffield Rd | Seaton Rd | Morrison Rd | 2022 |

For the purposes of this analysis, input from the Township was taken into account regarding existing budget and schedule for roadway rehabilitation already planned for 2022. The 10 year forecast analysis begins in the year 2023. A small number of select roadways that are currently part of the Township's government property network were removed from the budget capital forecast. These roadway sections have not been provided any maintenance for many years due to the actual lack of use of these sections, they serve as alleyways/driveways with no posted speed limit. Originally recorded as paved roadway sections they have deteriorated beyond repair to gravel/dirt access ways.

Based on the Townships existing improvement activities, it was assumed that any roads with a PCI less than 40 would be fully reconstructed (base and surface treatment), while any roads with a PCI between 40 and 55 would be rehabilitated (pulverized and/or resurfaced). The improvement types that were used for this analysis can be found in Table 16, below.

**Table 16: Surface Improvement Types based on PCI**

| Surface Type | Improvement Type | Improvement Description | PCI Threshold | Effect on PCI |
|---|---|---|---|---|
| Hard Surface (Asphalt, Chip and Tar) | Reconstruction | Base and Surface Reconstruction | PCI < 40 | 100 |
| | Rehabilitation | Pulverizing and Resurfacing | 40 < PCI < 55 | 100 |
| | Maintenance | Crack Sealing, Spot Drainage | 55 < PCI <70 | 85 |
| Gravel | Reconstruction | Adding a full lift of gravel | PCI < 40 | 100 |
| | Maintenance | Spot Drainage | 40 < PCI < 70 | 85 |

For costing, estimates for reconstruction, rehabilitation, and maintenance activities were inflated to 2022 dollars from the 2016 Study. The inflation used for this analysis was a 3% average annual inflation. This inflation rate was determined using monthly consumer price index (CPI) data from the Bank of Canada (which resulted in an inflation rate of 2.62%) and rounding up to 3% for contingency as the price index for commodities such as asphalt has been known historically to be slightly higher. The unit prices used can be found in Appendix B in the 2022 Road Study.

In 2022, the Township's budget for road resurfacing and reconstruction is $1,500,000, with an additional $550,000 for other road improvement projects (full road reconstructions, drainage improvements, etc.). The 2022 budget was used as a baseline for the analysis.

If the Township continues to use the 2022 budget for the next 10 years, the average PCI of the road network is predicted to decrease to an average of 52. The predicted cost and associated average PCI ratings can be found in Table 17 and Figure 5.

**Table 17: Road Total Expenditures and Average PCI with 2022 Budget**

| 2022 Budget | Total Program Cost | Average Annual Cost | Resulting Average PCI | % Change in PCI | Reinvestment Rate |
|---|---|---|---|---|---|
| $1,500,000, with an additional $550,000 for other road improvement projects | $20.1M | $2.01 M/yr | 59 | -6% | 1.5% |

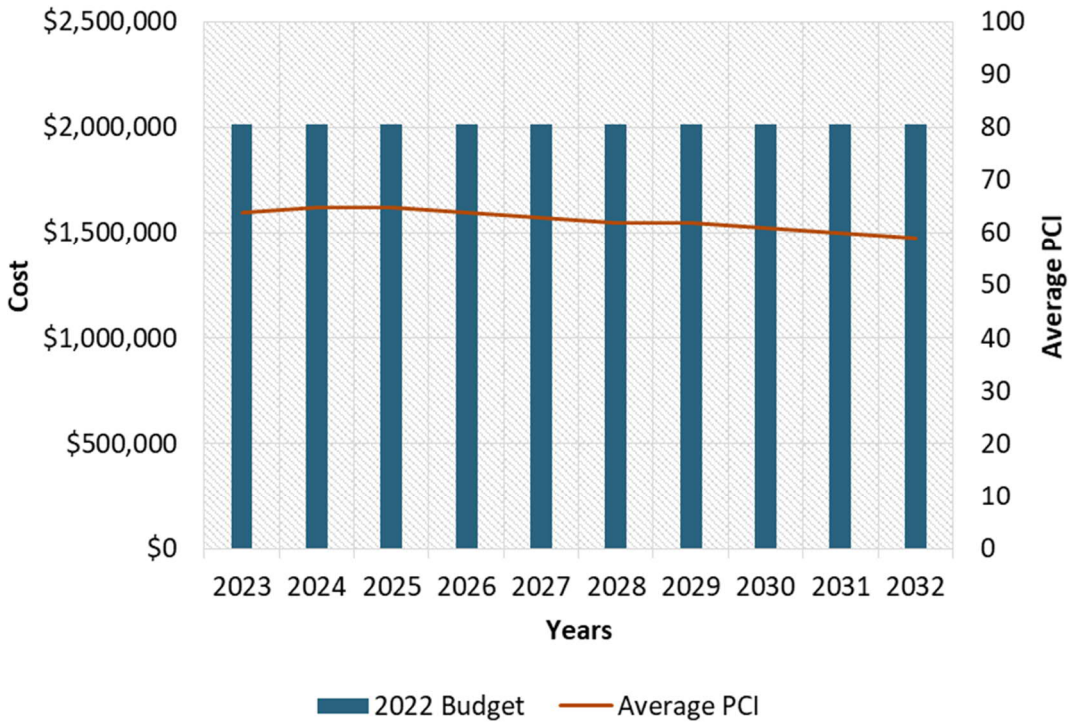



**Figure 5: Average PCI Achieved by 2032 (with $2.01 million/year)**

Based on the findings outlined in Table 17, it is anticipated that investments at the level of the 2022 budget would not be sufficient to maintain the current LOS (PCI of 63) or to achieve the proposed LOS (PCI of 70). There were three (3) options analyzed to determine the estimated budget that the Township would be required to achieve their proposed LOS. The options analyzed include:

- Increasing the 2022 budget by $250,000 a year;
- Increasing the 2022 budget by $500,000 a year; and
- Increasing the budget to achieve an average PCI of 65 within 10 years.

The following subsections summarize the findings of a multi-year projection scenario run for each strategy using the budgets noted above.

### 2.8.1 Option #1

Option #1 is to increase the 2022 budget of $1,500,000 (with an additional $550,000 for other road improvement projects) by $250,000 a year. Based on the results outlined in Table 18 and Figure 6, it appears that increasing the Township's existing budget by $250,000 a year would be sufficient to maintain its road network to the current LOS (PCI of 63) but not for achieving the proposed LOS of 70 in 10 years.

**Table 18: Increasing annual budget by $250,000 a year (Option #1)**

| Option #1 | Total Program Cost | Average Annual Cost | Resulting Average PCI | % Change in PCI | Reinvestment Rate |
|---|---|---|---|---|---|
| Increasing annual budget by $250,000 a year | $31.4 M | $3.14 M/yr | 68 | +8% | 2.5% |

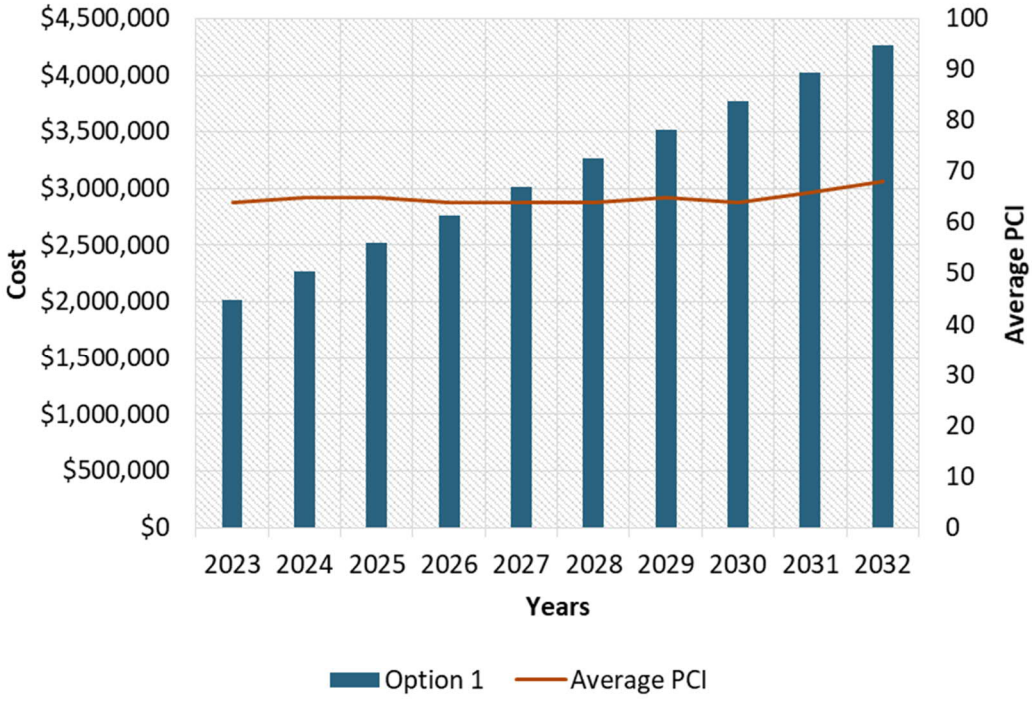



**Figure 6: Average PCI for Option 1**

### 2.8.2 Option #2

Option #2 is to increase the 2022 budget of $1,500,000 (with an additional $550,000 for other road improvements) by $500,000 a year. Based on the summary outlined in Table 19 and Figure 7, it appears that increasing the Township's existing budget by $500,000 a year would be enough for maintaining the existing current LOS and for achieving the proposed LOS of 70 within 10 years.

**Table 19: Increasing annual budget by $500,000 a year (Option #2)**

| Option #2 | Total Program Cost | Average Annual Cost | Resulting Average PCI | % Change in PCI | Reinvestment Rate |
|---|---|---|---|---|---|
| Increasing annual budget by $500,000 a year | $42.6 M | $4.3 M/yr | 75 | +19% | 3.2% |

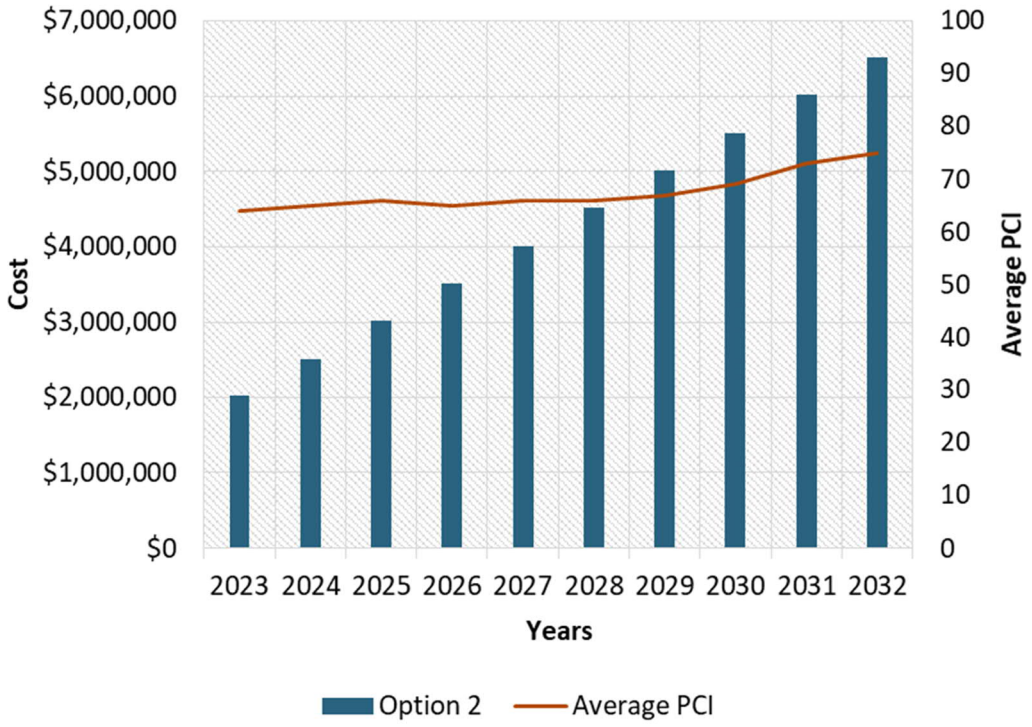



**Figure 7: Average PCI for Option 2**

### 2.8.3 Option #3

Option #3 is to increase the annual budget to achieve an average PCI of 65 for the road network within 10 years. As presented in Table 20 and Figure 8, to achieve an average PCI rating of 65 within 10 years a total of $28 million would be required. The average annual cost for this option would be $2.8 million which equates to approximately 2% of the total network value of $131 million.

**Table 20: Obtaining an average PCI of 65 in 2032 (Option #3)**

| Option #3 | Total Program Cost | Average Annual Cost | Resulting Average PCI | % Change in PCI | Reinvestment Rate |
|---|---|---|---|---|---|
| Obtaining an average PCI of 65 in 2032 | $28.0 M | $2.8 M/yr | 65 | +3% | 2.1% |

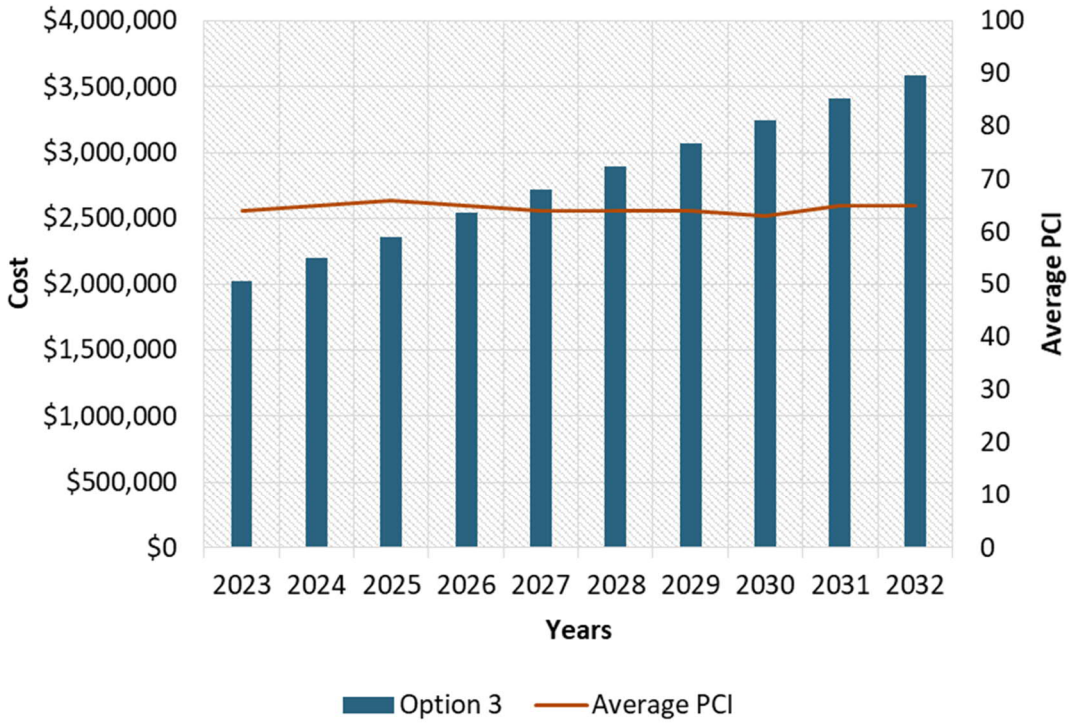



**Figure 8: Average PCI for Option 3**

### 2.8.4 Recommended Option

Based on the analysis outlined in the previous sections, it is recommended on approaching the road network with Option 3. This option would improve the overall condition of the road network over time, while increasing the amount reinvested into the network at a more modest rate. It is recommended to set the target (proposed) LOS to achieve an average PCI rating of 65 within 10 years.

# 3.0 Bridges and Culverts

## 3.1 State of Local Infrastructure

The Township owns five bridges and 14 structural culverts, for a total of 18 structures. The inventory of structures is shown in Table 21 and Table 22, including structure type and name. Bridges and structural culverts are defined as structures providing vehicle or pedestrian passage across and obstruction, gap or facility that are greater than or equal to 3 meters in span.

**Table 21: Inventory of Bridges**

| Structure Type | Quantity | Structure Name |
|---|---|---|
| Slab on I-Girder (Steel) | 2 | Footbridge Road Bridge<br>Shellard Road Bridge |
| Solid Slab | 1 | Jedburgh Dam Bridge |
| Rectangular Voided Slab | 1 | Piper Street Bridge |
| Pratt style through truss | 1 | Nithvale Bridge |
| TOTAL | 5 | - |

**Table 22: Inventory of Structural Culverts**

| Structure Type | Quantity | Structure Name |
|---|---|---|
| Corrugated steel plate pipe arch | 9 | Alps Twin Culvert<br>Industrial Road Culvert<br>Kings Road Twin Culvert<br>Reidsville Twin Culvert<br>Sheffield Rd Twin Culvert 2<br>West Alps Road Twin Culvert<br>Sheffield Rd Three-Cell Culvert 1<br>GreenField Road Twin Culvert<br>GreenField Road West Twin Culvert |
| Concrete Rigid Frame | 3 | Morrison Culvert 1 |
| | | Morrison Culvert 2 |
| | | Gore Culvert 1 |
| CSP/Concrete Rigid Frame | 1 | Clyde Road Culvert |
| Reinforced Concrete Elliptical | 1 | Gore Culvert 2 |
| TOTAL | 14 | - |

### 3.1.1 Replacement Cost

The total replacement cost of the majority of the roadway bridges and structural culverts is based on the 2022 OSIM Report which details the replacement values for each structure. The Nithvale Bridge was not included in the 2022 OSIM report, but a separate inspection and report was prepared by Jewell Engineering Inc. in March 2022. The OSIM report identifies the elements of each structure and the corresponding replacement value for each element. The total replacement value for each bridge and structural culvert was determined to be $12.4 million with the total replacement cost summarized for each structure type which is highlighted in Table 23.

**Table 23: Replacement Cost – Bridges and Culverts**

| Asset Type | Quantity | Total Replacement Cost (2022) |
|---|---|---|
| Bridges | 5 | $11,759,952 |
| Structural Culverts | 14 | $588,724 |
| Total | 18 | $12,348,676 |

### 3.1.2 Average Age

The bridge network varies in age distribution from 52 years (constructed in 1970) to 139 years (constructed in 1883) and has an average age of 82 years old. The age distribution is shown in Table 24.

**Table 24: Age Distribution of Bridges**

| Bridge Name | Year Constructed | Age (years) |
|---|---|---|
| Footbridge Road Bridge | 1970 | 52 |
| Jedburgh Dam Bridge | 1940 | 82 |
| Piper Street Bridge | 1967 | 55 |
| Shellard Road Bridge | 1940 | 82 |
| Nithvale Bridge | 1883 | 139 |
| | Average Age (years) | 82 |

There was no known age or year of construction information available for the structural culvert network.

### 3.1.3 Expected Useful Life

The average expected useful life of a bridge is generally 75 years. With a good maintenance program, i.e. following recommendations from OSIM reports, the useful life of bridges can be extended, by improving the condition of the bridge to meet levels of service and performance.

The Jedburgh Dam Bridge and the Shellard Road Bridge are older than 75 years, but are still providing the level of service that is required, thus their expected useful life is greater than 75 years. The Nithvale

Bridge is also older than 75 years, but has been closed to pedestrian and vehicular traffic for a considerable period of time.

The expected useful life for a structural culvert is also generally 75 years, although culvert age is unknown.

## 3.2 Condition – Bridges and Culverts

The Township has previously undertaken condition assessment for bridge and structural culvert assets, determined through completion of OSIM inspections, the most recent having been completed in 2022 by MEDA Engineering and Technical Services. As mentioned previously, inspection of the Nithvale Bridge was not included in the 2022 OSIM report, but the bridge was inspected separately by Jewell Engineering Inc. in March 2022. The OSIM provides an overall element condition index that quantifies the elements condition on a scale of 0-100, where 100 is the best and 0 is the worst. The average condition of all elements for a structure is used to determine an overall Bridge Condition Index (BCI). The Ontario Ministry of Transportation (MTO) has developed a general categorization for BCI values as summarized in Table 25.

**Table 25: Bridge Condition Index Categories**

| Bridge Condition Index (BCI) Value | Condition Rating |
|---|---|
| 71 to 100 | Good |
| 60 to 70 | Fair |
| 59 or less | Poor |

**Table 26** and **Table 27** below summarize the BCI values for each bridge and structural culvert and the corresponding qualitative condition. The average BCI for the four bridges is 67.5 (fair), and the average of the BCI for the fourteen structural culverts is 68.7 (fair).

**Table 26: Bridge Condition Summary**

| Bridge Name | BCI Value | Condition Rating |
|---|---|---|
| Footbridge Road Bridge | 67.2 | Fair |
| Jedburgh Dam Bridge | 51.7 | Poor |
| Piper Street Bridge | 71.3 | Good |
| Shellard Road Bridge | 79.6 | Good |
| Nithvale Bridge | 0* | Poor |
| Average BCI | 54 | Poor |

*A BCI value was not determined for the Nithvale Bridge during the most recent OSIM inspection, but due to it currently being closed, a BCI of 0 is assumed based on information provided by the Township.

Due to the severe corrosion of the steel members, it was recommended by Jewell Engineering Inc. that the bridge remained closed in its current condition.

**Table 27: Structural Culvert Condition Summary**

| Structural Culvert Name | BCI Value | Condition |
|---|---|---|
| Alps Twin Culvert | 61.4 | Fair |
| Industrial Road Culvert | 71.6 | Good |
| Kings Road Twin Culvert | 66.3 | Fair |
| Morrison Culvert 1 | 71.5 | Good |
| Morrison Culvert 2 | 71.6 | Good |
| Reidsville Twin Culvert | 72.7 | Good |
| Sheffield Rd Twin Culvert 2 | 69.8 | Fair |
| West Alps Road Twin Culvert | 66.4 | Fair |
| Sheffield Rd Three-Cell Culvert 1 | 73.3 | Good |
| Clyde Road Culvert | 69.8 | Fair |
| GreenField Road Twin Culvert | 65.0 | Fair |
| GreenField Road West Twin Culvert | 65.0 | Fair |
| Gore Culvert 1 | 66.4 | Fair |
| Gore Culvert 2 | 71.6 | Good |
| Average BCI | 68.7 | Fair |

**Figure 9** shows a summary of the condition rating distribution for the bridges and structural culverts.

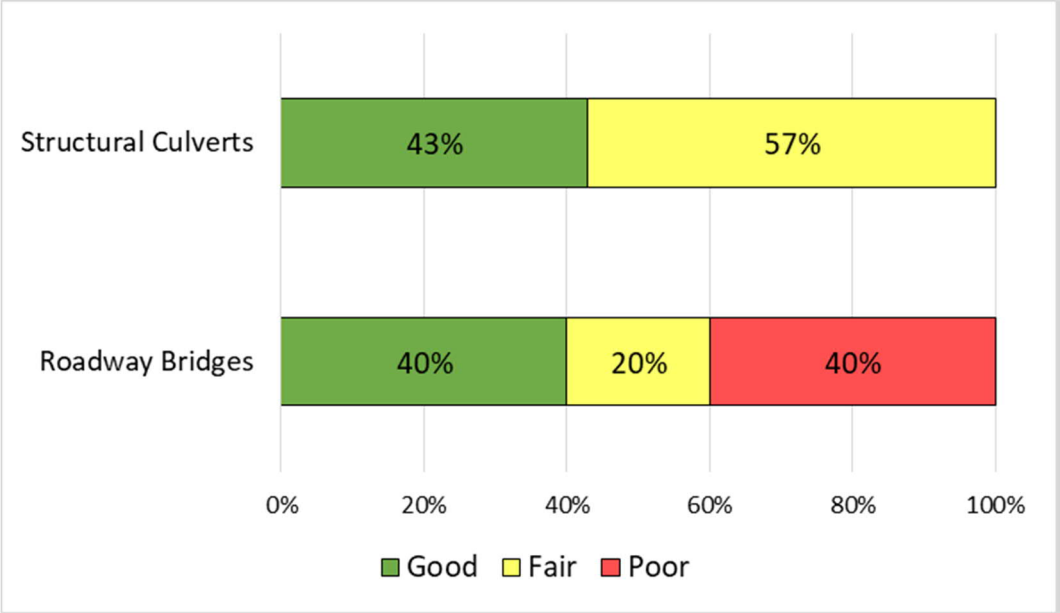



**Figure 9: Bridge and Structural Culvert Condition Distribution**

## 3.3 Current Levels of Service – Bridges and Culverts

Levels of service for bridges and culverts are outlined in Table 5 of O.Reg. 588/17.
Table 28 and Table 29 outline the Township's current community and technical levels of service for bridges and culverts.

**Table 28: Community Levels of Service – Bridges and Culverts**

| Service Attribute | Community Levels of Service (Qualitative Description) | Community LOS |
|---|---|---|
| **Scope** | Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists). | The Township's bridge and structural culvert network is designed to support various vehicle types, including:<br>• Heavy transport vehicles<br>• Motor vehicles<br>• Emergency vehicles<br>• Agricultural vehicles and equipment<br>• Pedestrians<br>• Cyclists |
| **Quality** | Description or images of the condition of bridges and how this would affect use of the bridges. | The condition of bridges and culverts are evaluated routinely (every two years) according to the OSIM requirements. For full descriptions and samples images of bridge and culvert condition classifications refer to the Ministry of Transportation's *Ontario Structure Inspection Manual 2008 and Field Inspection Guide* (April 2008).<br>Bridges and culverts in Good condition typically operate as designed and would not receive any additional restrictions or limitations beyond those designed. Bridges and culverts in Fair to Poor condition may receive load restrictions or be subject to closure as deterioration affects asset capacity to safely and reliably deliver the designed level of service. |
| **Quality** | Description or images of the condition of culverts and how this would affect use of the culverts. | |

**Table 29: Technical Levels of Service – Bridges and Culverts**

| Service Attribute | Technical Levels of Service (Technical Metrics) | Technical LOS |
|---|---|---|
| **Scope** | Percentage of bridges in the Municipality with loading or dimensional restrictions. | An OSIM bridge inspection report conducted in 2022 by MEDA Engineering and Technical Services identified one bridge that are posted with loading restrictions. This represents 5% of the total 19 |

| Service Attribute | Technical Levels of Service (Technical Metrics) | Technical LOS |
|---|---|---|
| | | bridges and culverts in the network. The 2022 report included the Jedburgh Dam Bridge with a posted loading restriction load restriction of 10 tonnes. In addition, the Nithvale Bridge is also currently closed. |
| **Quality** | For bridges in the Municipality, the average bridge condition index value. | The latest bridge condition index (BCI) value for the bridge network is based on 2022 inspections. The average index across the bridge network is 54, Poor. |
| **Quality** | For structural culverts in the Municipality, the average bridge condition index value. | The latest bridge condition index (BCI) value for the structural culvert network is based on 2022 inspections. The average index across the culvert network is 68.7, Fair. |

## 3.4 Current Performance – Bridges and Culverts

Asset performance measures were determined in consultation with the Township, which provide relevant metrics against which the Township can gauge the performance of their assets. The performance measures for bridge and culvert assets and their current values are shown in Table 30.

**Table 30: Bridge and Culvert Performance Measures**

| Asset Performance Measures | Current Value |
|---|---|
| Annual average daily traffic (AADT) counts over bridges to assess usage | Footbridge Road Bridge – 2,500<br>Jedburgh Dam Bridge – 1,300<br>Piper Street Bridge – 2,000<br>Shellard Road Bridge – 3,800<br>Nithvale Bridge – 0 |
| Number of bridge or culvert failures/road closures | 0 |
| Number of structures with load restrictions | 1 |
| Percentage of bridges and culverts in Fair or better condition | 60% of Bridges and 100% of Culverts |

## 3.5 Risk Assessment – Bridges and Culverts

The risk rating for bridges and culverts follow the risk methodology and approach, presented in Section 1.1. The risk profile for bridges and culverts are shown in Figure 10.

The bridges have a range of risk scores and fit into all of the risk ratings. The Footbridge Road Bridge is classified as High Risk, the Piper Street Road and the Nithvale Bridge are classified as Moderate Risk, and the Jedburgh Dam Bridge and the Shellard Road Bridge are classified as Low Risk.

All culverts are classified as low risk as they received risk ratings between 0 and 9.

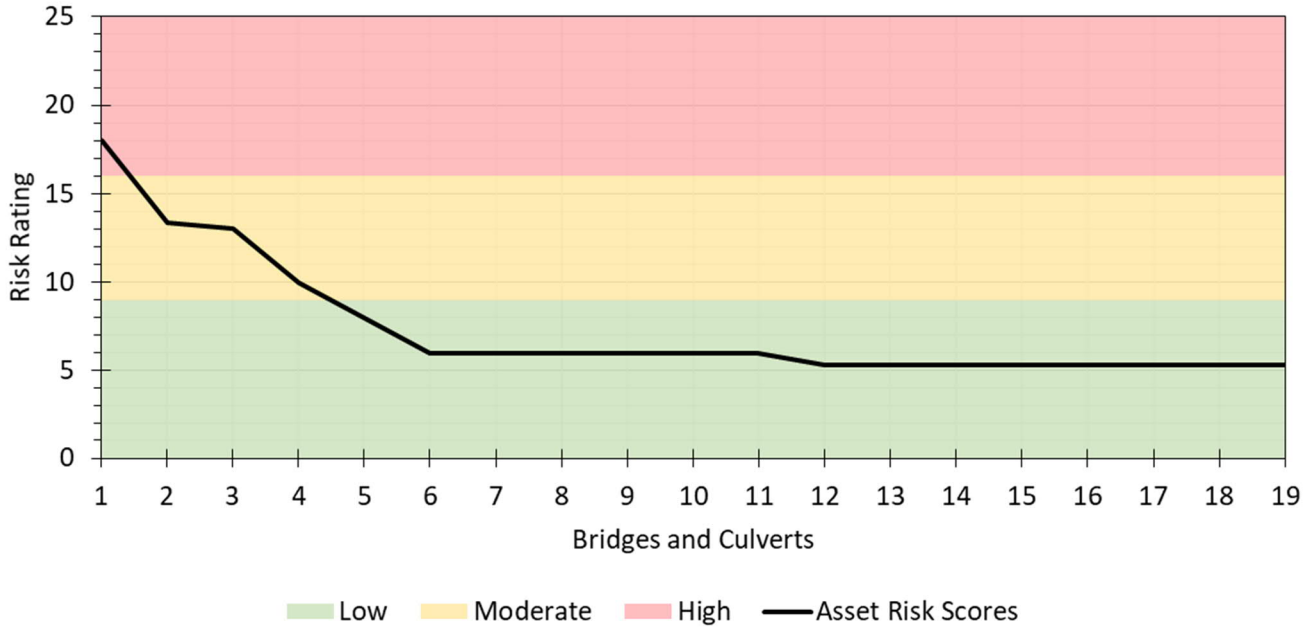



**Figure 10: Bridge and Culverts Risk Profile**

The replacement value of the high risk bridge is $5,404,000. The replacement value of the moderate risk bridges are $5,967,177.00. The replacement value of the low risk bridges and culverts is $388,000 and $589,000, respectively.

It is important to highlight that the risk rating is used to inform the capital plan and the development of the capital plan takes into account other factors in addition to risk rating, such as scheduling, accessibility during construction and availability of funding.

Other criteria used to prioritize work are:

- Planned road work or replacement
- Development and changes service demands
- Community benefits
- Project readiness.

### 3.5.1 Performance

Performance rating for individual assets were assumed to be 'Always Reliable' for all bridges other than those with load restrictions. Existing load restrictions were provided by the OSIM 2022 report.
Table 31 provides the rating criteria based on bridge loading conditions.

There were no loading restrictions noted in the OSIM report for culverts, so it was assumed they were always reliable.

**Table 31: Performance Rating - Bridges**

| Performance | Maximum Load Restriction |
|---|---|
| 1 | No Load Restriction |
| 2 | 25 tonnes |
| 3 | 15 tonnes |
| 4 | 10 tonnes |
| 5 | 5 tonnes or less |

### 3.5.2 Importance

Bridge and culvert importance was based on their proximity to densely populated areas and traffic levels as shown in Table 32. Pipe Street Bridge is rated of high importance as it is the main route from Ayr to a Regional Road and Footbridge Road Bridge is the only bridge across the Grand River within the Township and leads to a Provincial Highway. The Jedburgh Dam Bridge is rated of moderate importance as there are alternative routes located conveniently within Ayr. Although the Shellard Road Bridge has higher traffic volumes, it is located within a rural portion of the Township and is also rated of moderate importance. All culverts were deemed to be of low importance due to their mostly rural locations and the Nithvale Bridge is currently closed to vehicular and pedestrian traffic.

**Table 32: Importance Rating - Bridges**

| Importance Rating | Bridges and Culverts |
|---|---|
| High (3) | Footbridge Road Bridge<br>Piper Street Bridge |
| Moderate (2) | Shellard Road Bridge<br>Jedburgh Dam Bridge |
| Low (1) | Nithvale Bridge<br>All Culverts |

## 3.6 Lifecycle Activities – Bridges and Culverts

The following section describes the lifecycle activities that can be implemented within the asset management strategy for bridge and structural culvert assets. Note that bridge assets refers to the entirety of the asset which is made up of bridge deck surface and bridge structure. The primary lifecycle activities include construction, inspections, maintenance and repair, replacement, and decommissioning/disposal.

### Construction

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

### Inspections

Under O. Reg. 160/02: Standards for Bridges, the Township is required to complete one inspection of all bridges and structural culverts every two years to identify condition and produce a report outlining the recommended work for a 1 to 10 year period. The inspection uses the Ontario Structural Inspection Manual (OSIM) 2008 and is referred to as the OSIM or Bridge Inspection Report. The Township should continue the current biennial OSIM Bridge Inspections along the current schedule, with the next inspections scheduled for 2024 and 2026. The inspections should include all bridges and culverts with a single or combined span greater than 3 m.

### Maintenance and Repairs

Bridge and culvert assets are long-lived assets with estimated useful lives between 15 to beyond 75 years. Throughout the lifecycle of these assets the majority of expected needs will be maintenance and repair works.

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

A general summary of bridge and structural culvert maintenance activities include, but are not limited to:

- Cleaning, washing or flushing
- Railing system maintenance
- Painting of steel bridge components
- Bearing maintenance
- Pest control
- Deck drainage maintenance

- Erosion control
- Scaling of loose concrete and ACR Steel.

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

### Replacement

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

### Disposal

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

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

Disposal activities should be implemented when a bridge or culvert structural has reached the end of its useful life, or has degraded to such a state that it can no longer provide the level of service for which it is intended. Removal of a bridge from service without replacement, or decrease in level of service should be undertaken only when it is decided to no longer be required to provide level of service to residents. Disposal activities should be conducted such that health and safety protocols are being followed, and spent materials are disposed of at appropriate or approved facility.

## 3.7 Asset Management Strategy – Bridges and Culverts

The asset management strategy for bridges and structural culverts in the Township will employ the lifecycle activities to maximize the useful life of each asset.

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

- Consequence of asset failure
- Asset risk score
- Condition of adjacent assets
- Community growth and capacity requirements.

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

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

It is recommended that the Township use the OSIM report to identify and forecast lifecycle activities for bridge and structural culvert assets. For detailed recommendations of asset management strategies refer to the 2022 OSIM Inspections for Municipal Bridges and Culverts larger than 3 meters, prepared by MEDA Engineering and Technical Services (May 31, 2022).

### 3.7.1 Scenario Analysis

To understand the needs and projected works on the bridges and culverts within a 10 year period, a summary of the recommendations from 2022 OSIM Inspections for Municipal Bridges and Culverts larger than 3 meters, prepared by MEDA Engineering and Technical Services is presented in Table 33.

The costs provided by MEDA Engineering and Technical Services were presented in 2022 Dollars and are reflective of the quantity of work required as of 2022. Quantities are expected to increase over time as assets continue to deteriorate.

**Table 33: Projection of Works for Bridge and Culvert Assets based on OSIM Inspections**

| Timing of Needs | Estimated Rehabilitation Costs |
|---|---|
| Within 1 Year | $0 |
| 1 to 5 Year Period | $2,933,568 |
| 6 to 10 Year Period | $0 |

Since there is no recommended work within the 6 to 10 year period, the costs to complete all OSIM inspection recommended work with the next 5 years is estimated to cost an average of $586,713.60 per year.

The Nithvale Bridge was not included in the 2022 OSIM inspections, but the Nithvale Bridge Pre-Design Report Draft, prepared by Jewell Engineering Inc. (March 2022), recommends a rehabilitation of the structure (identified as Alternative #2), which includes the rehabilitation of the structure with reduced deck width at an estimated cost of $1,624,120, including engineering and construction services. After rehabilitation, the estimated service life of the bridge would be 25 years. There is no recommended timeline associated with this alternative specified in the report.

Should the Township wish to rehabilitate the Nithvale Bridge as recommended within the next 10 years, the adjusted costs to complete all recommended bridge and culvert work is estimated to cost an average of $455,800 per year.

# 4.0 Stormwater Management

## 4.1 State of Local Infrastructure

The Township owns and maintains a stormwater system which includes a linear storm sewer network, catch basins, manholes and stormwater management facilities. A summary of the quantity of linear storm assets and appurtenances is provided below in Table 34.

**Table 34: Inventory of Linear Stormwater Assets**

| Asset Type | Quantity of Assets | Unit of Measure |
|---|---|---|
| Storm Sewer Mains | 11,143 | Length (m) |
| Storm Sewer Manholes | 150 | Quantity |
| Storm Sewer Catch Basins | 625 | Quantity |

In addition, there are nine stormwater management (SWM) facilities that were are currently assumed by the Township. A further breakdown of these SWM facilities and their location is provided below in Table 35.

**Table 35: Inventory of Stormwater Management Facilities**

| Facility ID | Facility Name | Facility Type | Catchment Area (ha) | Location |
|---|---|---|---|---|
| A | Main Street SWM Pond | Dry Pond | 5 | 201 Main Street |
| B | Hunt St SWM Pond | Wet Pond | 9 | 19 Hunt Street |
| C | Robert Simone SWM Pond | Wet Pond | 8.6 | 37 Robert Simone Way |
| D | Vincent Drive SWM Pond | Wet Pond/ Wetland | 61.1 | 248 Vincent Drive |
| E | Jenkings SWM Pond | Wet Pond | 8.4 | 23 Jenkings Court |
| F | Wanless SWM Pond | Dry Pond | 40.5 | Behind 120 Wanless Court |
| G | Waydom SWM Pond | Dry Pond | 42.1 | Rear of 420/500 Waydom Drive |
| H | Earl Thompson SWM Pond | Dry Pond | 17.5 | 105 Earl Thompson Road |
| I | Darrell Pond | Dry Pond | 40.5 | 132 Earl Thompson Road |

### 4.1.1 Replacement Cost

#### 4.1.1.1 Linear Assets

Replacement costs for the storm sewer network were determined based on recent tender information and product information. The replacement costs include costs necessary for full reconstruction of a segment, including trench and surface restoration. It is assumed that reconstruction works on the assets

will be done using PVC material for pipes that are less than 500 mm in diameter, and concrete material for sizes larger than 500 mm diameter.

The replacement unit costs for storm sewers are shown in Table 36. These unit rates include installation of the pipe and appurtenances (i.e., catch basins and manholes installed at spacing which aligns with current standards) and restoration. A 10% mark-up was also included in each unit cost to account for miscellaneous construction costs such as bonding, insurance, etc. Additionally, 15% of the total construction costs were added to account for engineering design fees.

**Table 36: Replacement Unit Costs for Storm Sewer**

| Pipe Diameter (mm) | Pipe Material | Replacement Unit Cost ($/metre) |
|---|---|---|
| < 250 | PVC | $1,200 |
| 250 - 500 | PVC | $1,400 |
| 500 - 1000 | Concrete | $2,100 |

Table 37 provides a total estimated replacement cost for the linear storm sewer network including appurtenances. The total estimated replacement cost is $16.244 million.

**Table 37: Replacement Unit Costs for Storm Sewer including Appurtenances**

| Pipe Diameter (mm) | Total Pipe Length (m) | Total Estimated Replacement Cost |
|---|---|---|
| < 250 | 178 | $213,600 |
| 250 - 500 | 7,138 | $9,993,200 |
| 500 - 1000 | 3,827 | $8,036,700 |
| Total | 11,143 | $16,243,500 |

#### 4.1.1.2 Stormwater Management Facilities

The replacement cost of the stormwater management facilities is estimated at $7,911,800. This is based on the assumption of a unit cost of $34,000 per hectare of drainage area, in reference to a unit cost provided in the City of Barrie's 2020 Stormwater Asset Management Plan inflated to 2022 Dollars assuming a 3% average annual inflation. The total drainage area serviced by the Township's nine stormwater management facilities is 232.7 ha.

### 4.1.2 Average Age

There is limited available information related to the age of the storm sewers. As such, it is assumed that the storm sewers are the same age as the roadway which they are installed within. Based on this assumption, the average age of the storm sewer mains by linear metre is 18.5 years. It is assumed that

the manholes and catch basins were installed at the same time as the storm sewer mains and are of a similar average age. Figure 11 shows the distribution of age of the storm sewers.

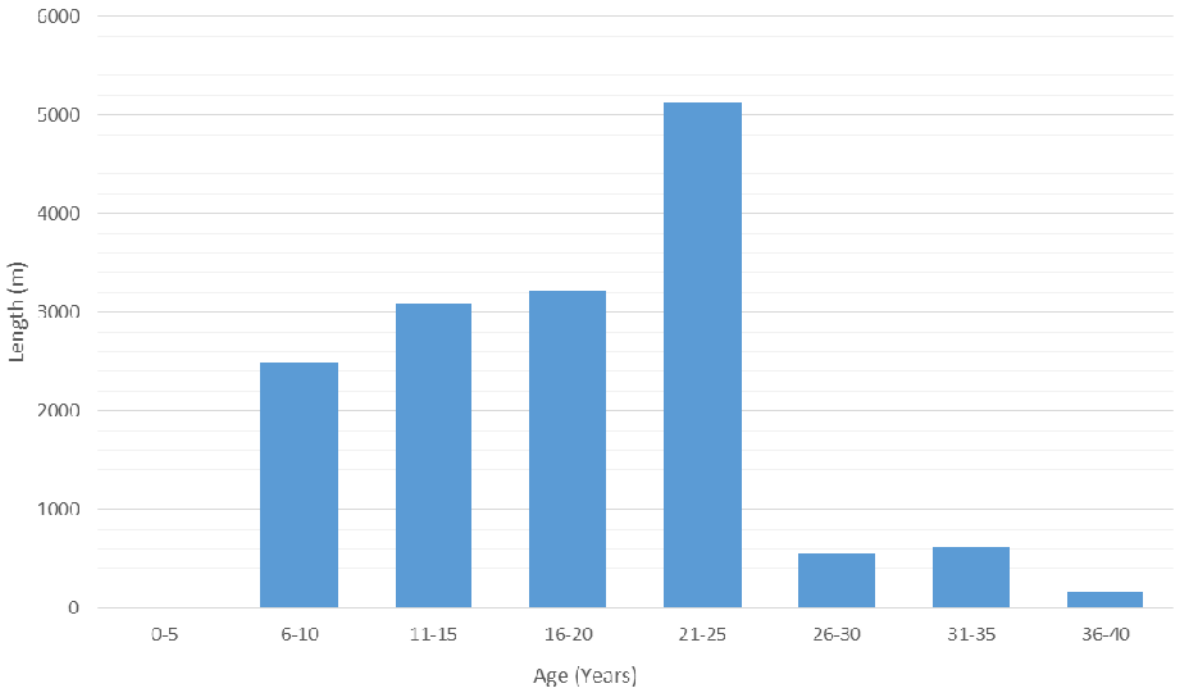



**Figure 11: Storm Sewer Age Distribution (2022)**

The average age of the existing stormwater management facilities is estimated to be approximately 30 years old.

### 4.1.3 Expected Useful Life

The expected useful life of storm sewer assets are used to estimate the replacement schedule. The expected useful life values for each type of assumed storm sewer material are summarized in Table 38.

**Table 38: Expected Useful Life for Storm Sewers**

| Pipe Material Type | Expected Useful Life (Years) |
|---|---|
| Concrete | 100 |
| PVC | 60 |

The expected useful life of SWM facilities varies depending on the type of facility (wet pond or dry pond) and the rate of sediment accumulation and the frequency of clean outs that are completed. According to Infrastructure Canada, the average expected useful life of stormwater management facilities is 50 years.

## 4.2 Condition – Stormwater Management

### 4.2.1 Linear Assets

A summary of the average condition of stormwater management linear assets, weighted by length of pipe, is included in Table 39. The condition is reported on a scale of 0 to 100, where 100 represents an asset in new condition. The average condition of all linear stormwater assets (by length) is Very Good.

**Table 39: Average Condition of Linear Stormwater Assets**

| Pipe Material | Total Length (m) | Average Condition Score | Average Condition Rating |
|---|---|---|---|
| Concrete | 3,827 | 99.2 | Very Good |
| PVC | 7,316 | 97.9 | Very Good |
| Total | 11,143 | 98.3 | Very Good |

### 4.2.2 Stormwater Management Facilities

Inspections of the existing SWM facilities were conducted by Township staff in June 2022. The conditions of SWM facilities were assessed using the rating system outlined in Table 40 with the condition results summarized in Table 41. The scoring system evaluates each facility with the lower score indicative of fewer issues. Under the assumption that each criteria is weighted equally, an average condition score has been calculated with all nine facilities with an average score of 3.1 (Attention required).

**Table 40: Condition Rating System of Stormwater Management Facilities**

| Condition Rating | Description |
|---|---|
| 1 | Excellent (the component has no deterioration) |
| 2 | Satisfactory (some wear is noticed, but does not affect the functionality of the component) |
| 3 | Attention Required (the component is still functioning but has minor problems that may prevent the component from functioning properly during extreme events – some simple upkeep is required) |
| 4 | Non-Functional (the component is no longer functioning as designed) |
| 5 | Non-functional and deterioration, but not causing a safety hazard |
| 6 | Safety Hazard (the component presents a safety hazard either because it allows access to restricted areas, e.g. a grate on a pipe is not secure, or the component is structurally unsound e.g. erosion of the access road). |
| N/A | Not observed or does not exist |

**Table 41: Stormwater Management Facilities Condition Summary**

| Criteria | SWM Facility Condition Score | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I |
| General facility appearance | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Inlet and outlet structures | 3 | 4 | 2 | 3 | 5 | 3 | 3 | 2 | 4 |
| Low flow channels | N/A | N/A | 2 | 3 | 5 | N/A | N/A | N/A | 5 |
| Emergency overland spillway | 4 | 2 | 2 | 3 | 5 | 3 | 3 | 3 | 4 |
| Vegetation | 5 | 5 | 5 | 5 | 2 | 5 | 5 | 2 | 3 |
| Access road and walkway | 5 | 5 | 5 | 5 | 3 | 4 | 4 | 3 | 3 |
| Perimeter fencing | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | N/A |
| Presence of erosion, unsafe conditions, nuisance issues, encroachments, poor water quality, etc. | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| Sediment accumulation | 4 | 4 | 2 | 3 | 5 | 5 | 5 | 2 | 2 |
| Public safety | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total Condition Rating Score | 31 | 30 | 27 | 31 | 35 | 31 | 31 | 19 | 26 |
| Overall Average Condition | 3.4 | 3.3 | 2.7 | 3.1 | 3.5 | 3.4 | 3.4 | 3.1 | 2.9 |

The results of the condition assessments identify that several of the stormwater facilities require operation and maintenance activities, including sediment removal and vegetation maintenance. Not addressing this backlog of maintenance activities will result in poor water quality and failure to meet regulatory requirements. The Jenkings SWM facility, which scored the highest overall condition score of 3.5, is being cleaned out in 2022.

## 4.3 Current Levels of Service – Stormwater Management

Levels of service for stormwater assets are outlined in Table 3 of the regulation, O.Reg. 588/17. Table 42 and Table 43 outline the Township's current community and technical levels of service for stormwater assets.

**Table 42: Community Levels of Service – Stormwater Management**

| Service Attribute | Community Levels of Service (Qualitative Description) | Community LOS |
|---|---|---|
| **Scope** | Description, which may include maps, of the user groups or areas of the Municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system. | The stormwater management system in the Municipality is devised of a pipe network and drains, which provide conveyance of stormwater from roadways. The extents of the network are shown in **Appendix A**. |

**Table 43: Technical Levels of Service – Stormwater Management**

| Service Attribute | Technical Levels of Service (Technical Metrics) | Technical LOS |
|---|---|---|
| **Scope** | Percentage of properties in municipality resilient to a 100-year storm. | Approximately 24% of the Ayr Urban Area is resilient to a 100-year storm. This is equivalent to approximately 10% of the properties in the Township. |
| **Scope** | Percentage of the municipal stormwater management system resilient to a 5-year storm. | Approximately 24% of the Ayr Urban Area is resilient to a 5-year storm. This is equivalent to approximately 10% of the properties in the Township. |

## 4.4 Current Performance – Stormwater Management

Asset performance measures were determined in consultation with the Township, which provide relevant metrics against which the Township can gauge the performance of their assets. The performance measures for stormwater management assets and their current values are shown in Table 44.

**Table 44: Stormwater Management Performance Measures**

| Asset Performance Measures | Current Value |
|---|---|
| Percentage of the Ayr community with stormwater quality and quantity control | Currently approximately 24% of the area in the Ayr Urban Area has quality and quantity control. This value with continue to increase as the Township undertakes road construction to implement SWM facilities. |
| Inspection frequency of stormwater ponds and catch basins | Annual inspection (initiated in 2021) |

## 4.5 Risk Assessment – Stormwater Management

The risk rating for the stormwater management network followed the risk methodology and approach presented in Section 1.1. The risk profile for the stormwater management network is shown in Figure 12.

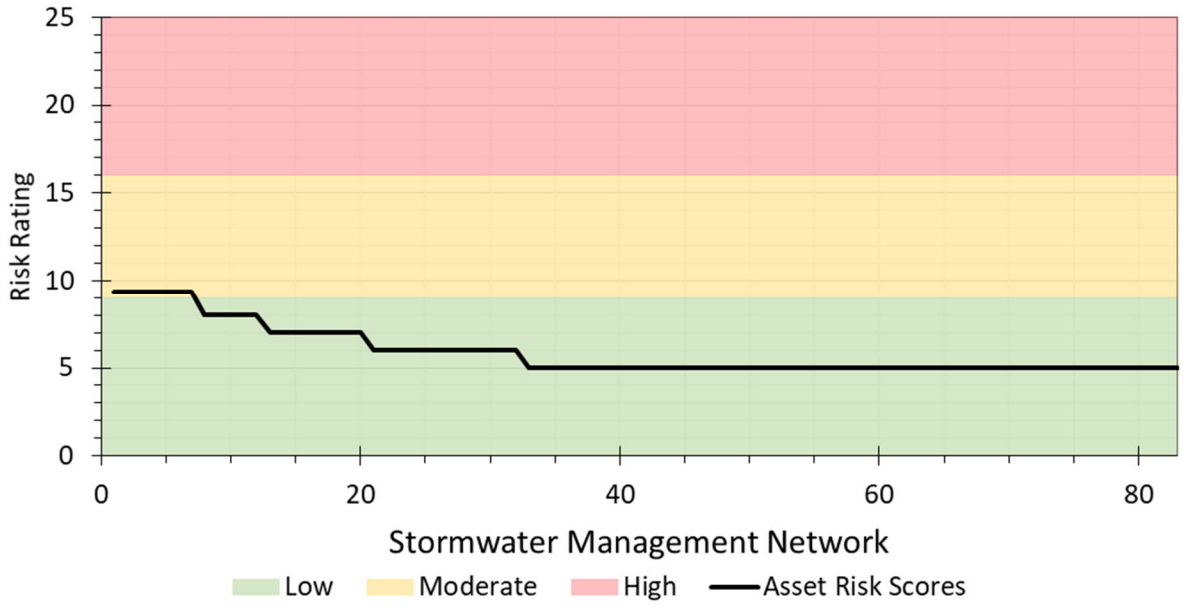



**Figure 12: Stormwater Network Risk Profile**

The majority of the storm sewer network were classified to be low risk based on the established criteria. Seven of the nine stormwater management facilities were classified as moderate risk, primarily due to their poorer condition. The condition of the entire storm sewer network was selected as 'Very Good' based on the assumed age of the network and the performance information that was calculated.

It is important to highlight that the risk rating is used to inform the capital plan and the development of the capital plan takes into account other factors in addition to risk rating, such as scheduling, accessibility during construction and availability of funding.

Other criteria used to prioritize work are:

- Planned road work or replacement;
- Development and changes in stormwater service demands;
- Community benefits; and
- Project readiness.

### 4.5.1 Performance

The performance of the entire stormwater management network was assumed to be 'Always Reliable'.

### 4.5.2 Importance

Moderate importance was applied to all linear storm sewer mains and high important to the stormwater management facilities.

## 4.6 Lifecycle Activities – Stormwater Management

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

### Construction Activities

The design of the new assets should be consistent with jurisdictional design requirements, including provincial design guidelines, local and conservation authority requirements. New construction of assets will occur where no previous stormwater servicing is available. The risk associated with new construction includes the high cost of brand new assets, and capacity for treatment and outlet of the stormwater flows.

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

### Maintenance Activities

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

Routine inspections of the conditions of SWM facilities and catch basins should be completed on an annual basis to identify any necessary cleaning and maintenance activities required.

The condition of the drainage area can have a significant impact on the maintenance cycle of a SWM facility. Soil erosion, construction and upstream sources of contamination should be identified and addressed in a timely manner. Addressing sediment and other contaminants at their source, in the contributing drainage area, is often much more manageable and cost effective than to remove sediment that has already accumulated in the facility.

- Measures that can be taken to manage pollutant sources before they reach the SWM facility include: Erosion and sediment control measures during construction
- Regular catch basin cleaning
- Regular street sweeping
- Reducing pesticide and fertilizer use

- Industrial pollution prevention programs
- Optimizing practices for winter snow and ice management.

Any structural components associated with the SWM facilities should be regularly inspected in order to proactively identify when corrective actions will be needed. Inspection of structural components can reveal reasons for hydraulic malfunctioning (too high or too low water levels) which need to be addressed immediately. Inlets or outlets can become clogged with sediment and debris.

If an inspection reveals, that the water levels are higher than expected after several days of dry weather, this may be an indication that the outlet is clogged with sediment, garbage and/or debris. Minor clogs that are accessible can be cleaned out by hand, but more significant clogs should be removed by flushing or a combination of jet washing and suctioning with a vacuum truck.

### Renewal Activities

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

To ensure long-term effectiveness, the sediment that accumulates in a SWM facility should be periodically removed. The required frequency of sediment removal varies between facilities and is dependent on several factors, including the type of facility and characteristics of the contributing drainage area. Sediment accumulation will typically be rapid for the entire construction period, but once the catchment area is completely developed and vegetation is established, sediment accumulation drops significantly.

Slow degradation of concrete structures can be caused by the sustained flow of sediment-laden stormwater and scour and freeze/thaw cycles. The need for structural repairs must be identified through routine preventative maintenance visits.

### Operating

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

### Decommissioning Activities

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

## 4.7 Asset Management Strategy – Stormwater Management

### 4.7.1 Linear Assets

The asset management strategy for the storm sewer mains in the Township will employ the lifecycle activities to maximize the useful life and economy of each asset. The primary indicator used in the development of a lifecycle strategy is the condition of each asset, however the strategy should be also consider other factors, such as:

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

As the Township continues to age and develop, these factors will continue to change, and each have an impact on the lifecycle of an asset. Consideration of these factors should be given when devising capital project outlooks and budgeting, and updating of the asset management plan.
The assets will deteriorate on a non-linear basis, and the various lifecycle activities can be implemented at varying stages within an assets deterioration. Figure 13 provides a visualization of the theoretical deterioration curve for an asset, and the opportunity windows to conduct lifecycle activities within the expected useful life of an asset.

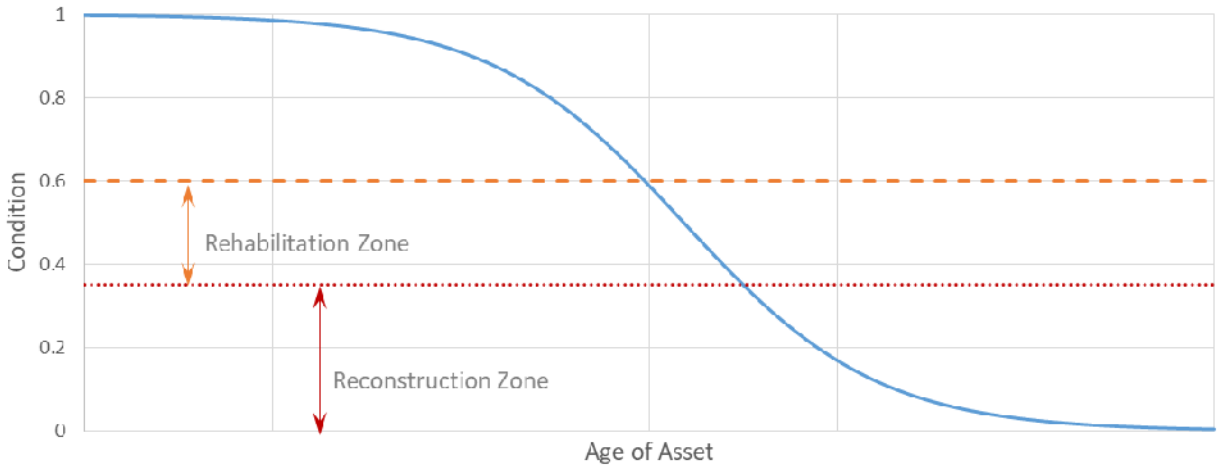



**Figure 13: Deterioration of Storm Sewer Assets and Lifecycle Activity Opportunities**

In reference to Figure 13, it is expected that maintenance and operating activities will occur through the full lifecycle of the asset. Renewal works are most appropriately employed within the rehabilitation zone, and reconstruction and decommissioning will most likely occur within the reconstruction zone.

The condition, a major factor in the asset management strategy, should be established to assist in decision making. The Township should establish/maintain a condition assessment program for the storm sewers. The recommendation is to use visual inspection facilitated by CCTV or Zoom camera inspection on a 3 to 5 year basis.

When the condition of the asset has degraded such that an intervention is required, it is recommended that maintenance be reviewed as the first opportunity to extend the useful life. Maintenance works can include localized repair work, or relining of a storm sewer pipe segment. Because of the non-intrusive nature of conducting relining, it can be done on an individual pipe segment at a time, or to localized repairs.

When the condition of the asset has degraded such that maintenance is no longer an appropriate activity, the segment can and should be reconstructed. The Township should follow best practices and applicable design guidelines when designing the reconstruction works. Assets at the end of their useful life should be abandoned in place or removed.

A summary of recommended storm sewer pipe condition and associated lifecycle activity is provided in Table 45. Note that condition assessment should be undertaken on a routine basis throughout the lifecycle of the asset, and other factors should be considered when selecting a lifecycle activity.

**Table 45: Storm Sewer Lifecycle Activities and Condition Ranges**

| Condition Range | Condition Description | Lifecycle Activity Category | Lifecycle Activity |
|---|---|---|---|
| 1.0 to 0.60 | Very Good to Good | Maintenance | Maintenance Works (cleaning, flushing)<br>Manhole repairs<br>Small pipe section repairs |
| 0.60 to 0.35 | Good to Fair | Rehabilitation | Localized repairs<br>Structural relining |
| 0.35 to 0.0 | Poor to Very Poor | Reconstruction | Pipe replacement or abandonment |

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

### 4.7.2 Stormwater Management Facilities

When sediment accumulation in a SWM facility has reached a point where removal efficiency has been reduced by 5% or more, sediment removal is required, as recommended in the MECP's Stormwater Management Planning and Design Manual (March 2003). In-situ measurement of sediment depth can also be carried out regularly (at least every three to five years) to determine when cleanout will be required. Once sediment dredging is complete, the facility is returned to its original design capacity and is again capable of providing effective hydraulic and water quality control.

### 4.7.3 Scenario Analysis

#### 4.7.3.1 Linear Assets

To understand the needs and projected works on the linear storm pipes within a 20-year timeframe, reconstruction and rehabilitation activities (i.e., relining) were reviewed under varying budget values to understand the impact on overall network condition. The budgets analyzed include:

1. Unlimited budget – To determine backlog of works
2. No budget – To understand the changes in average network condition with no investment
3. 2% of network value – Best practice of investment.

A multi-year projection scenario was run using the budgets noted above. The results of the varying scenarios indicated reconstruction works identified during a 20-year timeframe. A summary of the analysis is outlined below in Table 46.

**Table 46 Budgets Reviewed for Storm Sewer Works Projections**

| Scenario | Budget | Annual Value | Average Annual Investment over Timeframe | Total Investment over Timeframe | Average Condition Index (End of Timeframe) |
|---|---|---|---|---|---|
| 1 | Unlimited budget | Unlimited | $0 | $0 | 0.90 |
| 2 | No budget | $0 | $ - | $ - | 0.90 |
| 3 | 2% of network value | $543,414 | $0 | $0 | 0.90 |

Best practice recommends maintaining an average condition index of 0.6 across the system. Note that the overall condition of the assets is such that if no budget is spent on the system, after the 20- year timeframe the average condition would be within the acceptable range, with the average condition still in a 'Very Good' range.

The storm sewer assets were assessed to be in Very Good condition, with no immediate needs for the system. In the 20-year timeframe, there were no identified investments with the network maintaining an average condition index of 0.9 across the network.

An analysis was also undertaken to understand impacts of relining activities on the overall condition of the network, and associated costs. The unit costs for relining are shown in Table 47.

**Table 47: Expected Unit Relining Costs for Storm Sewers**

| Pipe Diameter | Relining Unit Cost ($/m) |
|---|---|
| Under 250 mm | $250 |
| 250 mm to 400 mm | $400 |
| Larger than 400 mm | $1,000 |

Relining is assumed to be an appropriate lifecycle activity when a pipe asset has a condition rating of between 0.35 and 0.6. Thus, relining activities are triggered if a segment is within that range at the outset of the analysis period, or when an asset degrades to a 0.6 condition rating. Further, relining is not expected to return an asset to perfect condition, therefore the condition index reaches only a 0.8 after relining work is completed. Using an unlimited budget to understand the extents of relining that can be undertaken to prolong the useful lifecycle of the assets, the assets were analyzed to determine the potential needs for relining, and the impact on the average condition of the assets. Within a 20-year timeframe, a total cost of $66,800 is estimated to be required.

Relining activities are recommended to be undertaken once per asset lifecycle, after which the pipe should be a candidate for reconstruction once condition has sufficiently degraded. The activities shown in the table above are limited to one occurrence of relining per segment.

#### *4.7.3.2* Stormwater Management Facilities

It is recommended that due to the existing condition of the stormwater management facilities that maintenance and renewal lifecycle activities be completed in order to extend the useful lives of the facilities. These activities should be determined on an individual facility basis based on existing conditions. Best practice for investment of non-linear stormwater management assets is to reinvest 2% of the replacement value of the assets in order to fund these lifecycle activities in the future.

# 5.0 Financing Strategy

## 5.1 Introduction

This chapter outlines the financing strategy that would sustainably fund the lifecycle management strategies presented in previous sections. This financing strategy focuses on examining how the Township can fund the lifecycle activities required to maintain its assets at the desired levels of service. The strategy presented is a suggested approach which should be examined and re-evaluated during the annual budgeting processes to ensure the sustainability of the Municipality's financial position as it relates to its assets.

O. Reg. 588/17 requires a 10-year capital plan that forecasts the costs of implementing the lifecycle management strategy and the lifecycle activities identified in the asset management plan. Various financing options, including reserve funds, debt, and grants can be considered during the process of developing the financing strategy.

## 5.2 Funding

The lifecycle costs required to sustain established level of service targets are being recovered through several methods:

- Ontario Community Infrastructure Fund (OCIF)
- Canada Community-Building Fund (CCBF)
- Aggregate Reserve funding
- Available grant funding
- Tax based levy

The Township will be dependent upon maintaining healthy Infrastructure Reserve funds in order to provide the remainder of the required lifecycle funding over the forecast period. This will require the Township to proactively increase amounts being transferred to these capital reserves during the annual budget process.

## 5.3 Reinvestment Rates

Increasing reinvestment rates will stop the deterioration of municipal infrastructure. The 2016 Canadian Infrastructure Report Card found that rates of reinvestment are lower than targets recommended by asset management practitioners. The rate can vary based on factors such as the age of the infrastructure, the level of service and risk tolerance. The values provided are based on the experience of municipal asset management practitioners and are intended to be informative in nature. Table 48 demonstrates the gap between current and target reinvestment levels for the core assets that the Township owns. Lack of or insufficient reinvestment will result in a gradual decline of physical condition

levels that will impact municipal services. When contrasted with target reinvestment rates it becomes clear that current levels of reinvestment in municipal infrastructure are inadequate.

**Table 48: Target Reinvestment Rates vs 2016 Reinvestment Rate**

| Infrastructure Category | Lower Target Investment Rate | Upper Target Investment Rate | Canadian Average Reinvestment Rate (2016) |
|---|---|---|---|
| Roads and Sidewalks | 2.0% | 3.0% | 1.1% |
| Bridges | 1.0% | 1.5% | 0.8% |
| Stormwater (linear) | 1.0% | 1.3% | 0.3% |
| Stormwater (non-linear) | 1.7% | 2.0% | 1.3% |

## 5.4 Annual Costs

Table 49 presents the annual lifecycle costs in 2022 dollars by asset class for the 2023-2032 forecast period. This expenditure forecast is based on the lifecycle activities identified in preceding sections of this plan and includes anticipated renewal/replacement activities required to achieve desired levels of service.

**Table 49: Annual Average Investment Forecast**

| Asset Category | | Annual Average Investment | Reinvestment Rate |
|---|---|---|---|
| Roads | | $2.8 million | 2.1% |
| Bridges and Culverts | | $455,800 | 3.7% |
| Stormwater Managment | Linear | $211,166 | 1.3% |
| | SWM Facilities | $158,236 | 2.0% |

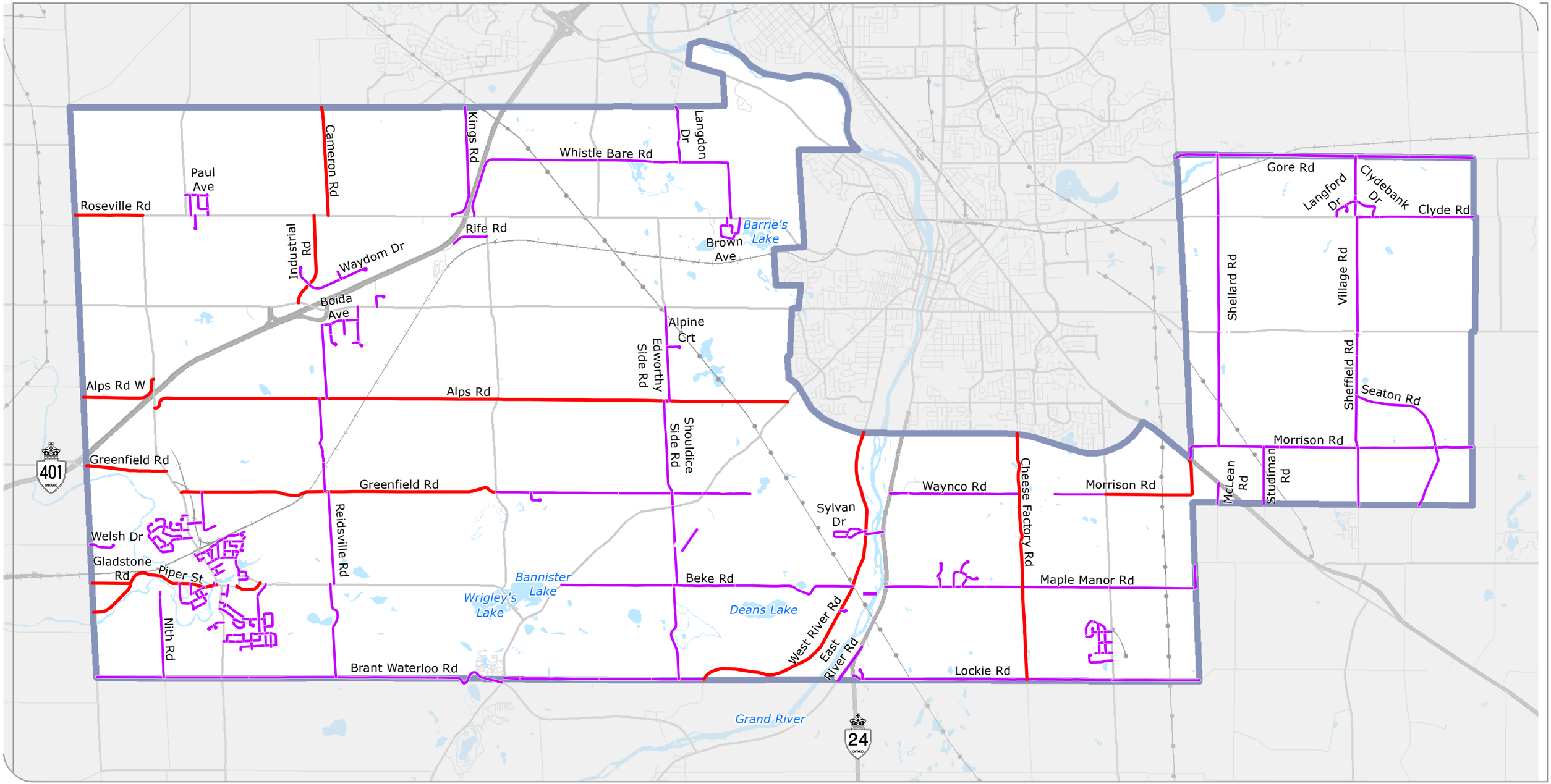
DILLON CONSULTING LIMITED
LONDON, ONTARIO

# Appendix A

## *Current Level of Service Maps (Scope)*



DILLON CONSULTING




# NORTH DUMFRIES
Infrastructure Study

## GENERAL ROAD NETWORK INVENTORY

**Surveyed Road**
- Arterial
- Collector*
- Local

**Base Data**
- Highway
- Major Road
- Minor Road
- Railway
- Utlitiy Line
- Municipal Boundary
- Water Body

*Collector roads includes Primary and Secondary Township Roads per the Township's Official Plan

SCALE 1:65,000

0 750 1,500 3,000 m

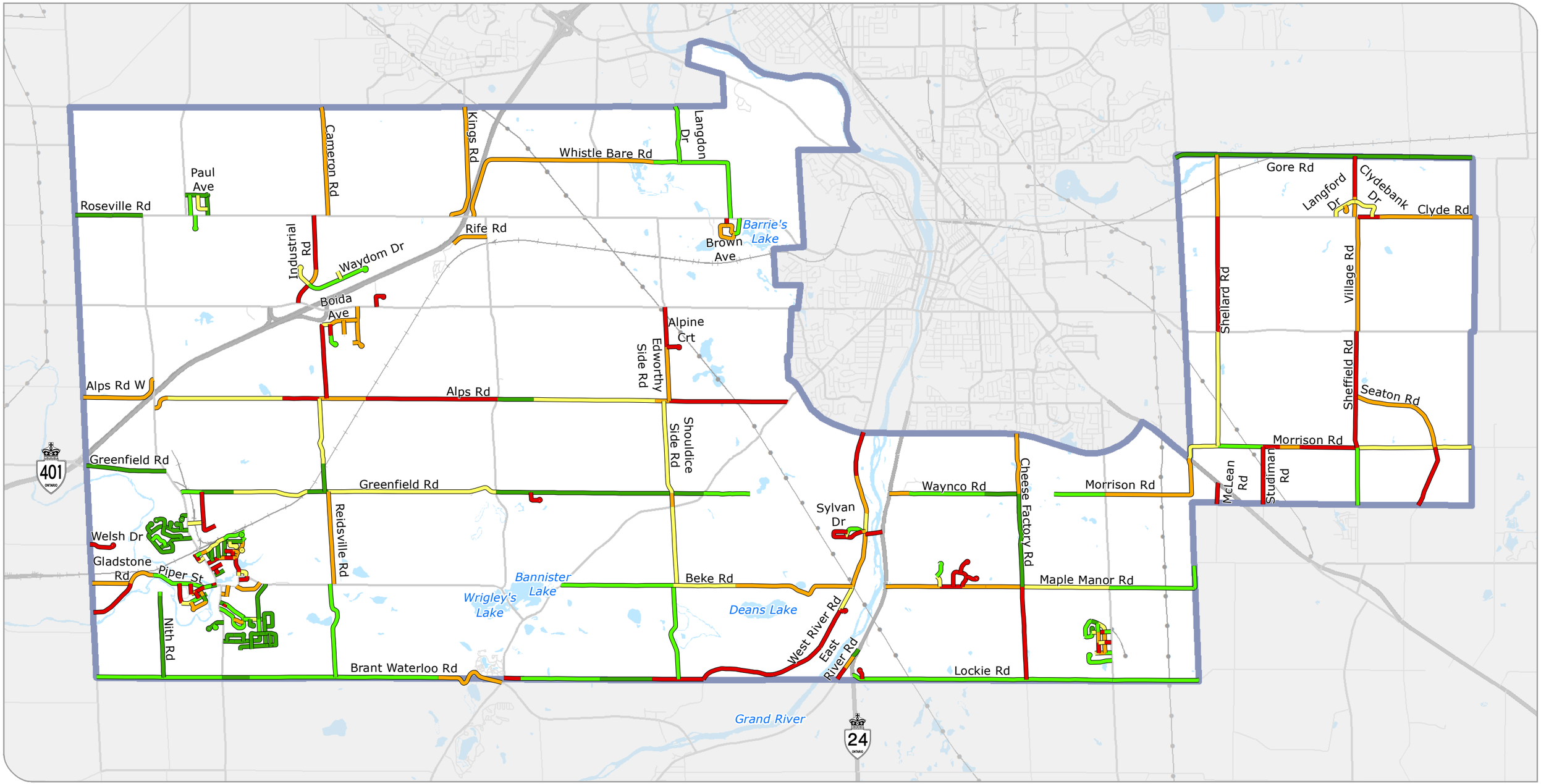
MAP DRAWING INFORMATION:
Base Data by MNRF, Data provided by Dillon Consulting Limted and Total Pave

MAP CREATED BY: LMM
MAP CHECKED BY: -
MAP PROJECTION: NAD 1983 UTM Zone 17N

PROJECT: 22-3722 STATUS: DRAFT DATE: 2022-06-10

DILLON CONSULTING

FILE LOCATION: K:\2022\223722\Product\Client\Report_May2022\223722_F1_GeneralRoadNetworkInventory.mxd




**NORTH DUMFRIES**
Infrastructure Study

**ROAD NETWORK BY CONDITION 2022**

**Condition 2022**
- Very Poor
- Poor
- Fair
- Good
- Very Good

**Base Data**
- Highway
- Major Road
- Minor Road
- Railway
- Utlitiy Line
- Municipal Boundary
- Water Body

SCALE 1:65,000

0 750 1,500 3,000 m

MAP DRAWING INFORMATION:
Base Data by MNRF, Data provided by Dillon Consulting Limted and Total Pave

MAP CREATED BY: LMM
MAP CHECKED BY: -
MAP PROJECTION: NAD 1983 UTM Zone 17N

PROJECT: 22-3722 STATUS: DRAFT DATE: 2022-06-10

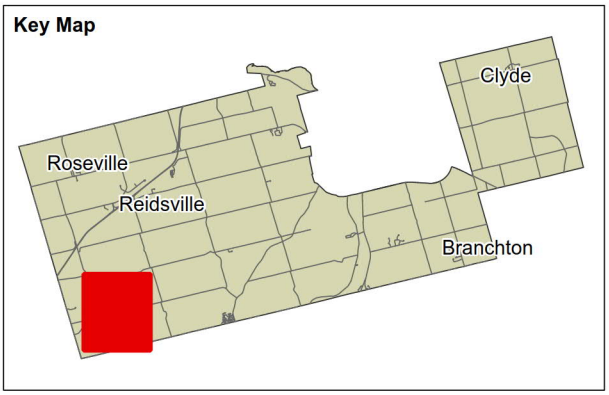
DILLON CONSULTING

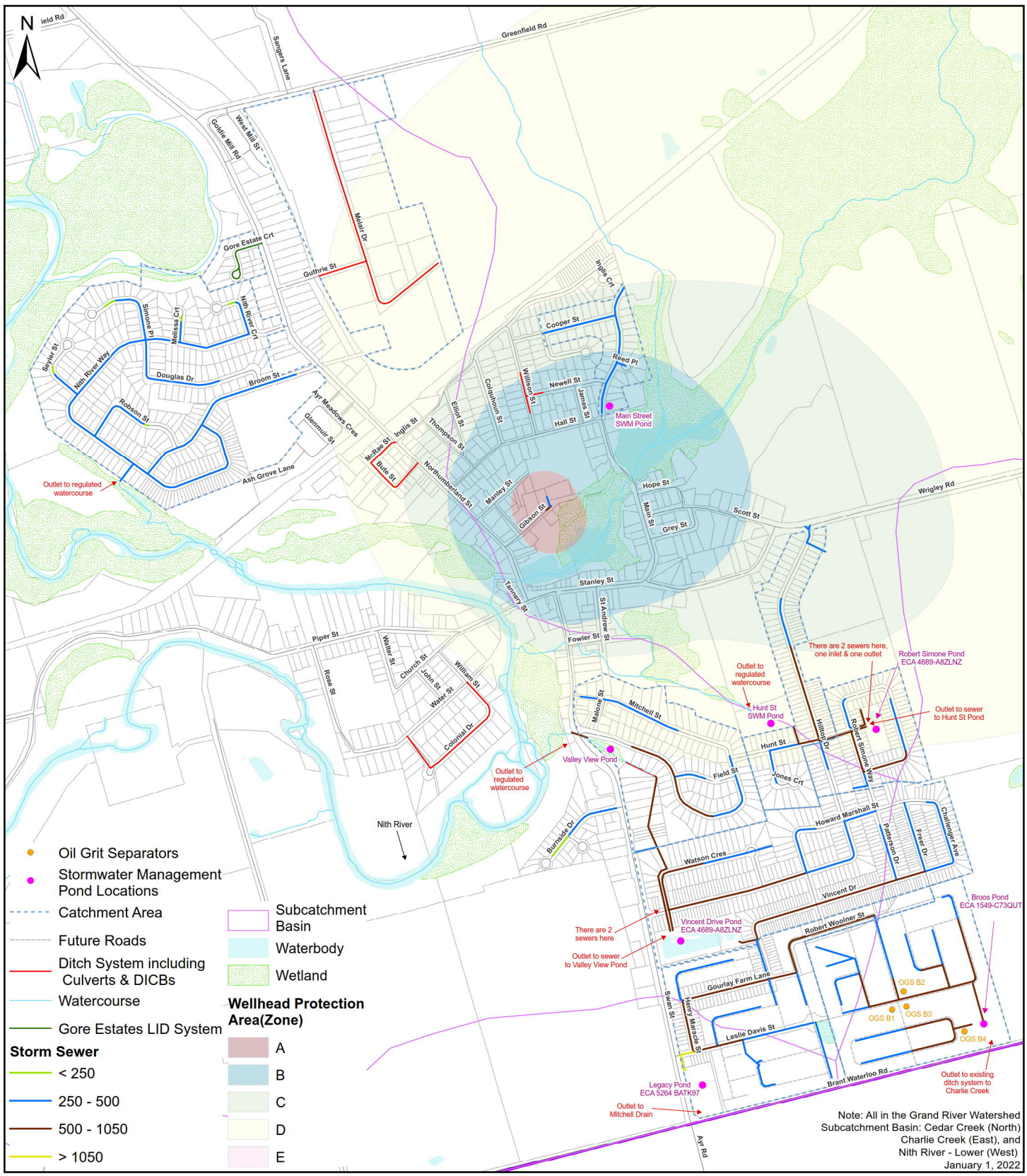
FILE LOCATION: K:\2022\223722\Product\Client\Report_May2022\223722_F4_RoadNetworkbyTimeofNeed.mxd

The TOWNSHIP of NORTH DUMFRIES

# Ayr

0 75150 300 450 600 Meters



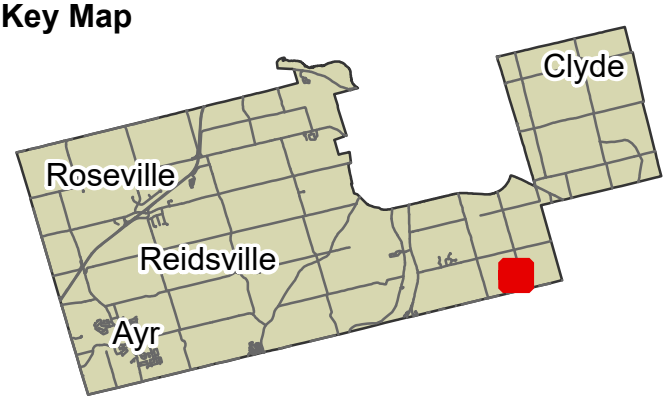




Note: All in the Grand River Watershed
Subcatchment Basin: Cedar Creek (North)
Charlie Creek (East), and
Nith River - Lower (West)
January 1, 2022

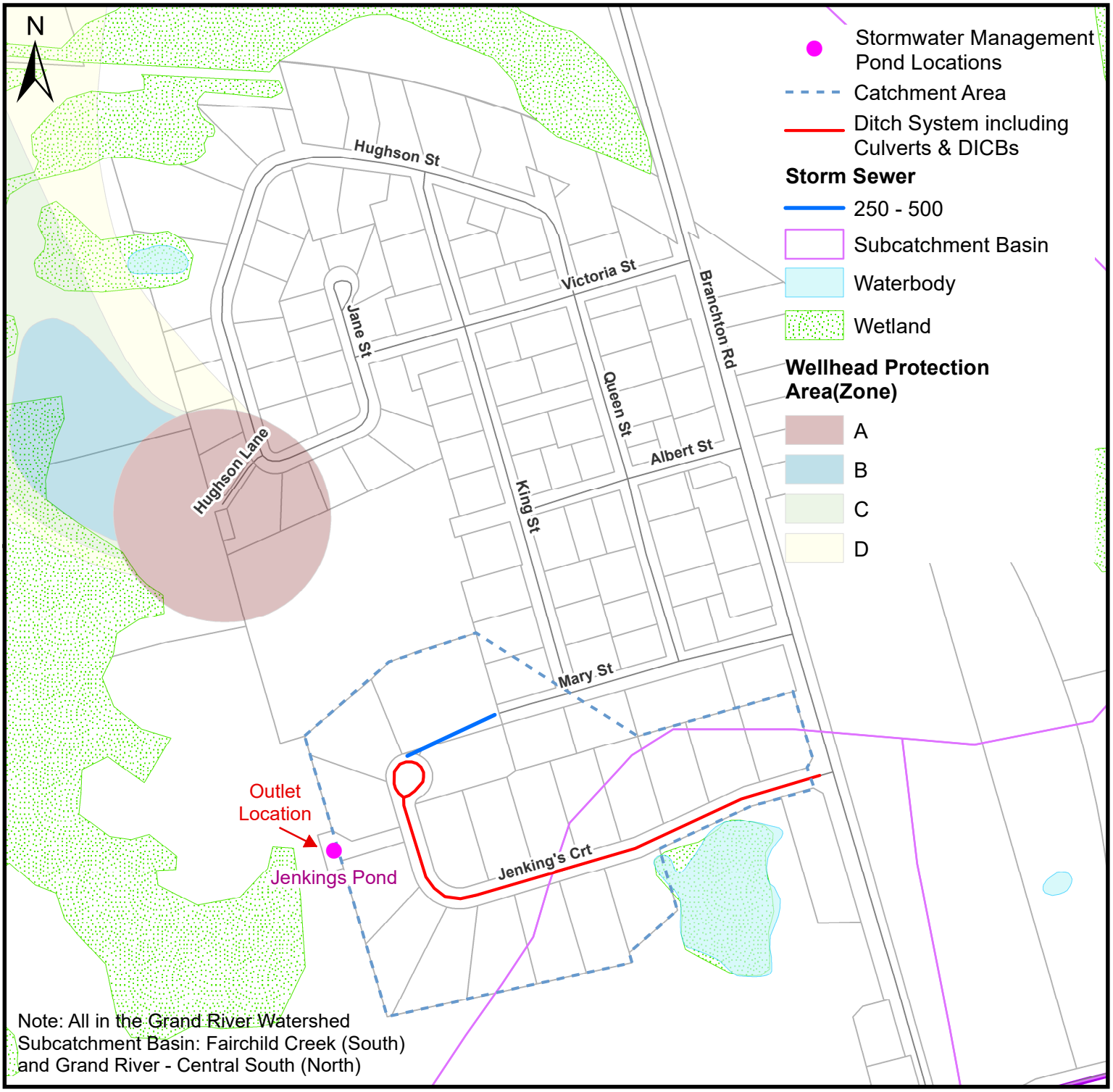
The TOWNSHIP of NORTH DUMFRIES

# Branchton

**Key Map**




0 25 50 100 150 200 Meters



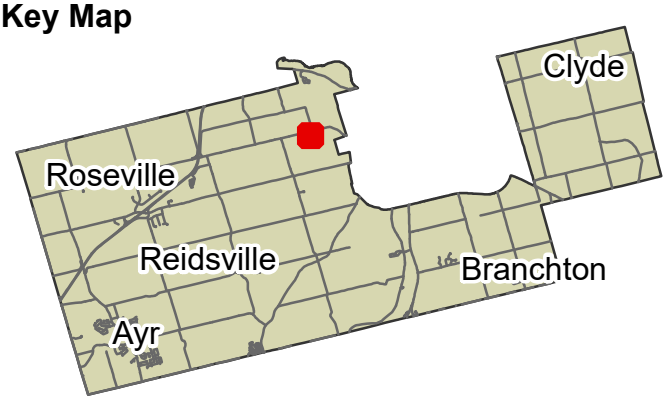

Note: All in the Grand River Watershed
Subcatchment Basin: Fairchild Creek (South)
and Grand River - Central South (North)

January 1, 2022

The TOWNSHIP of NORTH DUMFRIES

# Browns

**Key Map**




0 15 30 60 90 120 Meters

- Stormwater Management Pond Locations
- Catchment Area
- Ditch System including Culverts & DICBs
- Subcatchment Basin
- Waterbody
- Wetland

**Wellhead Protection Area(Zone)**

- A
- B
- C
- D

N

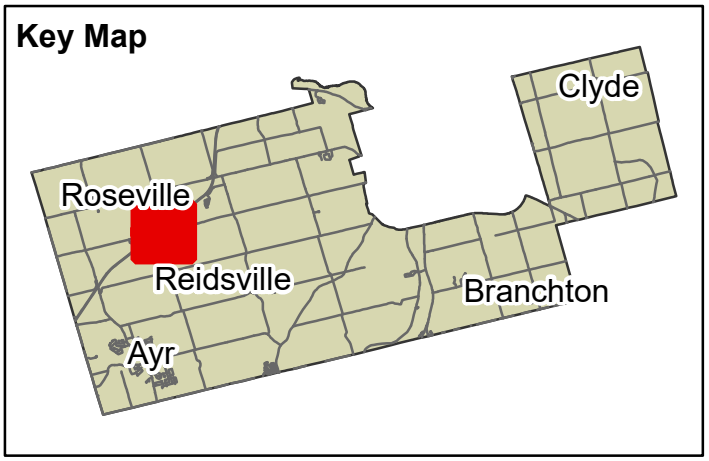
Whistle Bare Rd
Roseville Rd
Four House Lane
Hillside Ave
Brown Ave
Oakwood Dr
Orr's Lake Rd
Browns Pond
Surface drainage to wetland

Note: All in the Grand River Watershed
Subcatchment Basin: Bechtel Creek (West) and Grand River - Central South (East)

January 1, 2022

The TOWNSHIP of NORTH DUMFRIES

# Industrial Area
# Hwy 401 & Regional Rd 97




0 60 120 240 360 480
Meters

N

No outlets as it's all infiltration

Waydom Pond

No outlets as it's all infiltration

Wanless Pond

Industrial Rd

Waydom Dr

Wanless Crt

Hwy 401

Hwy 401

Cochran Dr

Cochran Pond

Cedar Creek Rd

No outlets as it's all infiltration

Earl Thompson Pond

Boida Ave

Earl Thompson Rd

Harmony Rd

Darrell Dr

Darrell Dr

401 W Off to Cedar Creek Rd

Off to Cedar Creek Rd

Reidsville Rd

Darrell Pond

No outlets as it's all infiltration

Stormwater Management Pond Locations
Catchment Area
Ditch System including Culverts & DICBs

**Storm Sewer**

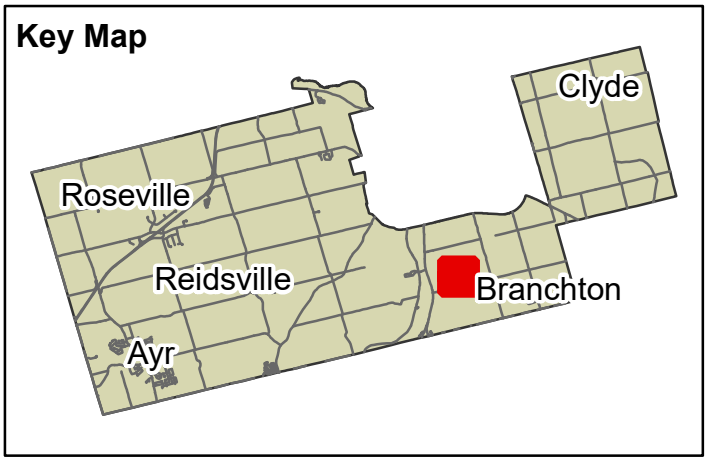
250 - 500
500 - 1050
Subcatchment Basin
Waterbody
Wetland

Note: All in the Grand River Watershed
Subcatchment Basin: Eden Creek (South/West) and Cedar Creek (North/East)

January 1, 2022

The TOWNSHIP of NORTH DUMFRIES

# Ranchlands




0 35 70 140 210 280 Meters

Stormwater Management Pond Locations

Catchment Area

Watercourse

**Storm Sewer**

500 - 1050

Ditch System including Culverts & DICBs

Wetland

N

No outlet as it's all infiltration

Ranchlands Pond

Autumn Maple Cres

Red Maple Crt

Sugar Maple Crt

Silver Maple Cres

Misty Maple Trail

Maple Manor Rd

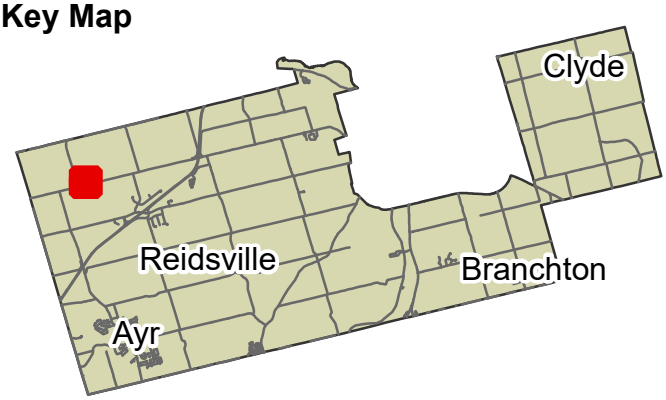
Note: All in the Grand River Watershed
Subcatchment Basin: Grand River - Central South

January 1, 2022

The TOWNSHIP of NORTH DUMFRIES

# Roseville

**Key Map**




0 25 50 100 150 200
Meters

N

Catchment Area
Watercourse
Ditch System including Culverts & DICBs
Waterbody

**Wellhead Protection Area(Zone)**

A
B
C
D
E

Paul Ave
Fischer-Hallman Rd
Roseview Cres
Marshall Ave
Roseville Rd

Ditches discharge to Regional Storm Sewer System

Note: All in the Grand River Watershed
Subcatchment Basin: Eden Creek

January 1, 2022