Comprehensive Road Needs Study 2024

Contract #2024-PW-03

PREPARED FOR

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Executive Summary

Montague Township's road infrastructure encompasses loose top, surface treated, and asphalt roads with different levels of traffic. This document outlines a suggested Ten-Year Capital Program and a Loose Top Maintenance Program, formulated based on the historical capital expenditures shared by Township staff. These plans aim to assist Municipal Staff and Council in their decision-making processes. The Ten-Year Capital Program gives precedence to high-traffic and semi-urban roads, emphasizing overlay projects for asphalt roads and single surface treatments for surface treated roads. For asphalt roads, overlay projects are the most cost-effective, followed by pulverize and pave or partial depth reconstruction. For surface treated roads, single surface treatments are the most economical, followed by partial depth reconstruction.

Despite plans to spend approximately $2.5 million over the next ten years, the road system will deteriorate without greater financial commitment. The current road quality and the integrity of the underlying gravel base are threatened by inadequate spending on road restoration and maintenance. It is estimated that approximately $35,600 per year needs to be added to the current average annual budget of $474,000 to maintain the current level of service. Funding opportunities, such as government grants, may be considered to help offset the additional costs.

Maintaining road infrastructure through timely rehabilitation is the most cost-efficient strategy. A proactive approach, including condition rating assessment studies conducted on a 5-year basis, will provide meaningful management information for decision-making. Regular updates and reassessments are recommended to adapt to evolving needs and conditions.

In conclusion, the Roads Needs Study provides a strategic framework for managing the road infrastructure in Montague Township. Through proactive and well-informed decision-making, the Township can ensure sustainable maintenance and improvement of its road network, ultimately benefiting the community and its long-term growth.

1.0 INTRODUCTION

The Comprehensive Roads Needs Study provides Council and Township staff with an inventory of all roads within the Township, a review of the existing conditions, with a plan for maintenance and repair of roads to maintain a satisfactory level of service as deemed acceptable by council.

The report provides the Township with a suggested capital program to manage the roads over the next 10 years. It is recommended that the study be repeated on a 5-year cycle to allow for a meaningful review of assumptions made, results of implementation of maintenance strategies and review updated needs of the roads and how to improve road networks to address these needs. This report represents an update to the study performed in 2020.

The RNS will achieve:

1) Identify current and future needs within the road networks;
2) Provide a cost-effective maintenance strategy, and;
3) Provide a 10-year Capital Plan for consideration.

The study contains:

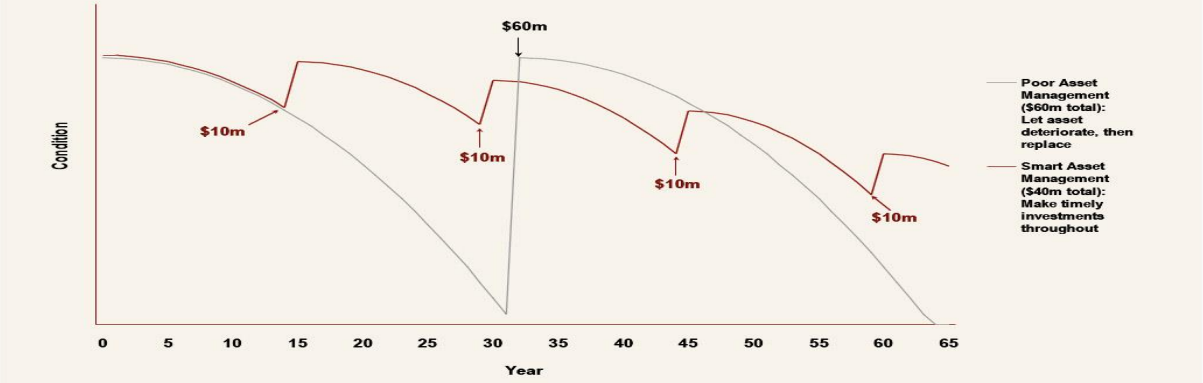
1) 2024 field review;
2) Recommendations for maintaining assets;
3) Updated road inventory;
4) Condition rating;
5) Recommendation on deficient or deteriorated roadways;
6) Cost-effective long-term maintenance and upgrade strategy;
7) Recommend 10-year capital improvement plan using proposed capital budgets, and;
8) Summary of capital improvements/maintenance that cannot be addressed with current budgets.

Effective asset management is vital for all governmental levels, as it leads to well-informed and strategic decisions that maximize investments and mitigate risks, including infrastructure failures and the effects of climate change, such as damage from severe weather. The Ministry of Transportation demonstrates this by employing preventative maintenance methods to prolong pavement lifespan. Methods like crack sealing, hot mix patching, and applying thin surface layers help keep pavements in excellent condition.

When these treatments are performed timely, they can extend pavement life by up to 15 years, postponing the need for expensive road reconstruction.

See the figure below provided by the Ministry of Infrastructure, Ontario. It demonstrates that effective inventory, condition assessment and timely maintenance can save costs in the long term while maintaining a more consistent level of service.

Figure 1 Small but Timely Renewal Investments Save Money



(Resource from "Building Together, Guide for Municipal Asset Management Plans", Ministry of Infrastructure, Ontario)

2.0 STUDY METHODOLOGY

2.1. General

The method developed by the Ministry of Transportation of Ontario and outlined in the "Inventory Manual for Municipal Roads for Small Lower Tier Municipalities", will be used to develop a short term (1-4 years), mid-term (5-7 years) and medium term (8-10 years), including a 10-Year Capital Plan from 2025 to 2034. The Manual was developed to assist Municipalities and Consultants in preparing Roads Needs Studies and provides the framework to manage the road network with a computerized system. The methodology is outlined below.

All road sections are listed and their condition rating by road type:

a) Earth Roads (listed in inventory but not rated)
b) Gravel Roads
c) Surface Treated or Low Class Bituminous (LCB) Roads
d) Hot Mix Paved or High Class Bituminous (HCB) Roads

Condition ratings of less than 50 are unsatisfactory, and road improvements costs are calculated. Roads with a rating of 50 or less are deemed deficient.

Except for earth roads, future condition ratings are calculated for each road, and predicted maintenance and capital expenditures can be produced. Newly reconstructed roads would have a 100-point condition rating, and roads requiring reconstruction would be assigned 30 points.

The condition rating for each road type should decrease every year, based on the following calculation for low volume roads:

Gravel:	No change in rating with regular maintenance.
Surface:	100 – 30 point condition rating = 4.7 per year.
Treatment:	15 year life cycle before reconstructing.
Hot Mixed Pave:	100 – 30 point condition rating = 2.3 per year.
	30 year life cycle before reconstructing.

Based on the foregoing discussion, Table 1 provides an example of how the condition rating is forecasted for each surface type. In this example, it is assumed the road types were reconstructed in 2024.

SURFACE TYPE	2024	2025	2026	2027	2028	2029
Gravel (1)	65.0	65.0	65.0	65.0	65.0	65.0
Surface Treatment	100.0	95.3	90.6	85.9	81.2	76.5
Asphalt	100.0	97.7	95.4	93.1	90.8	88.5

Table 1: Forecasting Condition Rating Example

[1] Gravel Roads have a stable unchanging life expectancy, if routine loose top maintenance is performed, until such time improvements are made.

The average condition rating is determined for each road type by summing the product of length multiplying by the condition rating and then dividing by the total length of the road system. This will result in an average condition rating for the three road surface types. An example is demonstrated in Table 2.

STREET	LENGTH, Km (L)	CONDITION RATING (CR)	PRODUCT (L x CR)
1	1.00	70.0	70.0
2	2.00	30.0	60.0
3	3.00	50.0	150.0
TOTAL	6.00		280.0

Table 2: Average Condition Rating Example

By combining the three (3) surface types an overall condition rating can be calculated for the total municipal system as shown here: **Average Condition Rating = 280.0 / 6.00 = 47.0**

The above analysis will determine if and when a road requires improvements within a 10-year planning period. Roads with a rating of 50 or less during the study period are flagged for appropriate improvements. This process helps identify the total road needs for the decade.

When prioritizing road improvements, the first consideration for available funds is given to asphalt resurfacing projects, particularly for roads with a condition rating of 50. This

approach rehabilitates roads at a reasonable cost. Without these improvements, roads will continue to deteriorate, eventually necessitating major, costly repairs to restore their structural integrity.

If funds remain after addressing roads rated at 50, they should be allocated to improvements that offer the best cost/benefit return. This study evaluates the cost of reconstruction based on road use (rural, semi-urban, and urban) against the Average Annual Daily Traffic (AADT). For example, if reconstructing a dead-end street costs the same per kilometer as a minor collector street, the minor collector street would be prioritized due to serving more commuters.

Other considerations include safety, truck traffic, development, environmental impacts, economic and social factors, and coordinating construction with other infrastructure projects (e.g., culvert replacements). Some roads may not require upgrading due to limited usage and may remain acceptable with normal maintenance despite a low condition rating for many years.

Benchmark costs, based on recent local construction expenses, are used to estimate the cost of construction associated with different types of capital improvements. Fixed costs, covering maintenance of the existing road system, overhead, and salaries, are typically covered by the Township's budget before capital construction funds are allocated. These fixed costs for forecasted requirements are derived from historical expenditures.

2.2. Traffic Counts

Through discussions with the Township, it was determined that there has not been significant population growth since the 2020 RNS and that the annual average daily traffic (AADT) information found within the previous 2020 report would be sufficient to provide a basis for the current study. We have reviewed the previous traffic counts and have included the highest record amounts. It is noted that the Township routinely carries out traffic counts by staff and their records are continuously updated. Accordingly, no traffic counts were carried out as part of this study however were provided by the Township of Montague for this study and were considered when determining short, medium, and long-term maintenance plans.

3.0 ROAD STANDARDS

The design and construction guidelines of most municipalities within Ontario are derived the below reference manuals:

1) Ontario Provincial Standards (OPS) for Roads and Municipal Services;
2) Ontario Traffic Manual;
3) Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads, and;
4) Ministry of Transportation of Ontario, Drainage Management Manual.

4.0 BENCHMARK COSTS

The term benchmark cost refers to the typical cost associated with repair or improvements to the roads. These costs can include maintenance of an existing road, upgrade of road to higher standard or construction of new road. To ensure relevance all costs are based on local construction costs.

The cost of suggested improvements is provided on an approximate basis for the purposes of estimation and planning. Each improvement is comprised of various items at their associated benchmark cost to provide an estimate.

Line Item	Cost	Unit
Asphalt – Base Course (50mm)	$ 170.00	per tonne
Asphalt – Top Course (40mm)	$ 170.00	per tonne
Driveway Culvert	$ 1,360.00	each
Rock Excavation, Ditching	$ 75.00	per meter
Earth Excavation, Ditching	$ 27.50	per meter
Earth Excavation, Grading	$ 21.50	per cubic meter
Granular A, Rehab	$ 25.00	per tonne
Granular A, Gravel Road	$ 45.00	per tonne
Granular A, Maintenance	$ 15.00	per tonne
Granular B	$ 42.50	per tonne
Grinding - Asphalt Key	$ 425.00	each
Removal – Asphalt	$ 7.50	per square meter
Removal – Mill Top Course	$ 5.00	per square meter
Removal – Pulverize	$ 1.50	per square meter
Remove and Replace 600mm Diameter CSP	$ 400.00	per meter
Road Widening per Shoulder	$ 38.00	per meter
Topsoil & Seed	$ 25.50	per square meter
Topsoil & Sod	$ 42.50	per square meter

Table 3: Benchmarking Costs

The estimated costs for common types of hard surface road reconstruction (resurfacing, partial reconstruction, and full depth reconstruction) are outlined in Tables 4.2 and 4.3. Lower course bitumen focuses on the structural integrity of the road, generally it is less expensive and involves coarser material suitable for load-bearing. Higher course bitumen reconstruction focuses on the road's surface quality, requiring high-performance materials and precise finishing. It is generally more expensive but essential for providing a smooth, durable finish. For full depth reconstruction, there are allowances for geotechnical investigation and testing, as well as engineering design and construction supervision, estimated at 4% and 15% of the costs respectively. It is suggested the Township retain the services of a professional engineer for resurfacing and/or partial reconstruction due to the complexity of the project or high workload. These estimated

costs are based on 2024 figures, and adjustments for inflation should be made for each budget year.

Repair Type	Description	Unit Price ($/km)
LCB-R1	Resurfacing	$35,000
LCB-R2	Partial Depth Reconstruction	$200,000
LCB-R3	Full Depth Reconstruction	$725,000

Table 4: LCB -Low Class Bitumen Repair Costs

Repair Type	Description	Unit Price ($/km)
HCB-R1	Resurfacing	$103,000
HCB-R2	Partial Depth Reconstruction	$220,000
HCB-R3	Full Depth Reconstruction	$900,000
HCB-R4	Pulverize and Pave	$250,000
HCB-R5	Pulverize in Place (without pave)	$75,000

Table 5: HCB - High Class Bitumen Repair Costs

5.0 CULVERTS

The Ministry of Transportation of Ontario defines a structure as a culvert with a span of 3.0m or greater. The Township has existing culverts that fall under this classification.

Replacing a culvert or constructing a new one can be a complex situation involving considerations related to environmental impact, structural integrity, and regulatory compliance. Triggers for culvert replacement include:

- Structural Failure – Visible signs of damage such as cracks, deformation, or collapse.
- Capacity Issues – The existing culvert no longer handles the required water flow due to increased runoff, changes in land use, or upstream development.
- Upgrading Infrastructure – Road widening or reconstruction.

Techniques for culvert replacement/construction vary depending on site conditions, applicable techniques include:

- Open Cut Method – The road is excavated to remove the old culvert and install a new one.
- Horizontal Directional Drilling – A new path is drilled for the culvert under the existing road, a useful technique for avoiding surface disruption and preserving existing structures.

It is important that existing culverts in the Township be inspected regularly to ensure they are functioning properly. As larger culverts can be expensive to replace, additional funds should be set aside over time to account for the reconstruction of these structures as they do have a limited lifespan.

6.0 ROAD MAINTIANCE AND IMPROVEMENT PROGRAM

6.1. Proposed Maintenance Strategies

Summarized below are numerous road maintenance strategies that the Township can implement into its maintenance strategy.

6.1.1. MICRO S, Micro-surfacing, Double Lift

Micro-Surfacing Double Lift is an advanced pavement maintenance technique used to enhance and restore the condition of existing road surfaces. The pavement is inspected and cleaned to remove debris, loose material, and contaminants. Any significant cracks or defects are repaired prior to applying the micro-surfacing. The first layer of micro-surfacing is applied. This mix consists of emulsified asphalt, fine aggregates, water, and additives, and is spread over the prepared surface using specialized equipment. This layer serves to fill minor cracks, seal the surface, and improve texture and skid resistance. The first lift is allowed to cure, which typically takes a few hours. This step ensures that the micro-surfacing material adheres properly and develops the desired properties. Once the first lift has cured, a second layer of micro-surfacing is applied. This additional layer further enhances the pavement's performance, providing extra durability, smoother texture, and improved resistance to environmental factors.

6.1.2. MICRO D, Micro-surfacing, Single Lift

Micro-Surfacing Single Lift is a pavement maintenance technique used to improve and extend the life of existing road surfaces. The pavement is first inspected and cleaned to remove debris, loose materials, and contaminants. Any significant cracks or surface defects are repaired prior to applying the micro-surfacing. A single layer of micro-surfacing is applied. This mix typically consists of emulsified asphalt, fine aggregates, water, and additives. It is applied using specialized equipment, which spreads the mix evenly over the prepared surface. After application, the micro-surfacing layer is compacted to ensure proper bonding and to achieve the desired smoothness and density. The surface is then allowed to cure, which usually takes a few hours. During this time, the material hardens and bonds to the existing pavement. Once the micro-surfacing has fully cured, the surface is inspected to ensure it meets quality and performance standards.

6.1.3. R1WM, Warm-mix Overlay, Single Lift

Warm Mix Overlay Single Lift is a pavement maintenance method that uses warm mix asphalt (WMA) to resurface and enhance existing road surfaces. The existing pavement is inspected and cleaned to remove debris, loose material, and contaminants. Significant cracks or surface defects are repaired before applying the overlay. Warm mix asphalt is prepared and applied in a single layer. WMA is produced and applied at lower temperatures (typically between 200°F to 275°F or 95°C to 135°C) compared to traditional hot mix asphalt. This lower temperature reduces energy consumption and emissions. Specialized paving equipment spreads the warm mix evenly over the prepared surface. After application, the WMA layer is compacted using rollers to achieve the desired density and smoothness. Proper compaction is crucial for the performance and longevity of the overlay. The new surface is allowed to cure and cool. Curing time is generally a few hours a day, depending on weather conditions and traffic. After curing, the surface is inspected to ensure it meets quality standards and performs as expected. Overall, Warm Mix Overlay Single Lift is an effective and environmentally conscious method for resurfacing and improving asphalt pavements, balancing performance, durability, and sustainability.

6.1.4. R2WM, Warm-mix Overlay, Double Lift

Warm Mix Overlay Double Lift is a sophisticated pavement maintenance technique that involves applying two layers of warm mix asphalt (WMA) to enhance and extend the life of existing road surfaces. The existing pavement is thoroughly inspected and cleaned to remove debris, loose material, and contaminants. Any significant cracks or surface defects are repaired prior to applying the overlay. A single layer of warm mix asphalt is applied as the first lift. WMA is produced and applied at lower temperatures (typically between 200°F to 275°F or 95°C to 135°C) compared to traditional hot mix asphalt, which reduces energy consumption and emissions. The first lift is spread evenly over the prepared surface using specialized paving equipment and then compacted to achieve the desired density and smoothness. The first lift is allowed to cure and cool, typically taking a few hours to a day, depending on weather conditions and traffic. This ensures that the layer has properly set before applying the second lift. After the first lift has cured, a second layer of warm mix asphalt is applied. This second lift enhances the performance of the overlay by adding additional thickness and strength. The second layer is spread evenly and compacted in the same manner as the first lift. The second lift is allowed to cure and cool. Once the entire overlay has cured, the surface is inspected for quality, smoothness, and adherence to performance standards. Overall, Warm Mix Overlay Double Lift is an effective and sustainable method for rejuvenating and reinforcing asphalt pavements, offering significant improvements in performance, durability, and environmental impact.

6.1.5. R1 Hot-Mix Overlay, Single Lift

Hot Mix Overlay Single Lift is a pavement maintenance technique used to rejuvenate and extend the life of existing road surfaces. The existing pavement is inspected and cleaned to remove debris, loose material, and contaminants. Significant cracks or structural issues are repaired before applying the overlay. A single layer of hot mix asphalt (HMA) is prepared and applied. HMA consists of a mixture of asphalt binder and aggregate (coarse and fine) that is heated to high temperatures (typically around 300°F to 350°F or 150°C to 180°C) before application. Specialized paving equipment is used to spread the hot mix evenly over the prepared surface. The hot mix asphalt is compacted using rollers to achieve the desired density and smoothness. Proper compaction is critical to ensure a durable and well-bonded overlay. After compaction, the overlay is allowed to cool and cure. This process typically takes a few hours a day, depending on weather conditions and traffic loads. Once cured, the new surface is inspected to ensure it meets quality and performance standards. Overall, Hot Mix Overlay Single Lift is an effective method for revitalizing and protecting asphalt pavements, offering a balance between performance, durability, and cost.

6.1.6. R2, Hot-mix Overlay, Double Lift

Hot Mix Overlay Double Lift is a pavement maintenance technique that involves applying two layers of hot mix asphalt (HMA) to improve and extend the life of existing road surfaces. The existing pavement is cleaned to remove debris, loose materials, and contaminants. Any significant cracks or surface defects are repaired to ensure a suitable base for the overlay. A layer of hot mix asphalt is applied as the first lift. Hot mix asphalt is prepared at high temperatures (typically around 300°F to 350°F or 150°C to 180°C) and applied using specialized paving equipment. This layer is then compacted to achieve the desired density and smoothness. The first lift is allowed to cure and cool, which generally takes a few hours to a day, depending on weather conditions and traffic loads. Proper curing is essential for ensuring that the first layer has set adequately before the application of the second lift. After the first lift has cured, a second layer of hot mix asphalt is applied. This additional layer adds more thickness and enhances the durability and performance of the overlay. The second layer is spread evenly and compacted in the same manner as the first lift. The second lift is allowed to cure and cool. Once the entire overlay has fully cured, the surface is inspected for quality, smoothness, and adherence to performance standards. Overall, Hot Mix Overlay Double Lift is a robust and effective method for rehabilitating and enhancing asphalt pavements, offering significant improvements in durability, performance, and surface quality.

6.1.7. DSTOVLY, Double Surface Treatment Overlay

Double Surface Treatment Overlay is a pavement maintenance technique designed to restore and extend the life of existing road surfaces. It involves applying two layers of a surface treatment, typically consisting of a combination of binder and aggregate. The existing pavement is cleaned to remove debris, loose material, and contaminants. Any significant cracks or surface defects are repaired to ensure a clean, stable base for the treatment. A layer of bituminous binder (usually asphalt emulsion or a similar product) is applied to the prepared surface. This binder serves as the adhesive layer for the aggregate. After the binder is applied, a layer of aggregate (typically crushed stone or gravel) is spread evenly over the binder while it is still tacky. The aggregate is then embedded into the binder through rolling and compaction. The first treatment layer is allowed to cure, during which the binder sets and the aggregate bonds to the surface. Compaction with rollers helps ensure that the aggregate is firmly embedded and that the surface is smooth. Once the first layer has cured, a second application of binder is applied over the existing surface. This binder helps to seal the surface and provide an additional layer of adhesion. A second layer of aggregate is then spread over the new binder. This layer provides additional texture and further seals the surface. The second layer is allowed to cure and bond. After curing, the surface is inspected to ensure it meets quality standards and performs as expected.

6.1.8. SSTOVLY, Single Surface Treatment Overlay

Single Surface Treatment Overlay is a pavement maintenance technique designed to enhance and protect existing road surfaces. It involves applying a single layer of surface treatment to improve the pavement's condition and extend its lifespan. The existing pavement is thoroughly cleaned to remove debris, loose material, and contaminants. Any significant cracks or defects are repaired to ensure a stable and clean surface for the treatment. A layer of bituminous binder (such as asphalt emulsion or a similar product) is applied to the prepared surface. This binder acts as an adhesive layer for the aggregate and helps to seal the existing pavement. After applying the binder, a layer of aggregate (usually crushed stone or gravel) is spread evenly over the binder while it is still tacky. The aggregate provides texture, improves skid resistance, and helps to further seal the surface. The aggregate is embedded into the binder through rolling and compaction with specialized equipment. Proper compaction ensures that the aggregate is well-set and that the surface is smooth and durable. The treated surface is allowed to cure, during which the binder sets and the aggregate bonds to the surface. The curing time can vary, but the surface is generally inspected once it has fully set to ensure it meets quality and performance standards.

6.1.9. PRDST, Pulverize, Restoration & Add Gravel, Double Surface Treatment

Pulverize Restoration and Add Gravel with Double Surface Treatment is a comprehensive pavement rehabilitation method that involves several key steps to restore and enhance the existing road surface. The existing asphalt pavement is first cleaned and inspected. Any significant defects or issues are addressed. The existing asphalt layer, along with a portion of the underlying base material, is mechanically ground up using a pulverizer. This process turns the old pavement into a rough, granular material. The pulverized material is then mixed to create a uniform, reusable base layer. Additional gravel or aggregate is mixed with the pulverized material to enhance its properties. This helps improve the stability, drainage, and load-bearing capacity of the base layer. The gravel and pulverized material are thoroughly blended and compacted to form a stable, well-graded base layer. This step ensures proper density and smoothness for the overlay. A layer of bituminous binder (such as asphalt emulsion) is applied over the prepared and compacted base. This binder acts as an adhesive for the aggregate. A layer of aggregate is spread over the binder while it is still tacky. Rolling and compaction are used to embed the aggregate into the binder.

After the first surface treatment has cured, a second application of binder is applied over the existing surface. A second layer of aggregate is then spread over the new binder. This layer provides additional protection, texture, and sealing. The surface is allowed to cure after the second treatment. The curing time depends on weather conditions and traffic. Once cured, the surface is inspected to ensure it meets quality standards and performs as expected.

6.1.10. PRWM1, Pulverize, Restoration, & Add Gravel, Warm Mix, Single Lift

Pulverize, Restoration, and Add Gravel with Warm Mix Single Lift is a pavement rehabilitation method that combines several techniques to restore and improve an existing road surface. The existing asphalt pavement is inspected and cleaned to remove debris and contaminants. Significant defects are repaired before pulverization. The existing asphalt layer is mechanically ground up using a pulverizer. This process breaks the asphalt into a granular, reusable material, which is then mixed with the underlying base material. The pulverization creates a rough, uniform base layer. Additional gravel or aggregate is mixed with the pulverized material. This helps to enhance the stability, drainage, and load-bearing capacity of the base layer. The mixture of gravel and pulverized asphalt is thoroughly blended and compacted to form a stable, well-graded base layer. This step ensures the layer has proper density and smoothness. Warm mix asphalt (WMA) is produced and applied at lower temperatures (typically between 200°F to 275°F or 95°C to 135°C) compared to traditional hot mix asphalt. This reduces energy consumption and emissions during production. The WMA is spread over the prepared and compacted base layer in a single lift. Specialized paving equipment is used to apply the asphalt evenly. The WMA layer is compacted using rollers to achieve the desired density and smoothness. Proper compaction is crucial for the durability and performance of the overlay. The warm mix asphalt is allowed to cool and cure. This typically takes a few hours to a day, depending on weather conditions and traffic. After curing, the surface is inspected to ensure it meets quality standards and performs as expected.

6.1.11. PRWM2, Pulverize, Restoration & Add Gravel, Warm-mix Double Lift

Pulverize, Restoration, and Add Gravel with Warm Mix Double Lift is a comprehensive pavement rehabilitation technique designed to restore and enhance road surfaces by combining several advanced methods. The existing asphalt pavement is cleaned and inspected. Any significant cracks or defects are repaired before pulverization. The existing asphalt layer is mechanically ground up using a pulverizer. This process breaks the asphalt into a granular, reusable material and incorporates some of the underlying base material. The pulverized material is then mixed to create a rough, uniform base layer. Additional gravel or aggregate is mixed with the pulverized asphalt to enhance the base layer's stability, drainage, and load-bearing capacity. The mixture of gravel and pulverized material is thoroughly blended and compacted to form a stable, well-graded base layer. Proper compaction ensures the base has the desired density and smoothness. Warm mix asphalt (WMA) is produced at lower temperatures (between 200°F to 275°F or 95°C to 135°C) compared to traditional hot mix asphalt. This reduces energy consumption and emissions. The WMA is applied in the first layer over the prepared base using specialized paving equipment. This layer is spread evenly and compacted to form a stable, durable surface. The first lift of WMA is allowed to cure and cool. This process generally takes a few hours to a day, depending on weather conditions and traffic. A second batch of warm mix asphalt is prepared for the second lift. The second layer of WMA is applied over the cured first lift. This additional layer provides extra thickness and further enhances the pavement's durability and performance. The second lift is compacted using rollers to achieve the desired density and smoothness. The second lift is allowed to cure and cool thoroughly. The curing time depends on weather conditions and traffic. Once the entire overlay has fully cured, the surface is inspected to ensure it meets quality standards and performs as expected.

6.1.12. PR1, Pulverize, Restoration, & Add Gravel, Hot-mix Single Lift

Pulverize, Restoration, and Add Gravel with Hot Mix Single Lift is a pavement rehabilitation method designed to restore and improve existing road surfaces by combining multiple techniques. The existing asphalt pavement is inspected and cleaned. Any major cracks or defects are repaired to prepare the surface for the rehabilitation process. The existing asphalt layer is mechanically ground up using a pulverizer. This process breaks the asphalt into a granular, reusable material and blends it with a portion of the underlying base material. This creates a rough, uniform, and stabilized base layer. Additional gravel or aggregate is mixed with the pulverized asphalt material to improve the stability, drainage, and load-bearing capacity of the base layer. The gravel and pulverized material are thoroughly mixed and then compacted using rollers. This step ensures that the new base layer is well-graded, dense, and smooth. Hot mix asphalt (HMA) is prepared at high temperatures (typically between 300°F to 350°F or 150°C to 180°C). The mix consists of asphalt binder and aggregates and is designed for durability and performance. The HMA is applied in a single layer over the prepared and compacted base. Specialized paving equipment is used to spread the asphalt evenly across the surface. The HMA layer is compacted using rollers to achieve the desired density and smoothness. Proper compaction is crucial to ensure the overlay's durability and performance. The hot mix asphalt is allowed to cool and cure. This process generally takes a few hours to a day,

depending on weather conditions and traffic loads. After curing, the surface is inspected to ensure it meets quality standards and performs as expected. This includes checking for smoothness, density, and adherence to specifications.

6.1.13. PR2, Pulverize, Restoration & Add Gravel, Hot-mix Double Lift

Pulverize, Restoration, and Add Gravel with Hot Mix Double Lift is an advanced pavement rehabilitation method that combines structural restoration with a high-quality surface treatment. The existing pavement is cleaned and inspected. Any major cracks or surface defects are repaired. The existing asphalt layer is mechanically ground up using a pulverizer. This process turns the old pavement into a granular material and mixes it with the underlying base material, creating a rough, uniform base layer. Additional gravel or aggregate is mixed with the pulverized asphalt to improve the stability, drainage, and load-bearing capacity of the base layer. The gravel and pulverized material are thoroughly blended and compacted using rollers. This step ensures a stable, well-graded base with the required density and smoothness. Hot mix asphalt (HMA) is prepared at high temperatures (typically between 300°F to 350°F or 150°C to 180°C). This mix includes asphalt binder and aggregates designed for durability and performance. The HMA is applied in the first lift over the prepared base layer. Specialized paving equipment is used to spread the asphalt evenly. The first lift of HMA is compacted using rollers to achieve the desired density and smoothness. The first lift is allowed to cool and cure. This process usually takes a few hours to a day, depending on weather conditions and traffic. A second batch of hot mix asphalt is prepared for the second lift. The second layer of HMA is applied over the cured first lift. This additional layer enhances the pavement's durability and performance. The second lift is compacted with rollers to ensure proper density and smoothness. The second lift is allowed to cool and cure thoroughly. The curing time depends on weather conditions and traffic. Once the entire overlay is fully cured, the surface is inspected for quality, smoothness, and performance. This includes checking for any issues such as unevenness or insufficient compaction.

6.1.14. Crack Sealing

Crack sealing is a common maintenance technique designed to extend the life of asphalt surfaces. First cracks are cleaned using methods like wire brushing, air blasting or vacuuming to remove debris ensuring proper adhesion of the sealant. The cracks are further prepared by routing if necessary. A hot or cold asphalt mix is then applied to the crack. The sealant is poured or injected into the cracks and then smoothed out to ensure it fills the crack uniformly. After applying the sealant, it is allowed time to cure, the curing time varies depending on the type of sealant used and environmental conditions. Crack sealing helps to prevent water from entering the pavement structure and causing more severe damage, thereby reducing the need for more costly repairs in the future.

6.1.15. Micro-surfacing, Fibremat, Warm-mix Overlay

Micro Surfacing with Fibremat Asphalt Overlay is an advanced pavement maintenance technique designed to restore and enhance the durability of existing road surfaces. The existing pavement is inspected and prepared. This involves cleaning the surface to remove debris and repairing any significant defects. The pavement may also be primed to improve adhesion. A fibremat is a type of reinforcing fabric or mat, often made from synthetic fibers, that is laid onto the prepared surface. This fibremat provides additional strength and flexibility to the overlay, helping to reinforce the pavement and distribute stresses more evenly. After the fibremat is applied, a micro surfacing mix is prepared. This mix typically consists of a combination of emulsified asphalt, fine aggregates, water, and additives. The mix is applied in a thin layer over the fibremat using specialized equipment. The micro surfacing is spread evenly over the surface, and the layer is compacted to ensure proper bonding and a smooth finish. The micro surfacing needs time to cure. During this period, it hardens and adheres to the fibremat and the underlying pavement.

6.1.16. Micro-surfacing, Warm-mix Overlay

Micro-Surfacing with Warm Mix Overlay is a pavement maintenance technique that combines the benefits of micro-surfacing with the environmentally friendly properties of warm mix asphalt. The existing pavement is inspected and cleaned to remove debris, dirt, and loose material. Any significant cracks or defects are repaired before applying the overlay. A micro-surfacing mix, composed of emulsified asphalt, fine aggregates, water, and additives, is prepared. This mix is applied in a thin layer over the cleaned surface to restore and protect the pavement. Micro-surfacing improves skid resistance, seals the surface, and extends the pavement's life. Warm mix asphalt (WMA) is used as the overlay material. WMA is produced and applied at lower temperatures compared to traditional hot mix asphalt, which reduces energy consumption and emissions. The WMA is spread and compacted over the micro-surfacing layer to provide additional strength and durability. The new surface requires time to cure. During this period, the micro-surfacing and warm mix asphalt layers harden and bond with the existing pavement. Overall, this method offers a cost-effective, environmentally friendly solution for maintaining and enhancing pavement performance.

6.1.17. Cold-in-place Recycled Asphalt

Cold-In-Place Recycled Asphalt (CIR) is a pavement rehabilitation method that reuses existing asphalt materials to repair and restore worn-out road surfaces. The existing asphalt pavement is milled or planed off to a specified depth. This involves grinding the surface to produce reclaimed asphalt pavement (RAP) material. The milled RAP material is then transported to a central processing facility or on-site mobile plant. At this stage, the RAP is mixed with additional binding agents, such as asphalt emulsion or foamed asphalt, and sometimes new aggregates to improve its properties. The recycled material is mixed thoroughly to create a new asphalt mix with the desired properties. This process may occur in-place, using specialized equipment that combines the RAP with the binder directly on the road, or in a central plant. The new asphalt mix is laid back onto the road surface using standard paving equipment. This layer is typically compacted to ensure

proper density and smoothness. The new layer is compacted to achieve the desired density and strength. Proper compaction is crucial for the performance and longevity of the recycled pavement. After compaction, the surface is allowed to cure. Once cured, the surface is inspected to ensure it meets quality and performance standards.

7.0 ROAD MAINTIANCE AND IMPROVEMENT PROGRAM

7.1. Typical Road Structure

Table 6 below shows the typical road structure based on AADT.

ADDT AT TIME OF CONSTRUCTION	SURFACE TYPE[1]
0 – 400	Gravel
400 – 700	Low Class Bituminous
700 – 1000	50mm of Hot Mix

Table 6: Typical Road Structure Based on AADT

The grade upon which surface type is applied is to be structurally adequate. Typical road structure includes a base of 150mm Granular 'A' and 300m Granular 'B', Type II.

7.2. Typical Road Cross Section

	Geometric Design Guidelines			Lanark County Minimum Pavement Widths				
AADT	Min Lane Width (m)	Min Shoulder Width (m)	Total Platform Width (m)	Total Pavement Width (m)	Min Granular Shoulder (m)	Total Platform Width (m)	Lane Width (m)	Resulting Paved Shoulder Width (m)
0-999	3.25	1	8.5	8	0.25	8.5	3.25	0.75
1,000-2,999	3.25	2	10.5	9.5	0.5	10.5	3.3	1.45
3,000 - 4,999	3.5	2.5	12	10.4	0.8	12	3.5	1.7
5,000 >	3.5	2.5	12	11.6	0.8	13.6	3.75	2.05

Table 7: Township of Montague Geometric Road design Parameters

8.0 TEN YEAR CAPITAL PLAN FOR ROADS

This section of report is comprised of two sections; a condition assessment of existing roads network with a comparison to the conditions noted in the 2019 Report. The second section is a suggested ten-year capital plan.

8.1. Condition of Existing Roads

The existing condition of the road network is presented in the table below with lengths, weighted average condition for the three surface types: gravel, low class bituminous, high class bituminous roadways as observed in 2024.

Category	Length (km) 2020 (1)	Average Condition Rating (1)	Length (km) 2024 (2)	Average Condition Rating
Gravel	97.75	47.1	98.10	62.3
Hard Surfaces	60.3	68.3	60.67	68.7
All Roads	158.05*	55.2	158.87*	64.9

Table 8: Average Condition Rating 2020 vs 2024

*There is a discrepancy in the total road lengths from 2020 to 2024 because section 56 Andrewsville Main Street was included in the 2020 report road inventory but not in the provided road inventory form the Township of Montague. Section 630 Industrial Road was included in the Township of Montague but not in the 2020 Report.

(1) 2020 lengths and condition ratings are based on the 2020 comprehensive roads needs study prepared by Mcintosh Perry.
(2) Appendix B provides a comprehensive assessment of each segment.

8.2. Ten Year Maintenance Plan

The ten year maintenance plan for hard surfaces is present in Appendix C. This plan is based on provided budgets.

A life cycle analysis was performed to determine which year a road resurfacing or reconstruction effort would be the most cost-effective. The below strategies were considered for the allocation of resources:

1) High traffic volume roads will be given priority over low traffic volume roads;
2) Asphalt overlays are given priority over reconstruction repairs;
3) For hard surfaces, partial depth reconstruction will be given priority over full depth reconstruction as it more long-term cost-effective;
4) Pavement preservation techniques mentioned above are preferred as maintenance of current condition ratings, and;
5) Projects that are geographically close will be given special consideration due to potential savings.

It is important to note that roads experiencing higher-than-average traffic volumes or substantial truck traffic may deteriorate at an accelerated rate. Consequently, the Township should be prepared to make necessary adjustments to the Ten-Year Capital Program to address these conditions. The provided figures are expressed in 2024 dollars; therefore, it is imperative that the Township accounts for construction inflation in each annual budget to ensure accurate financial planning.

To achieve and maintain an acceptable condition rating for the roads, as described in Section 12.1, the capital budget allocation for road maintenance and improvements needs to be significantly higher. It is noted annual spending amounts do not consider funding provided by the Canadian Community-Building Fund (CCBF) or the Ontario Community Infrastructure Fund (OCIF).

Most of Rosedale Road North was explicitly excluded from the 10-year plan because it is a large segment of road and due to its expensive cost would ideally be upgraded through funding from the CCBF and OCIF, it is our recommendation the Township focus on allocating their funding on local roads throughout the 10-year plan.

Addressing this budgetary shortfall is crucial for the sustainable maintenance and improvement of the Township's road network. Without appropriate funding adjustments, the Township may face escalating road deterioration, leading to higher future repair costs and potential impacts on traffic safety and efficiency. Therefore, it is recommended that the Township undertake a comprehensive review of its capital budget strategy to ensure that adequate resources are allocated to meet the evolving needs of its road infrastructure. It is our recommendation that a policy should be created by the Township to clearly identify the future needs of upgrading gravel roads. The policy should take into consideration current uses, possible connectivity, traffic counts, and future growth opportunities.

Below is a summary of the proposed works for each year in the 10-year plan:

2025 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
245	McLachlin Road	Upgrade to LCB
630	Industrial Road	HCB-R5

*Note: Beckwith was notified about our desire to reconstructed McLachlin Road in 2023. We suggest that McLachlin Road be designed in conjunction with a professional engineer to determine the best reconstruction methods across the total sections noting there are some sections of roadway in good condition.

2026 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
450	Minto Street	HCB-R1
470	Uphill Street	HCB-R2
490	Dean Street	HCB-R2
565	Third Street	HCB-R2
570	Third Street	HCB-R2
575	Third Street	HCB-R2

2027 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
35	Rideau River Road	HCB-R1
45	Boat Launch Road	HCB-R2

2028 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
15	Rainbow Valley Drive	HCB-R3
505	Union Street	HCB-R2

2029 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
205	Ferguson-Tetlock Road	HCB-R2

2030 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
310	Rosedale Road North	HCB-R1
410	Matheson Drive	HCB-R2
485	Dean Street	HCB-R2
555	Fourth Street	HCB-R2

2031 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
40*	Rideau River Road	HCB-R2
165	Caroll Road	LCB-R1
520	Alice Street	HCB-R1

2032 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
40*	Rideau River Road	HCB-R2
180	Carroll Road	LCB-R1
525	Lila Street	HCB-R1
550	Fourth Street	HCB-R2

*Note: First half to be completed in 2031 and second half to be completed in 2032.

2033 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
5	Bayview Crescent	HCB-R1
30	Kilmamock Road	HCB-R2
195	Kelly Jordan Road	HCB-R1
445	Dufferin Street	HCB-R2
595	First Street	HCB-R1

2034 Maintenance Plan		
Road Section Number	Road Name	Maintenance Scope
250	Code Drive	HCB-R2

8.3. Projected Annual Average Condition Rating

The table below shows the projected annual weighted average condition rating with the proposed ten year maintenance strategy. It is evident that the roads maintenance program is underfunded.

Category	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
LCB	68.4	66.1	63.8	61.5	59.2	56.9	60.1	60.9	58.6	66.4
HCB	70.7	69.0	68.4	66.6	68.3	66.3	67.0	65.3	64.7	62.4
Hard Surface	70.4	68.5	70.6	65.7	66.7	64.7	65.8	64.5	63.6	63.1
All	64.0	61.9	60.2	58.0	57.0	54.9	53.9	52.0	50.3	48.7

Table 9: Projected Annual Condition Rating

9.0 SUMMARY

The Comprehensive Roads Needs Study for Montague Township evaluates the current state of road infrastructure and provides strategic recommendations for maintenance and improvements over a ten-year period. The study focuses on ensuring cost-effective management of asphalt and surface-treated roads, emphasizing overlay projects and single surface treatments to extend the lifespan of existing roads.
Key recommendations include:

1. Ten-Year Capital Program: Prioritizes high-traffic and semi-urban roads for cost-effective rehabilitation as they are more likely to degrade with use and high traffic volumes directly correlate with an increased importance with residents. Overlay projects and partial depth reconstruction are highlighted as primary methods for maintaining asphalt roads.
2. Loose Top Maintenance Program: Suggests a maintenance cycle based on historical spending on granular materials to prevent major rehabilitation costs. We do not suggest reducing the gravel application schedule which is currently every four (4) years in the Township. This application rate is generally keeping the gravel road network in acceptable condition, however further reducing this would likely result in further deterioration, resulting in costly rehabilitation costs.
3. Funding and Budget Considerations: Acknowledges the need for an increase in the annual budget to maintain current service levels, recommending the exploration of government grants and working with boundary municipalities to split cost of shared boundary roads as these roads can be difficult to coordinate the on-going maintenance and repairs.
4. Proactive Maintenance: Advocates for regular condition rating assessments and updates to adapt to changing needs and conditions, ensuring timely rehabilitation and cost efficiency.
5. Policy Adaption: A policy should be created by the Township to clearly identify the future needs of upgrading gravel roads.

Despite the proposed plans, the study warns that without greater financial commitment, the road system will deteriorate. It is estimated that additional funds are necessary to maintain the current level of service and address the underfunding of the capital budget for road infrastructure.

The study concludes with a call for strategic and well-informed decision-making to ensure the sustainable maintenance and improvement of Montague Township's road network, ultimately benefiting the community and supporting long-term growth.

2024 COMPRENSIVE ROADS NEED STUDY

APPENDIX A

ROAD INVENTORY

Number	Road	From	To	Surface Type	Length (km)	Road Rideability	2024 Roadway Conditon	Traffic count
5	Bayview Crescent	43-County Road 43	43-County Road 43	HCB	0.60	70.0	60.0	209.0
10	Bayview Lane	Bayview Crescent	South End	HCB	0.10	70.0	65.0	44.0
15	Rainbow Valley Drive	43-County Road 43	West End	HCB	0.50	50.0	60.0	127.0
20	Hutton Road	43-County Road 43	East End	G/S	0.30	65.0	65.0	22.0
25	Acton Drive	43-County Road 43	North End	G/S	0.50	65.0	65.0	11.0
30	Kilmarnock Road	43-County Road 43	Rideau Canal	HCB	0.70	70.0	65.0	550.0
35	Rideau River Road	43-County Road 43	Boat Launch Road	HCB	3.90	70.0	65.0	220.0
40	Rideau River Road	Boat Launch Road	43-County Road 43	HCB	3.60	70.0	65.0	220.0
45	Boat Launch Road	Rideau River Road	South End	HCB	0.30	65.0	55.0	22.0
55	Water Street, Andrewsville	Main Street	East End	HCB	0.20	80.0	75.0	33.0
56	Andrewsville Main Street	Heritage Drive	Township Limits	HCB	0.20	80.0	80.0	NA
60	Wood Road	23-Rosedale Road South	Allington Road	G/S	0.60	65.0	65.0	94.0
65	Wood Road	Allington Road	43-County Road 43	G/S	1.90	65.0	65.0	94.0
66	Wood Road	McCrea Road	County Road 43	HCB	0.10	90.0	90.0	NA
70	Allington Road	Wood Road	North End	G/S	1.10	65.0	65.0	11.0
75	Guthrie Road	23-Rosedale Road South	0.9 km East of 23-Rosedale Road	G/S	0.90	65.0	65.0	187.0
80	Guthrie Road	0.9 km East of 23-Rosedale Road	East End	G/S	1.90	65.0	65.0	61.0
85	Bower Boulevard	23-Rosedale Road South	East End Turnaround	HCB	0.50	80.0	75.0	61.0
90	Matheson Drive	23-Rosedale Road South	1.4 km East of 23-Rosedale Road South	HCB	1.40	65.0	65.0	127.0
95	Matheson Drive	1.4 km East of 23-Rosedale Road South	East End	HCB	0.30	65.0	65.0	11.0
100	Van Exan Drive	4-Roger Stevens Drive	South End	HCB	0.80	65.0	70.0	72.0
105	McCrea Road	Wood Road	1.5 km East of Wood Road	HCB	1.50	70.0	70.0	115.0
110	McCrea Road	1.5 km East of Wood Road	Buffam Road	HCB	2.30	70.0	75.0	160.0
115	McCrea Road	Buffam Road	43-County Road 43	HCB	1.20	70.0	70.0	182.0
120	Richardson Road	Buffam Road	Burchill Road	G/S	1.70	65.0	65.0	116.0
125	Richardson Road	Burchill Road	2-Heritage Drive	G/S	4.20	65.0	65.0	81.0
130	Gilroy Road	2-Heritage Drive	North End	G/S	1.40	65.0	65.0	11.0
135	Burchill Road	Merrickville North Limits	Richardson Road	G/S	2.00	65.0	65.0	123.0
140	Burchill Road	Richardson Road	McConnell Road	G/S	1.60	65.0	65.0	137.0
145	Burchill Road	McConnell Road	4-Roger Stevens Drive	G/S	6.00	65.0	65.0	80.0
150	McConnell Road	Buffam Road	West End	G/S	0.40	65.0	65.0	22.0
155	McConnell Road	Buffam Road	Burchill Road	G/S	1.70	65.0	65.0	33.0
160	Buffam Road	McCrea Road	McConnell Road	G/S	1.80	65.0	65.0	22.0
165	Carroll Road	Smiths Falls North Limit	Kelly Jordan Road	LCB	3.00	60.0	65.0	919.0
170	Carroll Road	Kelly Road	0.1 km North of Ferguson-Tetlock Road	LCB	1.70	60.0	65.0	596.0
175	Carroll Road	0.1 km North of Ferguson-Tetlock Road	McGuire Road	G/S	3.20	50.0	50.0	243.0
180	Carroll Road	McGuire Road	McLachlin Road	G/S	1.40	65.0	65.0	231.0
185	Sturgess Road	Highway 15	West End	G/S	0.70	65.0	65.0	11.0
190	Sturgess Road	Highway 15	East End	G/S	0.10	65.0	65.0	22.0
195	Kelly Jordan Road	Carroll Road	Highway 15	HCB	1.90	60.0	70.0	325.0
200	Kelly Jordan Road	Highway 15	East End	HCB	0.15	50.0	55.0	33.0
205	Ferguson-Tetlock Road	Carroll Road	Highway 15	HCB	2.70	50.0	50.0	298.0
210	Ford Road	Highway 15	Brown Road	LCB	0.70	80.0	75.0	275.0
215	Ford Road	Brown Road	#328	LCB	0.43	80.0	75.0	165.0
220	Ford Road	#328	McLachlin Road	G/S	3.20	65.0	65.0	165.0

225	Brown Road	Ford Road	West End	G/S	1.50	65.0	65.0	39.0
230	McGuire Road	Carroll Road	Ford Road	G/S	3.00	65.0	65.0	160.0
235	McLachlin Road	Carroll Road	Drummond Boundary	G/S	1.60	65.0	65.0	103.0
240	McLachlin Road	Drummond Boundary	Ford Road	G/S	1.60	50.0	50.0	135.0
245	McLachlin Road	Ford Road	Highway 15	HCB	2.60	65.0	50.0	522.0
250	Code Drive	4-Roger Stevens Drive	Nolan's Road	LCB	2.60	70.0	70.0	453.0
255	Code Drive	Nolan's Road	Rosedale Road North	LCB	2.60	80.0	80.0	453.0
260	Nolan's Road	Code Drive	Rosedale Road North	G/S	2.40	65.0	65.0	215.0
265	Nolan's Road	Rosedale Road North	Holbrook Road	G/S	3.40	65.0	65.0	212.0
270	Nolan's Road	Holbrook Road	Weedmark Road	G/S	1.80	65.0	65.0	192.0
275	Prescott Road	Rosedale Road North	West End	G/S	0.40	65.0	65.0	28.0
280	William Campbell Road	Weedmark Road	Bennett Road	G/S	2.40	65.0	65.0	136.0
285	William Campbell Road	Bennett Road	Montague Boundary Road	G/S	2.20	65.0	65.0	149.0
290	Fletcher Road	4-Roger Stevens Drive	North End	G/S	0.50	65.0	65.0	72.0
295	Douglas Road	4-Roger Stevens Drive	North End	G/S	0.40	65.0	65.0	61.0
300	Rosedale Road North	4-Roger Stevens Drive	Nolan's Road	HCB	2.00	60.0	65.0	657.0
305	Rosedale Road North	Nolan's Road	0.2 km North of Prescott Road	HCB	1.80	60.0	60.0	396.0
310	Rosedale Road North	0.2 km North of Prescott Road	MacPherson Road	HCB	3.20	60.0	65.0	547.0
315	Rosedale Road North	MacPherson Road	McLachlin Road	HCB	3.50	60.0	60.0	474.0
320	McLachlin Road	Highway 15	Rosedale Road North	HCB	0.90	100.0	100.0	536.0
325	McLachlin Road	Rosedale Road North	East End	G/S	0.70	65.0	65.0	33.0
330	Salter Road	Rosedale Road North	McLachlin Road	G/S	1.10	65.0	65.0	22.0
335	MacPherson Road	Highway 15	Rosedale Road North	HCB	2.40	100.0	100.0	300.0
340	MacPherson Road	Rosedale Road North	East End	G/S	0.60	65.0	65.0	33.0
345	Holbrook Road	Nolan's Road	Pinery Road	G/S	5.60	65.0	65.0	51.0
350	Weedmark Road	Nolan's Road	William Campbell Road	G/S	1.60	65.0	65.0	121.0
355	Weedmark Road	William Campbell Road	North End	G/S	1.70	65.0	65.0	61.0
360	Bennett Road	William Campbell Road	North End	G/S	0.80	65.0	65.0	22.0
365	Montague Boundary Road	4-Roger Stevens Drive	Ellen Maloney Road	G/S	3.60	65.0	65.0	102.0
370	Montague Boundary Road	Ellen Maloney Road	Pinery Road	G/S	2.90	65.0	65.0	61.0
375	Montague Boundary Road	Pinery Road	Beckwith Boundary Road	G/S	0.50	65.0	65.0	145.0
380	Ellen Maloney Road	Montague Boundary Road	West End	G/S	1.20	65.0	65.0	6.0
385	Pinery Road	Rosedale Road North	Holbrook Road	G/S	4.50	50.0	50.0	222.0
390	Pinery Road	Holbrook Road	1.3 km East of Holbrook Road	G/S	1.30	50.0	50.0	72.0
395	Pinery Road	1.3 km East of Holbrook Road	4.7 km East of Holbrook Road	G/S	3.40	50.0	50.0	137.0
400	Pinery Road	4.7 km East of Holbrook Road	Montague Boundary Road	G/S	3.10	50.0	50.0	171.0
405	Beckwith Boundary Road	Brunton Side Road	Montague Boundary Road	G/S	2.60	65.0	65.0	171.0
410	Matheson Drive	Smiths Falls East Limit	0.3 km East of Smiths Falls East Limit	HCB	0.30	90.0	90.0	884.0
415	Matheson Drive	0.3 km East of Smiths Falls East Limit	23-Rosedale Road South	HCB	4.70	90.0	90.0	721.0
420	Riceville Road	Matheson Drive	South End	HCB	0.20	90.0	80.0	11.0
425	Matheson Drive	Rideau Avenue	Jubilee Street	HCB	0.13	100.0	100.0	22.0
435	Jubilee Street	Matheson Drive	Dufferin Street	HCB	0.13	80.0	80.0	77.0
440	Charlotte Street	Matheson Drive	North End	HCB	0.08	80.0	80.0	33.0
445	Dufferin Street	Rideau Avenue	Minto Street	HCB	0.40	70.0	65.0	143.0
450	Minto Street	Dufferin Street	Wellington Street	HCB	0.18	70.0	65.0	110.0
455	Wellington Street	Minto Street	Harper Condie Road	HCB	0.05	70.0	70.0	110.0
460	Harper Condie Road	Wellington Street	4-Roger Stevens Drive	HCB	1.00	70.0	75.0	110.0
465	O'Malley Street	4-Roger Stevens Drive	Dean Street	HCB	0.15	60.0	60.0	22.0

470	Uphill Street	4-Roger Stevens Drive	0.3 km North of 4-Roger Stevens Drive	HCB	0.30	70.0	75.0	66.0
475	Uphill Street	0.3 km North of 4-Roger Stevens Drive	Ruthven Street	G/S	0.25	50.0	50.0	66.0
480	Grange Street	4-Roger Stevens Drive	Ruthven Street	HCB	0.40	60.0	65.0	110.0
485	Dean Street	Grange Street	Uphill Street	HCB	0.35	60.0	70.0	132.0
490	Dean Street	Uphill Street	East End	HCB	0.35	65.0	65.0	110.0
495	Ruthven Street	Highway 15	Uphill Street	G/S	1.00	65.0	65.0	110.0
500	Field Street	Ruthven Street	North End Turnaround	G/S	0.10	65.0	65.0	22.0
505	Union Street	Highway 15	North End	HCB	0.30	60.0	60.0	77.0
520	Alice Street	Lorne Street	First Street	HCB	0.42	60.0	65.0	315.0
525	Lila Street	Lorne Street	First Street	HCB	0.42	60.0	65.0	286.0
535	Fifth Street	Rideau Street	Alice Street	HCB	0.15	70.0	70.0	154.0
540	Fifth Street	Alice Street	Lila Street	HCB	0.15	70.0	70.0	88.0
545	Fifth Street	Lila Street	East End	HCB	0.10	70.0	70.0	44.0
550	Fourth Street	Rideau Street	Alice Street	HCB	0.15	70.0	65.0	154.0
555	Fourth Street	Alice Street	Lila Street	HCB	0.15	70.0	65.0	121.0
560	Fourth Street	Lila Street	East End	HCB	0.10	70.0	65.0	66.0
565	Third Street	Rideau Street	Alice Street	HCB	0.15	60.0	60.0	165.0
570	Third Street	Alice Street	Lila Street	HCB	0.15	60.0	60.0	110.0
575	Third Street	Lila Street	East End	HCB	0.10	60.0	60.0	66.0
580	Second Street	Rideau Street	Alice Street	HCB	0.15	70.0	70.0	198.0
585	Second Street	Alice Street	Lila Street	HCB	0.15	70.0	70.0	110.0
590	Second Street	Lila Street	East End	HCB	0.10	70.0	70.0	55.0
595	First Street	Rideau Street	Lila Street	HCB	0.30	70.0	70.0	391.0
600	King Street	Rideau Street	East End	HCB	0.15	100.0	100.0	66.0
625	Bristow Drive	23-Rosedale Road South	East End	HCB	1.10	80.0	80.0	0.0
630	Industrial Road	Highway 15	South End	G/S	0.60	20.0	20.0	0.0

2024 COMPRENSIVE ROADS NEED STUDY

APPENDIX B

FORCAST OF CONDITION RATING BY YEAR

Number	Road	From	To	Surface Type	Length (km)	2024 Roadway Conditon	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5	Bayview Crescent	43-County Road 43	43-County Road 43	HCB	0.60	60	57.7	55.4	53.1	50.8	48.5	46.2	43.9	41.6	59.3	57
10	Bayview Lane	Bayview Crescent	South End	HCB	0.10	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	46.6	44.3	42
15	Rainbow Valley Drive	43-County Road 43	West End	HCB	0.50	60	57.7	55.4	53.1	100	97.7	95.4	93.1	90.8	88.5	86.2
30	Kilmarnock Road	43-County Road 43	Rideau Canal	HCB	0.70	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	46.6	90	87.7
35	Rideau River Road	43-County Road 43	Boat Launch Road	HCB	3.90	65	62.7	60.4	78.1	75.8	73.5	71.2	68.9	66.6	64.3	62
40	Rideau River Road	Boat Launch Road	43-County Road 43	HCB	3.60	65	62.7	60.4	58.1	55.8	53.5	51.2	90	87.7	85.4	83.1
45	Boat Launch Road	Rideau River Road	South End	HCB	0.30	55	52.7	50.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
55	Water Street, Andrewsville	Main Street	East End	HCB	0.20	75	72.7	70.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
56	Andrewsville Main Street	Heritage Drive	Township Limits	HCB	0.20	80	77.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
66	Wood Road	McCrea Road	County Road 43	HCB	0.10	90	87.7	85.4	83.1	80.8	78.5	76.2	73.9	71.6	69.3	67
85	Bower Boulevard	23-Rosedale Road South	East End Turnaround	HCB	0.50	75	72.7	70.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
90	Matheson Drive	Smiths Falls East Limit	0.3 km East of Smiths Falls East Li	HCB	1.40	90	90	87.7	85.4	83.1	80.8	78.5	76.2	73.9	71.6	69.3
95	Matheson Drive	0.3 km East of Smiths Falls East Limit	23-Rosedale Road South	HCB	0.30	90	87.7	85.4	83.1	80.8	78.5	76.2	73.9	71.6	69.3	67
100	Van Exan Drive	4-Roger Stevens Drive	South End	HCB	0.80	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
105	McCrea Road	Buffam Road	43-County Road 43	HCB	1.50	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
110	McCrea Road	1.5 km East of Wood Road	Buffam Road	HCB	2.30	75	72.7	70.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
115	McCrea Road	Wood Road	1.5 km East of Wood Road	HCB	1.20	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
165	Carroll Road	Smiths Falls North Limit	Kelly Jordan Road	LCB	3.00	65	62.7	60.4	58.1	55.8	53.5	51.2	68.9	66.6	64.3	62
170	Carroll Road	Kelly Road	0.1 km North of Ferguson-Tetlock F	LCB	1.70	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	66.6	64.3	62
195	Kelly Jordan Road	Carroll Road	Highway 15	HCB	1.90	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	69.3	67
200	Kelly Jordan Road	Highway 15	East End	HCB	0.15	55	52.7	50.4	48.1	45.8	43.5	41.2	38.9	36.6	34.3	32
205	Ferguson-Tetlock Road	Carroll Road	Highway 15	HCB	2.70	50	47.7	45.4	43.1	40.8	90	87.7	85.4	83.1	80.8	78.5
210	Ford Road	Highway 15	Brown Road	LCB	0.70	75	72.7	70.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
215	Ford Road	Brown Road	#328	LCB	0.43	75	72.7	70.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
235	McLachlin Road	Highway 15	Rosedale Road North	HCB	1.60	100	97.7	95.4	93.1	90.8	88.5	86.2	83.9	81.6	79.3	77
240	McLachlin Road	Ford Road	Highway 15	HCB	1.60	50	100	97.7	95.4	93.1	90.8	88.5	86.2	83.9	81.6	79.3
250	Code Drive	4-Roger Stevens Drive	Nolan's Road	LCB	2.60	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	90
255	Code Drive	Nolan's Road	Rosedale Road North	LCB	2.60	80	77.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
300	Rosedale Road North	4-Roger Stevens Drive	Nolan's Road	HCB	2.00	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	46.6	44.3	42
305	Rosedale Road North	0.2 km North of Prescott Road	MacPherson Road	HCB	1.80	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	46.6	44.3	42
310	Rosedale Road North	MacPherson Road	McLachlin Road	HCB	3.20	60	57.7	55.4	53.1	50.8	68.5	66.2	63.9	61.6	59.3	57
315	Rosedale Road North	Nolan's Road	0.2 km North of Prescott Road	HCB	3.50	60	57.7	55.4	53.1	50.8	48.5	46.2	43.9	41.6	39.3	37
335	MacPherson Road	Highway 15	Rosedale Road North	HCB	2.40	100	97.7	95.4	93.1	90.8	88.5	86.2	83.9	81.6	79.3	77
410	Matheson Drive	23-Rosedale Road South	1.4 km East of 23-Rosedale Road S	HCB	0.30	65	62.7	60.4	58.1	55.8	53.5	71.2	68.9	66.6	64.3	62
415	Matheson Drive	Rideau Avenue	Jubilee Street	HCB	4.70	100	97.7	95.4	93.1	90.8	88.5	86.2	83.9	81.6	79.3	77
420	Riceville Road	Matheson Drive	South End	HCB	0.20	80	77.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
435	Jubilee Street	Matheson Drive	Dufferin Street	HCB	0.13	80	77.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
440	Charlotte Street	Matheson Drive	North End	HCB	0.08	80	77.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
445	Dufferin Street	Rideau Avenue	Minto Street	HCB	0.40	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	90	87.7	85.4
450	Minto Street	Dufferin Street	Wellington Street	HCB	0.18	65	62.7	80.4	78.1	75.8	73.5	71.2	68.9	66.6	64.3	62
455	Wellington Street	Minto Street	Harper Condie Road	HCB	0.05	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
460	Harper Condie Road	Wellington Street	4-Roger Stevens Drive	HCB	1.00	75	72.7	70.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
465	O'Malley Street	4-Roger Stevens Drive	Dean Street	HCB	0.15	60	57.7	55.4	53.1	50.8	48.5	46.2	43.9	41.6	39.3	37
470	Uphill Street	4-Roger Stevens Drive	0.3 km North of 4-Roger Stevens D	HCB	0.30	55	52.7	50.4	68.1	65.8	63.5	61.2	58.9	56.6	54.3	52
480	Grange Street	4-Roger Stevens Drive	Ruthven Street	HCB	0.40	65	62.7	80.4	78.1	75.8	73.5	71.2	68.9	66.6	64.3	62
485	Dean Street	Grange Street	Uphill Street	HCB	0.35	70	67.7	65.4	63.1	60.8	58.5	76.2	73.9	71.6	69.3	67
490	Dean Street	Uphill Street	East End	HCB	0.35	65	62.7	80.4	78.1	75.8	73.5	71.2	68.9	66.6	64.3	62
505	Union Street	Highway 15	North End	HCB	0.30	60	57.7	55.4	53.1	50.8	48.5	46.2	43.9	41.6	39.3	37
520	Alice Street	Lorne Street	First Street	HCB	0.42	65	62.7	60.4	58.1	55.8	53.5	51.2	68.9	66.6	64.3	62

525	Lila Street	Lorne Street	First Street	HCB	0.42	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	66.6	64.3	62
535	Fifth Street	Rideau Street	Alice Street	HCB	0.15	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
540	Fifth Street	Alice Street	Lila Street	HCB	0.15	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
545	Fifth Street	Lila Street	East End	HCB	0.10	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
550	Fourth Street	Rideau Street	Alice Street	HCB	0.15	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	90	87.7	85.4
555	Fourth Street	Alice Street	Lila Street	HCB	0.15	65	62.7	60.4	58.1	55.8	53.5	71.2	68.9	66.6	64.3	62
560	Fourth Street	Lila Street	East End	HCB	0.10	65	62.7	60.4	58.1	55.8	53.5	51.2	48.9	46.6	44.3	42
565	Third Street	Rideau Street	Alice Street	HCB	0.15	60	57.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
570	Third Street	Alice Street	Lila Street	HCB	0.15	60	57.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
575	Third Street	Lila Street	East End	HCB	0.10	60	57.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57
580	Second Street	Rideau Street	Alice Street	HCB	0.15	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
585	Second Street	Alice Street	Lila Street	HCB	0.15	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
590	Second Street	Lila Street	East End	HCB	0.10	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	49.3	47
595	First Street	Rideau Street	Lila Street	HCB	0.30	70	67.7	65.4	63.1	60.8	58.5	56.2	53.9	51.6	69.3	67
600	King Street	Rideau Street	East End	HCB	0.15	100	97.7	97.7	95.4	93.1	90.8	88.5	86.2	83.9	81.6	79.3
625	Bristow Drive	23-Rosedale Road South	East End	HCB	1.10	80	77.7	75.4	73.1	70.8	68.5	66.2	63.9	61.6	59.3	57

Weighted Condition Rating Average - L	68.44	66.14	63.84	61.54	59.24	56.94	60.08	60.86	58.56	66.40
Total KM	11.03	11.03	11.03	11.03	11.03	11.03	11.03	11.03	11.03	11.03

Weighted Condition Rating Average -H	70.91	69.13	68.57	66.74	68.35	66.36	67.07	65.39	64.78	62.48
Total KM	51.93	51.93	51.93	51.93	51.93	51.93	51.93	51.93	51.93	51.93

Weighted Condition Rating Average -H	70.48	68.61	67.74	65.83	66.75	64.71	65.84	64.60	63.69	63.17
Total KM	62.96	62.96	62.96	62.96	62.96	62.96	62.96	62.96	62.96	62.96

Weighted Condition Rating Average -G	64.76	62.63	60.89	58.75	57.73	55.53	54.60	52.72	50.98	49.39
Total KM	158.34	158.34	158.34	158.34	158.34	158.34	158.34	158.34	158.34	158.34

2024 COMPRENSIVE ROADS NEED STUDY

THE TOWNSHIP OF MONTAGUE
COUNTRY LIVING AT ITS BEST

APPENDIX C

10 YEAR MAINTAINCE PROGRAM

APLIN MARTIN
ENGINEERING ARCHITECTURE PLANNING SURVEYING

10 Year Capital Plan

Number	Road	From	To	Surface Type	Road Rideability	2024 Roadway Conditon	Length (km)	AADT2	Type of Construction	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
5	Bayview Crescent	43-County Road 43	43-County Road 43	HCB	70.00	60.00	0.60	209.0	HCB-R1									$24,000	
15	Rainbow Valley Drive	43-County Road 43	West End	HCB	50.00	60.00	0.50	127.0	HCB-R3				$450,000						
30	Kilmarnock Road	43-County Road 43	Rideau Canal	HCB	70.00	65.00	0.70	550.0	HCB-R2									$140,000	
35	Rideau River Road	Boat Launch Road	43-County Road 43	HCB	70.00	65.00	3.90	220.0	HCB-R1			$401,700							
40	Rideau River Road	43-County Road 43	Boat Launch Road	HCB	70.00	65.00	3.60	220.0	HCB-R2							$360,000	$360,000		
45	Boat Launch Road	Rideau River Road	South End	HCB	65.00	55.00	0.30	22.0	HCB- R2			$60,000							
165	Carroll Road	Smiths Falls North L	Kelly Jordan Road	LCB	60.00	65.00	3.00	919.0	LCB-R1							$120,000			
180	Carroll Road	Kelly Road	0.1 km North of Ferg	LCB	60.00	65.00	1.40	231.0	LCB-R1								$56,000		
195	Kelly Jordan Road	Carroll Road	Highway 15	HCB	60.00	70.00	1.90	325.0	HCB-R1									$195,700	
205	Ferguson-Tetlock Road	Carroll Road	Highway 15	HCB	50.00	50.00	2.70	298.0	HCB-R2					$540,000					
245	McLachlin Road	Ford Road	Highway 15	G/S	65.00	50.00	2.60	522.0	Upgrade to LCB	$572,000									
250	Code Drive	4-Roger Stevens Dr	Nolan's Road	LCB	70.00	70.00	2.60	453.0	HCB-R2										$520,000
310	Rosedale Road North	MacPherson Road	McLachlin Road	HCB	60.00	60.00	3.20	547.0	HCB-R1						$329,600				
410	Matheson Drive	23-Rosedale Road S	1.4 km East of 23-R	HCB	65.00	65.00	0.30	884.0	HCB-R2						$60,000				
445	Dufferin Street	Rideau Avenue	Minto Street	HCB	70.00	65.00	0.40	143.0	HCB-R2									$80,000	
450	Minto Street	Dufferin Street	Wellington Street	HCB	70.00	65.00	0.18	110.0	HCB-R1		$18,540								
470	Uphill Street	4-Roger Stevens Dr	0.3 km North of 4-Ro	HCB	70.00	50.00	0.25	66.0	HCB-R2		$50,000								
480	Grange Street	4-Roger Stevens Dr	Ruthven Street	HCB	60.00	65.00	0.40	110.0	HCB-R2		$80,000								
485	Dean Street	Uphill Street	East End	HCB	65.00	70.00	0.35	132.0	HCB-R2						$70,000				
490	Dean Street	Grange Street	Uphill Street	HCB	60.00	65.00	0.35	110.0	HCB-R2		$70,000								
505	Union Street	Highway 15	North End	HCB	60.00	60.00	0.30	77.0	HCB-R2				$60,000						
520	Alice Street	Lorne Street	First Street	HCB	60.00	65.00	0.42	315.0	HCB-R1							$43,260			
525	Lila Street	Lorne Street	First Street	HCB	60.00	65.00	0.42	286.0	HCB-R1								$43,260		
550	Fourth Street	Rideau Street	Alice Street	HCB	70.00	65.00	0.15	154.0	HCB-R2								$30,000		
555	Fourth Street	Alice Street	Lila Street	HCB	70.00	65.00	0.15	121.0	HCB-R2						$30,000				
565	Third Street	Rideau Street	Alice Street	HCB	60.00	60.00	0.15	165.0	HCB-R2		$30,000								
570	Third Street	Alice Street	Lila Street	HCB	60.00	60.00	0.15	110.0	HCB-R2		$30,000								
575	Third Street	Lila Street	East End	HCB	60.00	60.00	0.10	66.0	HCB-R2		$20,000								
595	First Street	Rideau Street	Lila Street	HCB	70.00	70.00	0.30	391.0	HCB-R1									$30,900	
630	Industrial Road	Highway 15	South End	HCB	20.00	20.00	0.60	0.0	HCB-R5	$45,000									

Budget	475,000	475,000	475,000	475,000	475,000	475,000	475,000	475,000	475,000	475,000
Cost	$617,000	$298,540	$461,700	$510,000	$540,000	$489,600	$523,260	$489,260	$470,600	$520,000
Deficiet/Surplus	$ (142,000.00)	$ 176,460.00	$ 13,300.00	$ (35,000.00)	$ (65,000.00)	$ (14,600.00)	$ (48,260.00)	$ (14,260.00)	$ 4,400.00	$ (45,000.00)