MPE Engineering Ltd.

Final Report for:

VILLAGE OF RYLEY

INFRASTRUCTURE ASSESSMENT AND TEN-YEAR CAPITAL PLAN

Date: March 23, 2018
5562-001-00

Proud of Our Past... Building the Future

www.mpe.ca

#101, 10630-172 Street
Edmonton, AB T5S 1H8
Phone: 780-486-2000
Fax: 780-486-9090

MPE Engineering Ltd.

Village of Ryley
5005–50 Street
PO Box 230
Ryley, Alberta
T0B 4A0

March 23, 2018
File: N:\5582\001\00\R01

Attention: Michael Simpson
Chief Administrative Officer

Dear Mr. Simpson:

Re: Infrastructure Assessment and Ten-Year Capital Plan
Final Report

MPE Engineering Ltd. is pleased to submit the final report entitled *Infrastructure Assessment and Ten-Year Capital Plan*.

We thank you for the opportunity to be of service and to have prepared this assessment on your behalf. If you have any inquiries regarding this report, or if clarification is required, please contact the undersigned at 780-509-4304 or mgrzeszczuk@mpe.ca.

Yours truly,

MPE ENGINEERING LTD.

Mirek Grzeszczuk, P.Tech.(Eng.)
Edmonton Region Manager

MG:sb
Enclosure

CORPORATE AUTHORIZATION

This report has been prepared by MPE Engineering Ltd. under authorization of the VILLAGE OF RYLEY. The material in this report represents the best judgment of MPE Engineering Ltd. given the available information. Any use that a third party makes of this report, or reliance on or decisions made based upon it is the responsibility of the third party. MPE Engineering Ltd. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based upon this report.

Should any questions arise regarding content of this report, please contact the undersigned.

MPE ENGINEERING LTD.

PERMIT TO PRACTICE
MPE ENGINEERING LTD.
PERMIT NUMBER: P 3680
The Association of Professional Engineers and Geoscientists of Alberta

Mirek Grzeszczuk, P.Tech.(Eng.)

Professional Seal | Corporate Permit

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

Table of Contents

Appendices

List of Tables

List of Figures

1.0 INTRODUCTION

1.1 Overview

The Village of Ryley (Village) requires an assessment of capital assets for purposes of planning infrastructure maintenance and capital upgrades, and to evaluate the value of existing infrastructure. The Village has authorized MPE Engineering Ltd. (MPE) to perform an inventory of its capital infrastructure and provide recommendations for upgrades to the infrastructure.

1.2 Study Scope

The focus of this assessment is to review the condition and capacity of all Village-owned capital assets, including sanitary infrastructure, stormwater infrastructure, and road systems.

The major tasks included in this project were as follows:

- Review all existing information pertaining to all Village assets.
- Overview meetings with Village staff.
- Inspect and identify the condition and maintenance needs of the assets.
- Identify maintenance needs required to protect user health and safety and to prolong life of the asset.
- Provide Class "D" cost estimates for all proposed maintenance needs.
- Provide colour photographs to identify major problems and/or to support any recommendations for the asset.
- Assist the Village in acquiring software and computer hardware necessary to record asset inventory and condition.

1.3 Objective

The objective of this project is to collect, summarize, and present information on all Village assets in a form conducive to budget planning and capital spending prioritization.

1.4 Overall Drawings

Figure M1.1 and ***Figure M1.2*** in ***Appendix M*** show the sanitary sewer system and storm sewer system.

2.0 ASSESSMENT OF MUNICIPAL UTILITIES

2.1 General Information

MPE has assessed the general condition of infrastructure within the Village in preparation for the development of a ten-year capital projection and budget for the maintenance and rehabilitation of the system. Wherever possible, the Village may consider alternative rehabilitation measures such as those outlined in ***Table 2.1***.

Table 2.1: Alternative Rehabilitation Measures

Pipe Replacement Method	Advantages	Disadvantages
Open-Cut Replacement	▶ Complete replacement of pipe and bedding material ▶ Consistent grading	▶ Road disturbance ▶ Settlement issues ▶ Cost
Pipe Bursting	▶ Little disturbance of road surface	▶ Services must be reattached in separate excavation ▶ Can only be used with select pipe types ▶ Cost
Pipe Reaming	▶ Little disturbance of road surface	▶ Services must be reattached in separate excavation ▶ Can only be used with select pipe types ▶ Cost
Cast-In-Place Pipe	▶ Little disturbance of road surface ▶ Services can be reopened easily ▶ Coefficient of friction is reduced	▶ Cannot be used in deformed or blocked pipe ▶ Reduces the interior diameter of the pipe

The design life for pipe material and permanent structures used throughout this section adheres to the information presented in ***Table 2.2***. The design life of a given asset typically dictates the planned timeframe for replacement of that infrastructure. However, with appropriate monitoring and maintenance practices, infrastructure may be operated beyond these guidelines.

Table 2.2: Typical Design Life(s) for Underground and Above Ground Utility Infrastructure Components

Pipe Material	Estimated Design Life (Years)
Cast Iron Pipe	25
Asbestos Cement Pipe	40
Concrete Pipe	40
Corrugated Steel Pipe	40
Ductile Iron Pipe	40
Vitrified Clay Tile Pipe	50*
Copper Pipe	50
Polyethylene Pipe	50
Polyvinyl Chloride Pipe	50
Permanent Structure	**Estimated Design Life (Years)**
Lagoon	25

**Vitrified clay tile pipe has exhibited life expectancies of 100 years or greater under appropriate geotechnical conditions. The estimated design life for vitrified clay tile pipe within the Village of Ryley is discussed in further detail in Section 2.3.2.*

2.2 Design Criteria for Wastewater Systems

2.2.1 Design Criteria for Average Day Flow

Estimated design flows for the period of this assessment are currently based on population figures from the 2016 Federal Census and updated based on the most recent municipal information. The 2016 census found that a growth rate of -2.8% reflected growth trends since 2011. Despite the recent drop, MPE recommends utilizing a 1.0% growth rate for planning purposes. This recommendation is based on the position that planned growth should be positive in order to remain conservative during the planning process, and the observations that the previous census growth rate from 2006 to 2011 was 8.5%. Annual flows and corresponding average day flows are projected based on a 2% increase per year. This recommendation of a 2% increase is a lower estimate than the estimated typical bulk wastewater flows that would be generated by the population at 375 Lpcd and if 85% of the water consumed per day went to wastewater. ***Table 2.3*** outlines the projected population growth and associated average day flows based on historical pump hours and wastewater generation for year 2016.

Table 2.3: Determination of Average Day Flow

Year	Population (persons)	Annual Flow (m^3)	Average Day Flow (m^3/day)
2016	483	51 067	140
2018*	493	53 130	146
2028*	543	64 767	177

**For 2018 and 2028, annual flows and corresponding average day flows are projected based on a 2% increase per year.*

The Average Day Design Flows are calculated based upon the Village of Ryley "Lift Station Assessment" draft report produced on May 12, 2017. The baseline value of 140 m^3/day of average day sewage generation for year 2016 is calculated based upon the multiplication of the total pump hours for year 2016 (937 hours) and the pumping rate (54.5 m^3/hour) divided by 365 days in the year.

$$\boldsymbol{Average\ Day\ Flow}\ (\frac{\boldsymbol{m^3}}{\boldsymbol{day}}) = \frac{Total\ Pump\ Hours\ (hours) \times\ Pumping\ Rate\ (\frac{m^3}{hour})}{365\ days}$$

$$\boldsymbol{Average\ Day\ Flow}\ (\boldsymbol{140}\ \frac{\boldsymbol{m^3}}{\boldsymbol{day}}) = \frac{Total\ Pump\ Hours\ (937\ hours) \times\ Pumping\ Rate\ (54.5\ \frac{m^3}{hour})}{365\ days}$$

The average day design flows for 2018 (146 m^3) and 2028 (177 m^3) will be utilized later in the report for the purpose of assessing the lagoons in the Village.

2.2.2 Design Criteria for Peak Wet Weather Flow

For the purpose of analyzing the sanitary collection system, the wastewater design flows calculated for Peak Wet Weather Flow (Peak Dry Weather Flow + Infiltration and Inflow), the Village of Ryley "Lift Station Assessment" will be utilized. The following ***Table 2.4*** illustrates the Peak Wet Weather Flows for years 2016, 2018, and 2028.

Table 2.4: Determination of Peak Wet Weather Flow

Year	Population (persons)	Peak Dry Weather Flow (m^3/day)	Infiltration and Inflow (m^3/day)	Peak Wet Weather Flow (m^3/day)
2016	483	433	327	760
2018	493	441 (5.1 L/s)	334 (3.87 L/s)	775 (8.97 L/s)
2028	543	483	368	851

The sanitary model (see Section 2.4.2) constructed for the Village to analyze the capacity of the system is calibrated for the Peak Wet Weather Flow of 775 m^3/day (8.97 L/s) and a population of 493 people.

2.3 Water Supply and Pumping Assessment

2.3.1 Overview

Water is supplied to the Village through the Highway 14 Regional Water Services Commission. The Commission owns and operates all the water supply, storage, pumping, and distribution systems and will therefore not be discussed any further for the purposes of this report.

2.4 Sanitary Collection System Assessment

2.4.1 Overview

MPE reviewed the ability of the sanitary collection system to meet the loading generated by the Village. This was completed through review of previously completed CCTV inspections, dating from 2007 to 2012, GPS survey of the sanitary system, as well as comparison of design parameters to actual lift station flows. MPE also reviewed the GIS data provided by the Village.

2.4.2 Sanitary Collection System Model – Existing System

A manhole inspection survey was conducted in the summer of 2017, with the invert elevations measured. Missing manhole inverts were interpolated based on minimum design standards for slopes of the size of the pipe. MPE constructed a sanitary model for the Village based on the inverts collected and calculated the capacity of the system for year 2018. The sanitary model spreadsheet can be found in ***Appendix K***.

The following design parameters in ***Table 2.5*** were utilized for the construction of the sanitary model. The total catchment area for the existing collection system is 47.72 hectares, with a population of 493 people in 2018 (projected value); the residential density was calculated to be 10.33 persons/ha.

As stated previously, the model was calibrated to meet the demands of the estimated peak weather flow of 775 m^3/day (8.97 L/s) for 2018.

Table 2.5: Sanitary Model Design Parameters

Design Parameter	Value	Unit
Residential Flow	225	L/person/day
Commercial/Industrial Flow	0.07	L/s/ha
Infiltration Allowance	0.08	L/s/ha
Sag MH Inflow (not used in model)	0.40	L/s
Pipe Roughness	0.013	unitless
Residential Persons per Hectare	10.33	persons/ha

The sanitary model for the Village concludes that the system is currently *utilizing **39% of its available capacity*** based on the current pipe sizes in the collection system.

2.4.3 Future Development – Sanitary Model Analysis

The Village informed MPE that future development (approximately 16.7 hectares) of developable land within the Village boundary could be developed. MPE created a sanitary model spreadsheet to account for the future development such that the sewage flows would tie into Manhole 47. The spreadsheet model is located in ***Appendix K***. The sanitary model for future development concludes that the system would utilize ***52% of its available capacity*** based on the current pipe sizes in the collection system.

2.4.4 Existing Collection System Material, Size, and Length

The sanitary collection system is comprised of approximately 4.2 km of 200 mm and 1.6 km of 250 mm. The majority of the installed pipe, approximately 70%, is Vitrified Clay Tile (VCT), with some sections being PVC pipe. It is believed that much of the pipe in the Village was installed in the 1950s or early 1960s, and a reasonable portion is in marginal condition. The GIS data provided indicates that most of the main trunk line along 57 Avenue and Highway 854 is PVC installed in 1979. There is also a portion of 52 Avenue and 53 Avenue that have been replaced with PVC. Of the pipes surveyed in the CCTV inspections, twelve (12) sections were flagged with high- and medium-priority defects.

VCT pipe is an inert material that does not chemically degrade over time. Properly installed pipe can, in the absence of a structural or mechanical failure, last a period of time in excess of 100 years. However, improper installation, dynamic ground conditions, settlement, and loading often make the implementation of a design life in excess of 50 years infeasible for the purposes of long-term planning. The CCTV inspection program outlined in Section 2.4.6 found that approximately 10% of inspected pipes showed signs of critical defects. This observation indicates that a 50-year design lifecycle may be a reliable metric to determine VCT pipe replacement requirements within the Village.

A program must be implemented to provide flushing, scouring, inspection, and maintenance for sanitary pipe beyond its predicted design life. MPE recommends an interval less than 5 years be used as a benchmark for this inspection program. Should inspected pipes be found to have critical structural deficiencies, MPE recommends that all deficient pipes be repaired or replaced.

The Village had information regarding the composition of pipe as well as some information on year of installation. Where the year of installation is unknown, it was assumed that no replacement has occurred since the original installation and that the pipe is VCT. At these locations, MPE recommends the Village confirm the condition of the pipe prior to commencing a replacement or rehabilitation program.

2.4.4.1 Local Issues

No local issues were noted by Village staff regarding the sanitary system. Some issues were identified during review of the CCTV inspections. Critical issues are outlined further in Section 2.4.6.

2.4.4.2 Sanitary Sewer Replacement

A large percentage of the existing sanitary collection system is approaching or already beyond its predicted design life. At this age, physical changes to the pipe bedding and subsoil conditions create a greater risk of pipe failure regardless of the chemical stability of the pipe. By 2020, approximately 70% of the existing system will have exceeded its design life, at which point the pipe inspection program outlined in Section 2.4.4 will become increasingly important in estimating the remaining life expectancy for individual portions of pipe.

2.4.5 Lift Stations

2.4.5.1 Main Lift Station

The lift station is located approximately 400 m northeast of the Village along Secondary Highway 854 and services the entire raw sewage generated by the Village. The lift station is a wet well/dry well type configuration with two separate structures made of cast-in-place reinforced concrete. The dry well features a narrow spiral stairway that opens up to a lower area that houses two vertically mounted end suction centrifugal pumps. Wastewater enters the wet well and is drawn into the pumps in the dry well through suction inlet piping. Wastewater is pumped through a 150 mm forcemain to the wastewater treatment facility. For further details on the main lift station, refer to the "Lift Station Assessment" draft report in ***Appendix L***. An amendment to the cost estimate provided in the draft report can be found in ***Appendix N***.

2.4.5.2 Lower Lift Station

The lower lift station is located approximately 150 m west of 46 Street (Secondary Highway 854) along 50 Avenue. The lift station is situated within a tin shed building and services the sanitary connections along 50 Avenue east of 49 Street. Wastewater is pumped through a 100 mm forcemain to the manhole at the intersection of 50 Avenue and 49 Street where it is conveyed north by gravity main. At the time of this assessment, no issues were noted with this lift station.

2.4.6 CCTV Inspection

Three CCTV inspection programs have been implemented recently in 2007, 2008, and 2012. The inspections were completed by Cam-Trac Inspection Services of Morinville, Alberta, and Inline Pipe Inspections of Ardrossan, Alberta. During these inspections, approximately 60% of the sanitary system was inspected. The inspectors reported high levels of encrustation, root intrusion, and sagging throughout the piping system.

Within the Village collection system, there were a number of locations where the VCT pipe had cracked, broken, sagged, or was physically deformed due to fracturing. These assorted pipe defects have been classified as critical deficiencies, and the sections of pipe that exhibited these defects during the CCTV inspections are highlighted as "high priority" in ***Table 2.6***. Approximately 44% (see ***Tables 2.6*** and ***2.7***) of the pipe segments inspected were found to be deficient, with only 10% being considered high priority. The segments of pipe indicated in ***Table 2.6*** will need to be replaced in order to restore desired flow rates.

Other key pipe locations identified in the CCTV inspections are outlined in ***Table 2.7***. These sections of pipe are classified as "moderate priority" based on the potential for the pipe to be salvaged. These sections of pipe displayed deficiencies during the CCTV inspections, such as cracking and encrustations, which are potentially repairable with a Cured-in-Place-Pipe (CIPP) product. As discussed in Section 2.4.6.1, CIPP may be a cost-effective solution for these locations where the pipe has not suffered serious deformation.

Table 2.6: High-Priority Pipe Locations

Pipe Section	Road	Nearest Intersection	Issue
MH 34–35	54 Avenue	49 Street	Collapsed Pipe
MH 32–33*	54 Avenue	50 Street	High Severity Joint Displacements
MH 13–23*	49 Street	52 Avenue	High Severity Sagging/Collapsed Pipe
MH 40–41	56 Avenue	50 Street	High Severity Sagging/Collapsed Pipe

**CCTV image not available*

Table 2.7: Medium-Priority Pipe Locations

Pipe Section	Road	Nearest Intersection	Issue
MH 39x–39	55 Avenue	50 Street	Low Severity Cracking and Low-High Severity Sagging
MH 22–26	50 Street	52 Avenue	Low-High Severity Cracking and Moderate-High Severity Encrustations
MH 26–33	50 Street	53 Avenue	Low-High Severity Cracking and Low-High Severity Sagging
MH 15–22*	50 Street	51 Avenue	Moderate Severity Sagging
MH 23–22*	52 Avenue	49 Street	Low-High Severity Sagging
MH 17–16*	51 Avenue	50 Street	High Severity Cracking
MH 6–13*	49 Street	50 Avenue	Moderate Severity Sagging
MH 2–3*	50 Avenue	51 Street	Moderate Severity Sagging
MH 1–2*	50 Avenue	51 Street	Moderate Severity Sagging

**CCTV image not available*

During the CCTV inspections, six (6) sections of pipe were not fully inspected due to the presence of impassably large encrustations within the pipe section. These large encrustations prevented the CCTV unit from completing the inspection of the entire segment. ***Table 2.8*** highlights these sections of pipe. These segments will need to be ground down before a complete CCTV inspection can be performed.

Table 2.8: Sections of Pipe with Impassable Encrustations

Pipe Section	Road	Nearest Intersection	Issue
MH 38–39	55 Avenue	50 Street	Incomplete Inspection Due to Large Encrustations in Pipe
MH 38–37	55 Avenue	50 Street	Incomplete Inspection Due to Large Encrustations in Pipe
MH 35–36	54 Avenue	51 Street	Incomplete Inspection Due to Large Encrustations in Pipe
MH 34–33	54 Avenue	50 Street	Incomplete Inspection Due to Large Encrustations in Pipe
MH 31–32*	54 Avenue	50 Street	Incomplete Inspection Due to Large Encrustations in Pipe
MH 25–26*	53 Avenue	50 Street	Incomplete Inspection Due to Large Encrustations in Pipe

**CCTV image not available*

The images on the following pages highlight some of the system deficiencies indicated in the previous three tables: ***Table 2.6*** – sections of pipe with critical deficiencies; ***Table 2.7*** – sections of pipe with moderate deficiencies; and ***Table 2.8*** – sections of pipe not fully inspected in previous CCTV reporting due to large encrustations. A selection of images highlighting the general condition of the pipe system (non-deficient pipe) is also included. (***Note:** Deficient sections where no CCTV image is available are indicated by an asterisk in each table.)

HIGH-PRIORITY PIPE LOCATIONS – CRITICAL DEFICIENCIES

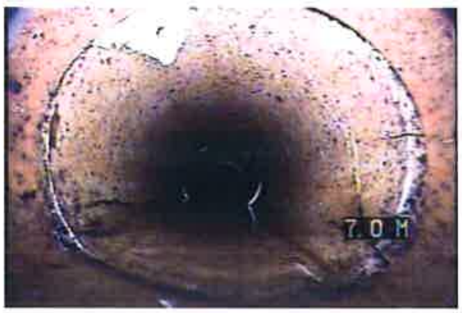
- 54 Avenue between MH 34 and MH 35 @ 61.6 m and 68.2 m

- 56 Avenue between MH 40 and MH 41 @ 134.5 m

MEDIUM-PRIORITY PIPE LOCATIONS – MODERATE DEFICIENCIES

- 55 Avenue between MHx 39 and MH 39 @ 129.3 m and 88.5 m

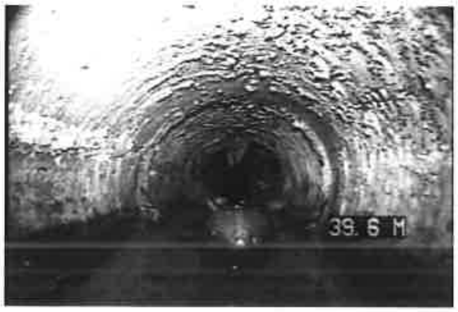
- 50 Street between MH 22 and MH 26 @ 7.0 m and 31.6 m



- 50 Street between MH 26 and MH 33 @ 26.8 m and 38.7 m

SECTIONS OF PIPE WITH IMPASSABLE ENCRUSTATIONS

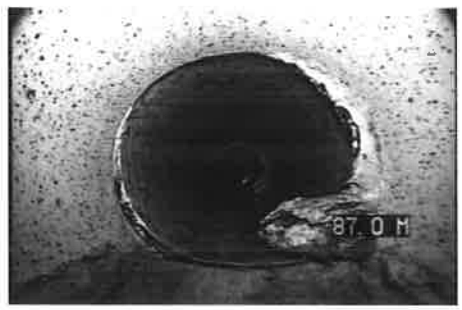
- 55 Avenue between MH 38 and MH 39



- 55 Avenue between MH 38 and MH 37

- 54 Avenue between MH 35 and MH 36

- 54 Avenue between MH 34 and MH 33

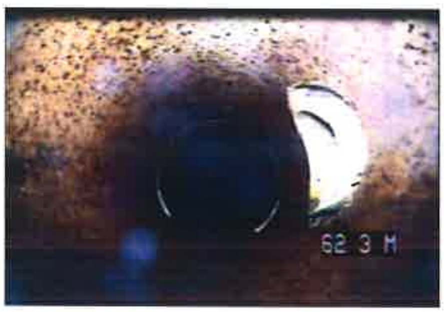


SYSTEM – GENERAL CONDITIONS

- 55 Avenue between MH 38 and MH 39

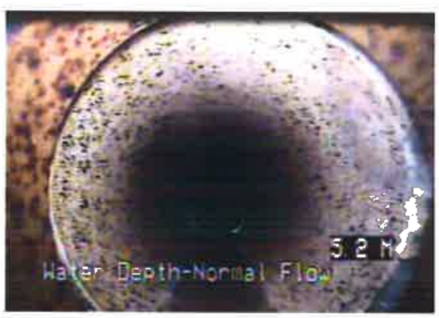
- 55 Avenue between MH 39x and MH 39

- 50 Street between MH 22 and MH 26

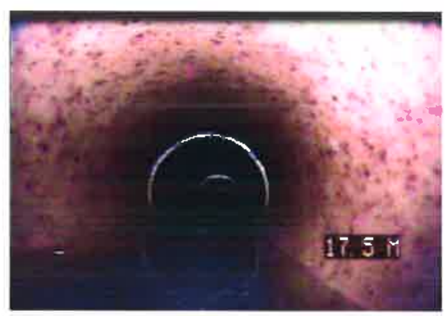


- 50 Street between MH 26 and MH 33

- 56 Avenue between MH 39x and MH 39



- 54 Avenue between MH 34 and MH 35



2.4.6.1 CIPP Rehabilitation

In areas where sanitary sewer replacement is required, but water and drainage replacement will not be needed for many years, one option to rehabilitate the existing pipe is a cured-in-place-pipe liner. CIPP technology uses heated air to force a fibreglass reinforced resin tube into the pipe to be rehabilitated. The tube then expands to fit the interior of the pipe and cures into place to form a new pipe with an effective design life of 50 years. The new pipe is typically rated structurally to withstand the bury pressures at approximately 3 m, but a variation in the thickness of the liner may allow for deeper installation. The CIPP process removes 12 mm of effective diameter from the interior of the pipe, but typically the change in the friction factor from cast-iron or VCT pipe offsets this reduction in diameter. A CIPP pipe system is also less susceptible to inflow and infiltration, reducing further the pipe size requirements. Any benefits resulting from a reduction in inflow and infiltration will only become apparent following installation, but could be substantial.

Sanitary services can also be accommodated in CIPP rehabilitation; however, any pipes intruding into the existing sewer must be ground down before a CIPP operation can be successful. Benefits and restrictions of CIPP installation are outlined further in ***Table 2.9***.

Table 2.9: CIPP Benefits and Restrictions

Advantages	Disadvantages
- Competitive cost with standard construction practices - Trenchless construction - Fully structural pipe - Extended life - Improved coefficient of friction - Reduced inflow and infiltration - Can also be used to re-line services	- Cannot be used in pipes with uneven surfaces - Cannot be used in pipes with an ovality greater than 10% - Does not remedy grading or settling issues - Smaller overall diameter - Intruding services must be ground down - Bends in pipe may cause hydraulic issues - Liner may only be cleaned through high-pressure water blasting

Costs for CIPP installation are typically similar to those for open trench installation on native ground, and the process is most often used when no other underground infrastructure requires attention and the above surface is not in need of reconstruction. However, the use of CIPP is an effective means of greatly reducing costs for the restoration of a sanitary collection system without disturbing other infrastructure.

Budget pricing was supplied by Ivis Inc. based on 2017 numbers for a total project length of 1,000 m.

Table 2.10: CIPP Cost

Pipe Diameter (mm)	CIPP Thickness (mm)	Approximate Cost ($/m)
150	6	175
200	6	225
250	6	275

2.4.6.2 Conclusions and Recommendations

Sanitary sewer pipes within the Village are in variable condition. Some high-priority deficiencies were identified within the system during previous CCTV inspections but appear to have been conveying flow adequately since. The Ten-Year Capital Plan will summarize the recommended minimum expenditure for maintenance of the sanitary sewer system.

2.5 Sanitary Lagoon Assessment

The sanitary lagoon is located in the SW ¼ 10-50-17 W4M, the northeast side of the Village, adjacent to Range Road 173, approximately 800 m north of 57 Avenue. The wastewater system is currently licensed by Alberta Environment and Parks (AEP) under authorization number 1136-01-01. The existing 1995 approval from AEP for the operation of wastewater and drainage facilities indicates that the design capacity for the lagoon system is 320 m^3/day. There are no noted issues with the lagoon; therefore, it is assumed that all structures and lagoon cells are functioning under normal conditions. The Village has the following sewage lagoon infrastructure:

- 4 anaerobic cells
- 1 facultative cell
- 1 storage cell
- 1 detention cell

Table 2.11: Sewage Lagoon Capacities

Anaerobic Cell	Depth (m)	Volume (m^3)	Total Volume (m^3)
1	4	1,294	5,177
2	4	1,294	
3	4	1,294	
4	4	1,294	
Facultative Cell	**Depth (m)**	**Volume (m^3)**	**Total Volume (m^3)**
1	1.26	16,376	16,376
Storage Cell	**Depth (m)**	**Volume (m^3)**	**Total Volume (m^3)**
1	2.45	116,686	**116,686**
Detention Cell	**Depth (m)**	**Volume (m^3)**	**Total Volume (m^3)**
1	Unknown	Unknown	**Unknown**

2.5.1 Sanitary Lagoon Storage Requirements

Lagoon storage requirements for the Village are dictated by AEP based on a standardized set of guidelines for municipalities with a population less than 20,000. Lagoon guidelines are not dependent on effluent water quality, but are instead built around designated retention times for treatment processes occurring in each cell of the lagoon. Based on the design criteria for wastewater systems, the sewage generated would be 146 m^3/day and 177 m^3/day respectively.

It is important to note that the sewage flow generated for 2018 and 2028 is **less than** the Village's current licensed approval of 320 m^3/day.

Based on the average daily design flow, the number of anaerobic cells, facultative cells, and requirement for 12-month storage cell(s) is presented in ***Table 2.12***. All requirements are based on AESRD's guidelines.

2.5.2 Anaerobic Cells

In anaerobic cells, much of the solid material present in the waste stream settles out, and microbial action from bacteria present in the waste stream breaks down organic compounds. The breakdown of organic compounds in an anaerobic cell is a three-stage process that can be susceptible to influent that is acidic or that has highly variable amounts of Biological Oxygen Demand (BOD).

The reduction of BOD present in the waste stream is a vital function within a wastewater lagoon that occurs in the highest intensity in anaerobic cells. AEP specifies a contact time within each anaerobic cell of 48 hours, and that each cell maintains a depth of 3 m. The depth of each cell is important to mitigate the amount of oxygen that enters the lagoon through the water surface. Due to the high solids loading rate, anaerobic cells require more frequent maintenance than other cells within the sanitary lagoon system. Each cell is intended to operate independently of the other cell for a period of 48 hours to allow for additional repair and maintenance without negatively impacting the quality or operation of other parts of the lagoon.

2.5.3 Facultative Cell

Despite the reduction of BOD in the anaerobic cells, the constant influx of fresh sewage prevents effluent from reaching the levels required for release into the environment. To reach these levels, two further stages of treatment are required. The first of these stages takes place in the facultative cell. In the facultative cell, both anaerobic and aerobic bacteria act on the sludge in different layers. The Alberta Standards and Guidelines for Facultative Cells dictates a maximum depth of 1.5 m for these cells, which increases the volume of oxygen that can be absorbed through the water's surface to support the growth of aerobic bacteria.

AEP dictates a retention time in the facultative cell of a lagoon system of 60 days. This long retention time allows most of the remaining solids to settle out and significantly reduces the concentration of BOD in the waste stream.

2.5.4 Storage Cell

The final cell in the lagoon is sized to store 12 months of flow at a given time as per AEP Standards. This size allows for final finishing of the wastewater effluent to further reduce the environmental loading caused during annual releases. AEP identifies that the maximum depth of the storage pond should be 3 m. The water entering the storage lagoon has typically been treated to a high degree in the anaerobic and facultative cells and as such, sedimentation of the storage cell is not a concern unless qualitative observations made after the lagoon has been discharged identify sedimentation as an issue. No such issues have been identified by the Village at this time.

Table 2.12: Sewage Lagoon Capacity Assessment

Component	Units	2018	2028
Population	Persons	483	543
Average Day Flow	m^3/day	146	177
Anaerobic Cells			
Number of Cells Required	each	0	0
Number of Cells Existing	each	4	4
Retention Required, Each Cell	days	2	2
Retention Volume Required, Each Cell	m^3	292	354
Retention Volume Required (Total)	m^3	0	0
Volume Available (Total)	m^3	5177	5177
Additional Volume Required (Retention > Volume Available)	m^3	**None**	**None**
Facultative Cell			
Retention Required	days	60	60
Volume Required	m^3	8760	10,620
Volume Available	m^3	16,376	16,376
Additional Volume Required (Retention > Volume Available)	m^3	**None**	**None**
Storage Cells			
Retention Required	days	365	365
Volume Required	m^3	53,290	64,605
Volume Available (Total)	m^3	116,686	116,686
Additional Volume Required (Retention > Volume Available)	m^3	**None**	**None**

2.5.5 Conclusions and Recommendations

Based on the wastewater lagoon requirements set by AEP, the Village **does not** require any additional anaerobic cells, facultative cells, or storage cells leading into the year 2028. If average daily design flows increase dramatically, MPE recommends reassessing the sewage lagoon capacities.

2.6 Storm Drainage Assessment

2.6.1 Surface Drainage

Drainage within the Village is generally managed through a network of overland drainage pathways. The stormwater system is currently licensed by AEP under authorization number 1136-01-01. The drainage system within the Village is shown in ***Figure M1.2*** in ***Appendix M***. The existing 1995 approval from AEP for the operation of wastewater and drainage facilities indicates that no underground drainage system is present within the Village; however, a piped system has since been installed on, and adjacent to, 52 Avenue. AEP approval should be updated to include these facilities.

MPE noted the following deficiencies in the existing drainage system within the Village:

- Catch basins have leads that terminate in other catch basins. This is generally poor practice as all catch basin leads should terminate into manholes.
- The ditch north of the Community Centre becomes inundated during large rainfall events and has standing water. This should be dredged or reshaped and graded to efficiently convey flow.

Where rehabilitation projects are pursued in areas where storm drainage infrastructure is in place, MPE recommends the affected storm drainage infrastructure be upgraded to meet the current AEP Standards and Guidelines for Stormwater Management Systems.

2.6.2 Stormwater Retention

The Village has no existing stormwater retention facilities. The current approval from AEP carries no stipulation for the retention or treatment of drainage from the Village site. However, the province has since stiffened the requirements for stormwater treatment, and it is highly likely that any new developments will require a dedicated drainage collection and retention system.

2.6.3 Conclusions and Recommendations

Given the lack of direction present in the existing drainage plan for the Village, MPE recommends the Village develop a Master Drainage Plan. A Master Drainage Plan will allow the Village to develop a strategy to meet AEP requirements moving forward.

3.0 ROAD DATA COLLECTION

3.1 Executive Summary

The Village is responsible for the administration of a paved roadway network consisting of Collector and Local roads, totalling approximately 15 lane-kilometres as shown in ***Table 3.1***.

Table 3.1: Village of Ryley Road Network

Functional Class	Sections	Lane-km
Collector	10	**4.432**
Local	39	**10.364**
Entire Paved Network	**49**	**14.796**

For many years, pavement management systems have been extensively used to develop a rehabilitation program based on the current condition of a road network. In order to facilitate the development of the pavement rehabilitation budget for 2018, MPE completed the following tasks:

- Collection of pavement roughness and surface distress data on the Entire Paved Roadway Network (15 lane-kilometres).
- Implementation of the RUBIX rMD asset management dashboard to facilitate a pavement assessment and the ongoing asset management of the roadway network and other infrastructure assets.
- Preparation of the roadway evaluation report including the network present status and the development of a ten-year rehabilitation needs priority program.

PERFORMANCE INDICATORS

Performance indicators serve to describe the present status or current condition of the pavement network. The present status of the network serves as the 'benchmark' for the future maintenance and rehabilitation requirements of the network—you cannot determine which direction to take until you know where you are. The performance indicators used for the pavement evaluation are presented herein.

RIDE COMFORT INDEX (RCI)

- Index representing measured roughness for the perceived riding comfort experienced by the users of a pavement section.
- Index represented by a value on a scale of zero (0) to 100, where zero is considered an extremely rough surface and 100 is an extremely smooth surface.

- Value calculated based on the results of the pavement roughness survey, during which longitudinal profiles of the left and right wheel paths in the survey travel lane are measured, a calculated RCI score is used to represent the dynamic response of a reference vehicle travelling over the measured profile.
- Roughness surveys are typically completed for the entire paved road network, in the direction of survey, and are considered representative of the travelled pavement surface.

PAVEMENT DISTRESS INDEX (PDI)

- Index representing the presence, severity, and extent of various surface distresses (e.g., cracking, potholes, etc.) occurring throughout a given pavement section.
- Index represented by a value on a scale of zero (0) to 100, where zero is considered a significantly distressed pavement surface and 100 indicates no surface distress exists.
- Value calculated based on the results of the pavement distress survey.
- Surface distress surveys are typically completed for the entire paved road network.

OVERALL CONDITION INDEX (OCI)

- Index representing the overall condition of a pavement section.
- Index represented by a value on a scale of zero (0) to 100, where zero is considered to be the worst case and 100 is considered to be the best case.
- Value calculated using one of the OCI models, each of which is based on a weighted combination of RCI, PDI, and SAI where available.

The minimum acceptable OCI values for each functional class are set as follows:

- OCI min of 50 for Collector
- OCI min of 45 for Local

The analysis of the pavement condition results indicate the majority of the Village's road network is providing a marginal level of service given the network average OCI is 50. The Collector network is showing an OCI of 89 which is very good and reflective of the fact that most of the pavements in the Collector network have been recently rehabilitated. The Local network is showing poor level of performance with an OCI of 35.

The 2018 rehabilitation needs backlog is 61.7%. Typical backlog targets are between the ranges of 10%–25%. The Village has a higher than recommended roadway rehabilitation backlog, and reducing this to a more manageable level should be the focus in the early stages of the next ten-year planning phase.

The results of the present status and backlog (present needs) analysis are provided in ***Table 3.2***.

Table 3.2: Village of Ryley Network 2018 Present Status

Functional Class	Present Status				Backlog (% of FC)	
	OCI	RCI	PDI	IRI	Lane-km	% F/C
Collector	89	55	95	3.61	0.4	0.4
Local	35	32	25	6.13	8.8	8.8
Entire Paved Network	**50**	**38**	**45**	**5.40**	**9.1**	**9.1**

The results of the rehabilitation needs analysis show the Roadway network will require approximately $1.68M for rehabilitation recommendations over the next ten years. By Functional Class, the Collector network will require approximately $0.23M, and the Local network will require approximately $1.45M.

The funding budgets run on the Entire Paved Network show the performance impact of the two budget scenarios selected for the analysis. The budget scenarios analyzed are a Fixed annual budget of $160,000/year, and a Flexible annual budget where the network is funded at $250,000/year for the first four years, and $100,000/year for the final six years of the ten-year programming period. These budget scenarios show more realistic budget planning options that would meet the majority of the identified rehabilitation needs.

The results of the budget programming analysis are provided in ***Table 3.3***.

Table 3.3: Village of Ryley Budget Analysis Summary

Budget ID	Budget Scenario	10-Year Budget	2018		10-Year (2027)	
			OCI	%DEF	OCI	%DEF
Do Nothing	No Funding	$0	41	61.4	12	80.8
Need Driven	Unconstrained	$1.68M	79	0.0	54	0.0
$160,000/year	Annual Fixed Funding	$1.6M	44	54.3	47	4.7
$250,000–100,000/year	Annual Flexible Funding	$1.6M	46	50.8	46	4.7

The results of the two annual budget analysis runs show the Village's road network will have essentially the same predicted performance at the end of the ten-year programming period.

The Fixed budget scenario shows an overall actual budget cost of $1.47M to achieve a predicted OCI of 47 and a backlog of 4.7% in 2027. The Flexible budget scenario shows a slightly higher overall cost of $1.52M to achieve a predicted OCI of 46 and a backlog of 4.7% in 2027.

The Flexible budget approach, where the current backlog is addressed earlier in the programming period, does show an improved network level of service throughout most of the programming period. If funding options do become available, it is recommended the Village plan roadway works with an emphasis on reducing the current backlog of 9.1 lane-kilometres as early in the planning cycle as is feasible.

3.2 Project Overview

3.2.1 Background

The Village is responsible for the administration of a paved roadway network consisting of Collector and Local roads, totalling approximately 15 lane-kilometres. This network forms a valuable asset to be managed in a cost-effective manner in order to provide a desirable level of service to the stakeholders of the network.

3.2.2 Scope and Objectives

In 2017, the Village retained the services of MPE to undertake a comprehensive pavement evaluation program. Pavement roughness and surface distress were collected on the Entire Paved Road Network. The breakdown of the current data collection and reporting program are as follows:

- Collection of pavement roughness and surface distress data on the Entire Paved Roadway Network (15 lane-kilometres)
- Implementation of the RUBIX rMD asset management dashboard to facilitate a pavement assessment and the ongoing asset management of the roadway network and other infrastructure assets
- Preparation of the roadway evaluation report including the network present status and the development of a ten-year rehabilitation needs priority program

The 2017 field survey consisted of the following:

- An automated roughness survey using MPE's data collection vehicle (15 lane-kilometres)
- A semi-automated surface distress survey using MPE's data collection vehicle (15 lane-kilometres)

The data collected during the field surveys was used to identify the present status of the pavements in terms of three performance indicators:

- Ride Comfort Index (RCI)
- Pavement Distress Index (PDI)
- Overall Condition Index (OCI)

Over time, weathering, traffic loading, and aging cause pavement quality to deteriorate. Maintenance and/or rehabilitation options applied at the appropriate time can renew and extend the life of a road network. The objective of pavement management is to maximize the present and future value and level of service of the road network by cost-effective management of available public capital funds.

An effective pavement management system should have the following qualities:

- Method of data collection that is uniform, consistent, and repeatable
- Logical and functional database
- Objective method of present status calculation and reporting
- User-definable methodology of needs analysis to develop rehabilitation strategies
- Analytical engine for optimization of network rehabilitation, following a user-definable set of goals

The Village has opted to utilize the RUBIX rMD asset application provided by MPE and developed by Rival Solutions Inc. The RUBIX platform will provide the basis for the 2018 pavement evaluation program analysis and will enable the Village to maintain and update a pavement management system moving forward.

Figure 3.1 on the following page shows the 2017 survey coverage. The coverage shows the colour-coded inspection intervals (30-metre stations). The colour codes are based on the roughness condition classification ranging from Good (Green) to Poor (Red).

LEGEND
— SURVEY COVERAGE

MPE Engineering Ltd.

VILLAGE OF RYLEY

INFRASTRUCTURE ASSESSMENT AND 10 YEAR CAPITAL PLAN
2017 SURVEY COVERAGE

SCALE: 1:10000	DATE: DECEMBER 2017	JOB: 5582-001-00	DRAWING: FIG 3.1

3.3 Data Collection

3.3.1 Network Definition and Attribute Data

The 2018 network definition and attribute data setup consisted of the following:

- Define the roadway network based on the Village's existing GIS road centreline file. Roadway sections are identified using unique Asset IDs stored in the GIS database.
- Establish key information including Traffic and Pavement Structure (Layer) data attributes for each roadway section.

The roadway network definition used for the purpose of the 2018 Pavement Condition Assessment Report is based on the Village's current GIS road centreline file. The network definition maintains a direct link to the Village's Asset ID convention established for the network in the GIS database provided to MPE. Slight modifications were made to the network definition based on actual conditions encountered during the field surveys.

During discussions with the Village, it was determined that network attribute information regarding traffic and pavement structure data was not readily available. As a result of this discussion, it was decided that MPE would fill in the data gaps with default values for the required analytics attributes. MPE established the default attributes (by functional classification) based on previous project experience with similar-sized municipalities in Alberta.

Table 3.4 and ***Table 3.5*** show the default attribute values used for the 2018 Pavement Condition Assessment Report.

Table 3.4: Traffic Default Attributes

Functional Class	Average AADT	AADT Method
Collector	222	*1.0 x CL Length*
Local	33	*0.25 x CL Length*

Table 3.5: Pavement Structure Default Attributes

Functional Class	EGT (mm)	L1 Asphalt (mm)	L2 Granular (mm)	L3 Base (mm)
Collector	585	115	250	150
Local	505	100	200	150

As no pavement structural data collection were defined as part of the project scope, the Subgrade Strength condition for the network sections was defaulted to 'Strong' for the purpose of the analysis and reporting.

3.3.2 Field Surveys

The roughness of each section was measured using MPE's data collection vehicle. The collection vehicle is a specially equipped Class I Profiler equipped with accelerometers and laser sensors mounted to the front bumper. This technology was used to measure the longitudinal profile of the pavement surface in each wheel path of the survey travel lane. The profile data was then used to calculate an International Roughness Index (IRI), measured as m/km or mm/m, and reported at 30-metre intervals (stations).

The surface distress survey recorded the extent and severities of key distress classifications, such as load-associated cracking, environmental (non-load associated) cracking, surface deformations, and surface defects. The following 12 pavement distress types were inventoried:

Distress Types for Flexible Pavements

- Patching
- Rippling & Shoving
- Raveling/Streaking
- Flushing & Bleeding
- Distortion
- Progressive Edge Cracking
- Alligator Cracking
- Potholes
- Block/Map Cracking
- Longitudinal Cracking
- Transverse Cracking
- Wheel Track Rutting

The survey was generally conducted in the outside lane of the northbound or eastbound lanes of each road segment. Road sections with four or more traffic lanes and divided road sections were tested in both directions of travel. The data collection vehicle was operated at speeds of 25 km/h, or greater where possible, to ensure reliable profile data was being collected.

Road testing equipment used for the field data collection
MPE Engineering Ltd. Pavement Testing Vehicle (Class I Profiler)

3.4 Analysis

As part of the project workflow, MPE implemented the RUBIX Management Dashboard (rMD) solution to enable the pavement evaluation and the ongoing management of the roadway network. The RUBIX asset management solution is a lightweight, user-definable, cloud-based application that enables the user to collect, analyze, monitor, and report on the performance of various infrastructure assets, including pavements. The RUBIX platform supports multiple data collection and analysis methodologies, including Paver (ASTM D6433). MPE utilized the rMD application as the primary analysis and database platform for the pavement evaluation analysis and reporting. **For the purpose of this report, the Base Year of the analysis was set to 2018.**

The roadway pavement condition data is summarized into the key performance indicators of Pavement Distress Index (PDI) based on the surface distress inventory, Ride Comfort Index (RCI) based on the longitudinal profile data, and Overall Condition Index (OCI) as a function of the PDI and RCI components.

The pavement condition results provide the Present Status, or current condition, of the roadway network. The condition of the network is summarized and provided to the Village by the entire network and broken down by the major functional classes defined in the GIS database.

Rehabilitation triggering levels are established for each functional classification in the network based on the OCI, and determine the condition threshold at which a roadway section is considered to be in need of rehabilitation. The rehabilitation trigger levels are typically set higher for the upper functional class networks (Arterial and Collector), reflecting the increased importance of these traffic corridors.

Pavement deterioration curves are used to predict the future performance of the OCI score for a given section. The rMD application defines six deterioration models based on pavement classifications built around traffic volume, structure thickness, and subgrade strength levels. The results indicate the Need Year in which a given section will require treatment and provide the current needs, or backlog, as well as the predicted future needs of the roadway network.

The rMD application utilizes a decision matrix methodology to determine the recommended treatment based on the performance characteristics of the pavement section. The decision matrix methodology is designed around the fundamentals of pavement management and the four main drivers of pavement deterioration. Performance condition results from the analysis of the field data are further analyzed to produce condition levels for these four main causes of Load, Environment, Construction, and Material.

The appropriate rehabilitation treatment option is defined in the matrix at the various levels of these 'cause-condition' combinations. A decision matrix will be built for each functional class, as treatment options and constraints do vary between lower- and higher-volume roadways.

The final stage of the analysis is the Budget Optimization Analysis. During this step of the analysis, several ten-year budget scenarios will be applied to the rehabilitation needs results. MPE will provide the Village with four budget scenarios. These scenarios show the annual cost to do all the recommended work (Needs Budget), the impact on the network level of service if no work is done (Do Nothing scenario) and, finally, two annual dollar budgets based on the Village's current and predicted rehabilitation needs (Funding Budget). Each budget scenario shows the ten-year predicted network OCI performance and resulting backlog for comparison.

3.4.1 Roughness – Ride Comfort Index (RCI) Analysis

One of the primary operating characteristics of a road, from the user's perspective, is the RCI, which represents the travelling public's opinion of the smoothness and, hence, the quality of service provided by a pavement. The data collection vehicle is used to measure the longitudinal profile of the pavement surface, reported as an IRI value. Roughness measurements are correlated to an assessment of ride quality as perceived by the users of the pavements. This subjective assessment is termed the RCI.

The RCI condition score for each road section ranges from zero (0) to 100, where 100 is indicative of an extremely smooth pavement and an index of zero (0) is indicative of an extremely rough pavement. The detailed RCI methodology is provided in ***Appendix A***.

3.4.2 Surface Distress – Pavement Distress Index (PDI) Analysis

The PDI is a measure of physical pavement cracking, deformations, and surface defects collectively referred to as distresses. The surface distress survey provided an inventory of the severity and extent for 12 surface distresses in each station of every section in the network (i.e., 30-metre intervals).

These distress ratings were analyzed to produce %Area values at each severity level, which were further combined using distress-specific weighting factors to generate an overall PDI for each station. A sectional PDI score was then computed based on the aggregated station PDI scores for each section.

The PDI condition score for each road section ranges from zero (0) to 100, where 100 indicates a perfect (no distress) surface and an index of zero (0) indicates a significant level of surface distress. The detailed PDI methodology is provided in ***Appendix B***.

3.4.3 Overall Condition Index (OCI) Analysis

The OCI provides an overall indication of the pavement with regard to present and future service to the user and is derived through a combination of the sectional RCI and PDI values.

The models used to calculate OCI are as follows:

For roadways without pavement structural condition scores:

OCI = f(RCI,PDI)

For roadways with pavement structural condition scores:

OCI = f(RCI,PDI,SAI)

For roadways with surface distress data only (optional):

OCI = f(PDI)

As is the case with RCI and PDI, the OCI ranges from zero (0) to 100, where zero (0) represents the worst condition of pavement and 100 represents the best condition of pavement. The detailed OCI methodology is provided in ***Appendix C***.

3.4.4 Performance Prediction Modelling

The OCI values of pavements typically decrease over time. In order to estimate future rehabilitation requirements of a pavement network, it is necessary to model the deterioration of OCI values. The rate of deterioration of OCI depends on several factors, but it can be demonstrated that the principal factors are the traffic loading conditions, the properties and thickness of the pavement structure layers, and the strength of the underlying subgrade.

The factors used to model pavement performance within the rMD application are as follows:

- Equivalent granular thickness (EGT) in three levels (thin, medium, thick).
- Traffic volume or average annual daily traffic (AADT) in three levels (low, medium, high).
- Subgrade strength in two levels (strong, weak).

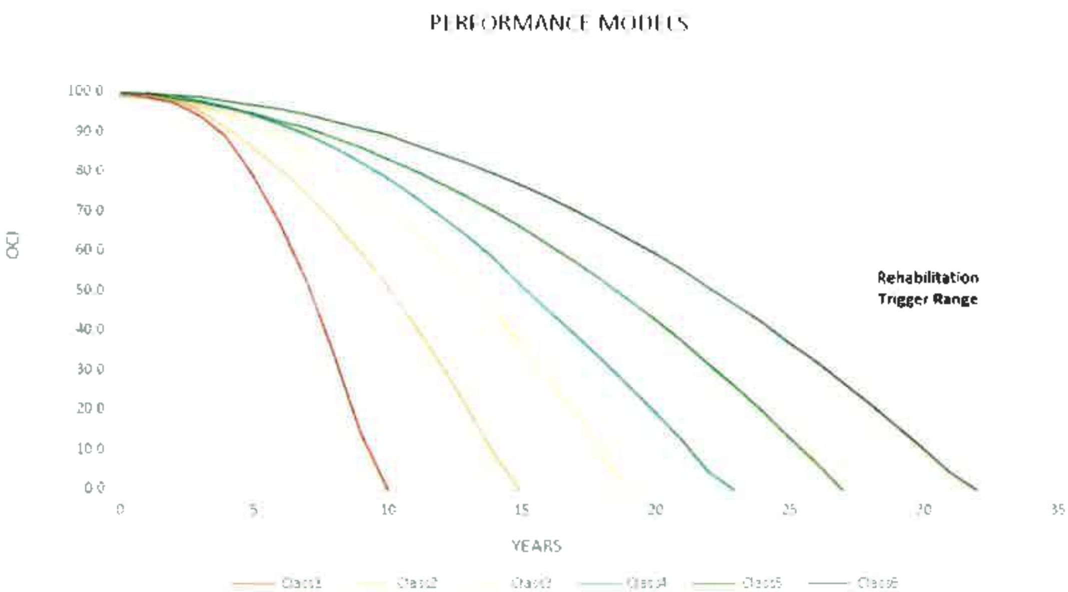
The criteria used to classify traffic (AADT) and structural (EGT) threshold levels are shown in ***Table 3.6***.

Table 3.6: Structure Thickness and Traffic Classification Levels

Functional Class	Thickness Level (EGT mm) THIN≤MED<THICK	Traffic Level (AADT) LOW<MED<HIGH
Entire Network	400 ≤ Medium < 700	200 ≤ Medium < 1500

The combination of the three classification parameters—pavement structure thickness, traffic loading, and subgrade strength—results in six possible performance classes of pavements, and each roadway section in the network is assigned an individual performance curve based on its performance classification. The performance curves plot the deterioration of the OCI over time, and the difference between the curves is based on variations in levels of the pavement thickness, traffic, and subgrade strength.

The OCI performance deterioration models used for the Village are shown in ***Figure 3.2***.



PERFORMANCE CURVE CLASSES		EGT					
		Thin		Med		Thick	
		Subgrade					
		Weak	Strong	Weak	Strong	Weak	Strong
Traffic	Low	3	3	4	5	5	6
	Med	2	2	3	4	5	6
	High	1	2	2	3	4	6

Figure 3.2: OCI Performance Curves

The OCI performance curves used in the analysis were established based on the historical performance of similar municipal networks in Alberta.

Based on the analysis parameters set up, the Village's roadway network is distributed across two performance classes: Class 4 (3.0 lane-kilometres) and Class 5 (11.8 lane-kilometres).

3.4.5 Priority Programming Analysis

3.4.5.1 Need Year Analysis

The Needs analysis is the identification of pavement sections that are deficient with regard to some specified criterion. For a paved road network, sections that are currently deficient are referred to as 'present needs,' and sections that will be deficient in future years are referred to as 'future needs.' A Need Year distribution graphically illustrates the annual network rehabilitation needs for sections that fall below a given level of service (i.e., OCI) and should be rehabilitated. The Need Year analysis assumes an unrestricted budget for rehabilitation.

For this analysis, the minimum acceptable OCI (OCI min) is the threshold level of service used to determine when rehabilitation should take place. The minimum acceptable OCI for each functional classification within the network is shown in ***Table 3.7***.

Table 3.7: Minimum OCI Thresholds

Functional Class	Minimum OCI Trigger 2018
Collector	**50**
Local	**45**

The higher trigger value for the Collector roads, relative to Locals, reflects that these roads are a higher priority, requiring heavier and more costly treatments, and therefore must be identified for rehabilitation earlier in their life cycle.

3.4.5.2 Rehabilitation Decision Matrix

Once a Need Year has been calculated for a pavement section, any potential rehabilitation strategies that may be applied to the pavement section must be determined. In the analysis, a section that has a deteriorated OCI of less than or equal to the trigger value requires some form of rehabilitation during its Need Year.

The foundation of the decision matrix approach is based around the causes of various distresses as outlined in the Pavement Management Guide (RTAC). The approach is centred on the relationship between Load, Environmental, Construction, and Material causes for various pavement distresses.

Using the guidelines provided by the ASTM D6433 PCI Standard, the distress, roughness, and structural data collected in the field were classified for three levels of condition (Good, Fair, and Poor). The principles of distress causes were then utilized to consolidate and group these performance indicators into condition-matrices for the four main pavement deterioration drivers of Load, Environmental, Construction, and Material.

Table 3.8 illustrates the relationship between deterioration cause and defect type.

Table 3.8: Defect-Cause Relationship

Defect Type	Possible Cause			
	Load	Material	Environmental	Construction
Surface Defects (Class 4)		X	X	X
Raveling		X		X
Bleeding/Flushing		X	X	X
Potholes		X	X	X
Surface Deformations (Class 3)	X			X
Rutting	X	X		X
Rippling	X	X		X
Depressions (Distortion)	X			X
Upheaval (Distortion)			X	
Slippage/Edge Lipping	X			X
Excessive Crown	X			X
Cracking (Classes 1 & 2)	X	X	X	
Alligator	X			
Longitudinal/Meandering	X	X	X	
Transverse		X	X	
Edge Cracking		X	X	
Block/Map	X	X	X	

The final decision-making input is done at the Rehabilitation decision matrix level. At this level, the four main deterioration drivers are grouped in pairs in a cross-relational matrix structure based on common distress types and influence factors. Load and Construction are grouped on one axis and Environmental and Material on the other.

By applying the available rehabilitation treatments to the appropriate condition levels of the combined deterioration drivers, a reliable program of recommended work can be generated from the pavement condition results through the use of the cause-driven matrix approach. The decision matrices for the three functional classifications are provided in ***Appendix D***.

Table 3.9 presents the rehabilitation treatments and associated parameters used in the analysis.

Table 3.9: Rehabilitation Alternatives

Code	Rehabilitation	Cost/m²	Cost/ln-km	OCI Benefit
1	Micro Surface/Surface Treat	$18.50	$83,250	25
2	Overlay 50 mm	$28.50	$128,250	50
3	Overlay 75 mm	$35.00	$157,500	60
4	Edge Mill and Overlay 50 mm	$32.50	$146,250	55
5	Full Mill and Overlay 50 mm	$38.00	$171,000	60
6	Full Mill and Overlay 75 mm	$46.00	$207,000	70
7	Full Mill and Overlay + LBR	$58.00	$261,000	80
8	Local Reconstruction	$150.00	$675,000	100
9	Collector Reconstruction	$190.00	$855,000	100
10	*Arterial Reconstruction*	*$225.00*	*$1,012,500*	*100*

3.4.5.3 Priority Programming and Optimization

Without the burden of limited funding, pavement sections would be rehabilitated whenever required. In actual practice, budgetary constraints often determine the timing and implementation of rehabilitation strategies. Using different budget scenarios and/or other constraints, the rehabilitation program analysis assembles an optimized multi-year rehabilitation program, estimates the impact the scenario will have on the overall network performance, and calculates the annual rehabilitation backlog of work that could not be addressed (for scenarios with limited funding). The budget optimization analysis generates prioritized work programs that are the most cost effective based on annual budget constraints. For the purpose of this report, the analysis was run over a ten-year programming period, with the first year of the programming set to 2018.

The network programming analysis was run using the following funding scenarios:

- Do Nothing Budget (no funding)
- Need Driven Budget (unlimited funding)
- Fixed Annual Budget: $160,000 per year
- Flexible Annual Budget: $250,000 per year for the first four years and then $100,000 per year for the remaining six years

3.5 Analysis Results

The following discusses and summarizes the condition of the Village's roadway network based on the paved Collector and Local roads. This section provides the summary performance indicators for the entire paved network (15 lane-km). The performance indicators distribution graphs for each functional classification and condition index are provided in ***Appendix E***. The overall network present status section listing is provided in ***Appendix F***.

The Need Year summaries are also included for the entire paved network, as well as each functional classification.

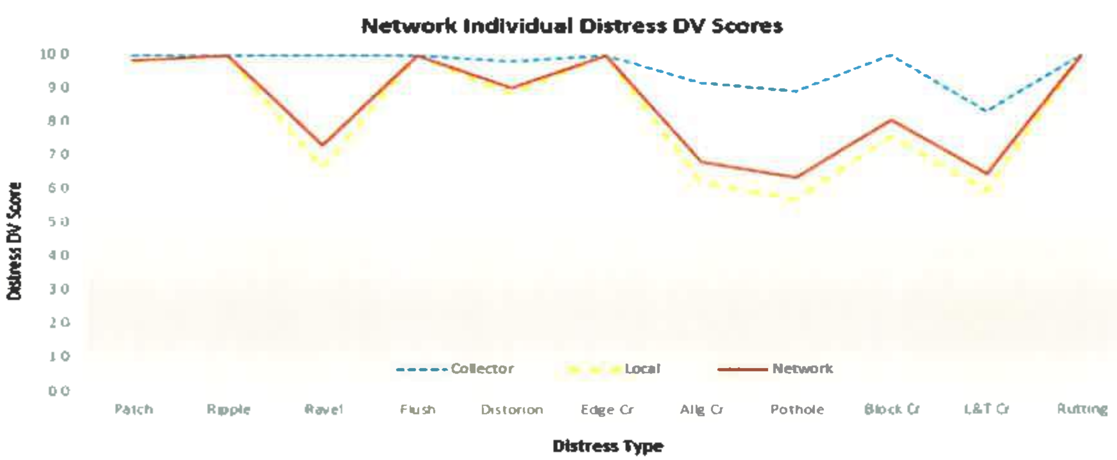
The 2018 present status of the Village's roadway network is summarized in ***Table 3.10***.

Table 3.10: 2018 Network Performance Summary

Functional Class	No. Sections	Lane-km	OCI	RCI	PDI	IRI (m/km)
Collector	10	4.4	89	55	95	3.61
Local	39	10.4	35	32	25	6.13
Entire Paved Network	**49**	**14.8**	**50**	**38**	**45**	**5.40**

Figure 3.3 shows the network average individual distress scores by functional class and the entire network. The lower scoring distresses are the most prevalent in the pavement network.

Figure 3.3: Network Individual Distress Comparison



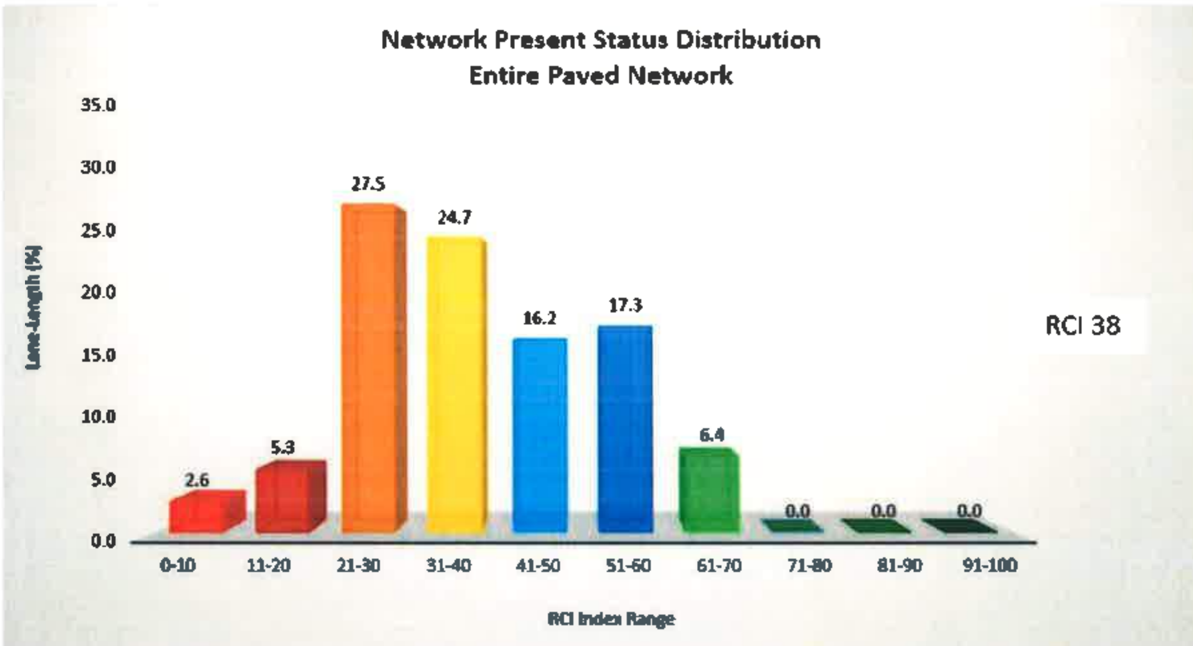
NETWORK DV SCORES

	Patch	Ripple	Ravel	Flush	Distorion	Edge Cr	Allg Cr	Pothole	Block Cr	L&T Cr	Rutting	IRI
Collector	10.0	10.0	10.0	10.0	9.8	10.0	9.2	8.9	10.0	8.3	10.0	3.61
Local	9.8	10.0	6.6	10.0	8.8	10.0	6.2	5.7	7.6	6.0	10.0	6.13
Network	9.8	10.0	7.3	10.0	9.0	10.0	6.8	6.4	8.1	6.5	10.0	5.40

3.5.1 Present Status Analysis Results – Entire Paved Network

3.5.1.1 Roughness (RCI) Analysis Results

A chart showing the distribution of RCI values, weighted by lane-kilometres, is shown in ***Figure 3.4***. The plot indicates a mean RCI of 38 for the Entire Paved Network.



	RCI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	2.6	5.3	27.5	24.7	16.2	17.3	6.4	0.0	0.0	0.0	100.0
LL km	0.4	0.8	4.1	3.7	2.4	2.6	1.0	0.0	0.0	0.0	14.8

Figure 3.4: RCI Distribution for Entire Paved Network

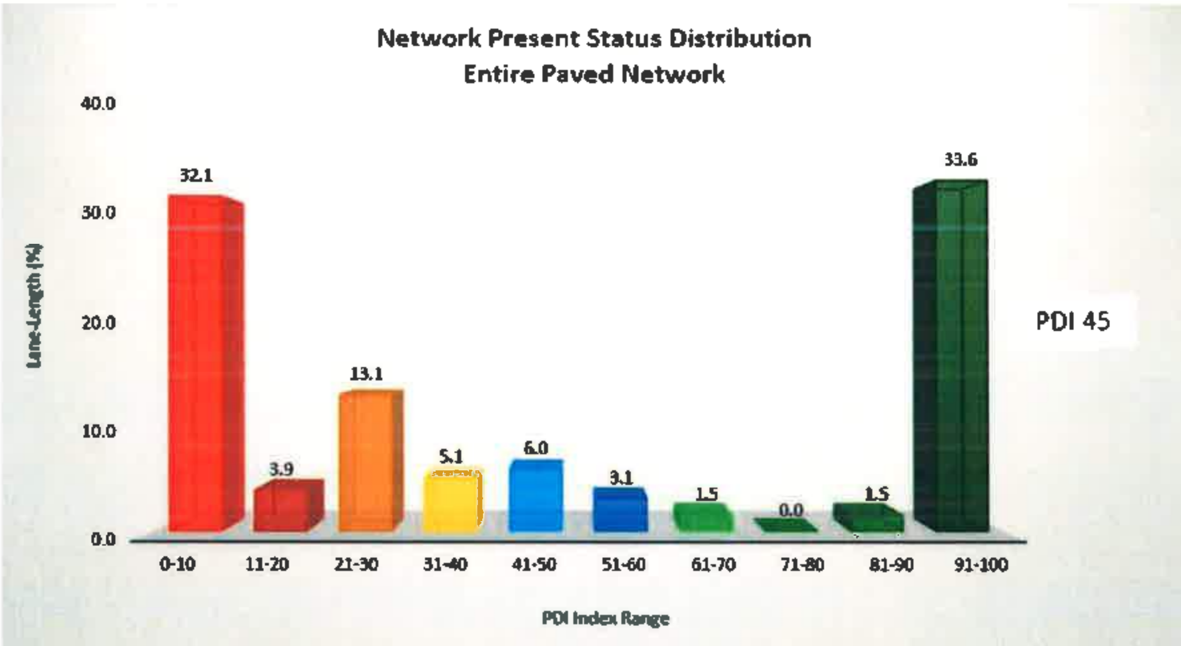
The results indicate a large portion of the roadway network is exhibiting signs of marginal to poor ride quality. Much of this is due to the significant presence of potholes, alligator cracking, and environmental cracking on the pavements. ***Table 3.11*** shows the distribution of the network between poor, marginal, and acceptable RCI values.

Table 3.11: RCI Distribution for Entire Paved Network

RCI Range	Ride Quality	Lane-km	% of Entire Paved Network
RCI ≤ 40	Poor	8.9	60.1
40 < RCI ≤ 60	Marginal	5.0	33.5
RCI > 60	Acceptable	1.0	6.4

3.5.1.2 Pavement Distress (PDI) Analysis Results

A chart showing the distribution of PDI values, weighted by lane-kilometres, is shown in ***Figure 3.5***. The plot indicates a mean PDI of 45 for the Entire Paved Network.



	PDI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
ILL %	32.1	3.9	13.1	5.1	6.0	3.1	1.5	0.0	1.5	33.6	100.0
ILL km	4.7	0.6	1.9	0.8	0.9	0.5	0.2	0.0	0.2	5.0	14.8

Figure 3.5: PDI Distribution for Entire Paved Network

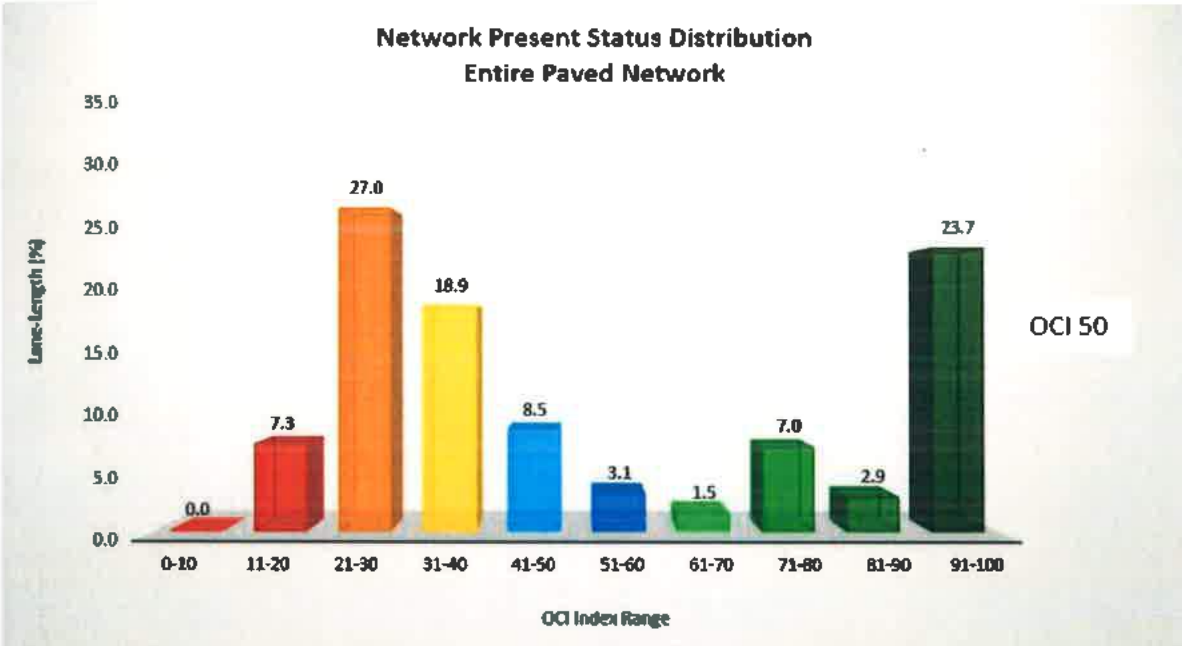
The results show two-thirds of the network is showing marginal to poor performance with respect to the pavement distress. Much of this is driven by the notable presence of environmental-related distresses (L&T cracking and raveling) and potholes in the roadway network, with some areas also showing fatigue-associated deterioration (alligator cracking). ***Table 3.12*** shows the distribution of the network between poor, marginal, and acceptable PDI values.

Table 3.12: PDI Distribution for Entire Paved Network

PDI Range	Surface Distress	Lane-km	% of Entire Paved Network
PDI ≤ 40	Poor	8.0	54.2
40 < PDI ≤ 60	Marginal	1.4	9.1
PDI > 60	Acceptable	5.4	36.7

3.5.1.3 Overall Pavement Quality (OCI) Analysis Results

A chart showing the distribution of OCI values, weighted by lane-kilometres, is shown in ***Figure 3.6***. The plot indicates a mean OCI of 50 for the Entire Paved Network.



	OCI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	0.0	7.3	27.0	18.9	8.5	3.1	1.5	7.0	2.9	23.7	100.0
LL km	0.0	1.1	4.0	2.8	1.3	0.5	0.2	1.0	0.4	3.5	14.8

Figure 3.6: OCI Distribution for Entire Paved Network

These results indicate two-thirds of the Entire Paved Network is in need of some form of rehabilitation with OCI values less than or equal to the trigger levels. The roughness component of the network is showing deterioration, particularly in the Local network. The Local network is also exhibiting significant distress deterioration as indicated by the PDI score of 25, which is bringing down the network average. ***Table 3.13*** shows the distribution of the network between in-need and acceptable OCI values.

Table 3.13: OCI Distribution for Entire Paved Network

OCI Range	Pavement Quality	Lane-km	% of Entire Paved Network
OCI ≤ trigger[1]	In-Need	9.1	61.7
OCI > trigger[1]	Acceptable	5.7	38.3

1 Trigger levels correspond to appropriate functional class trigger levels; i.e., 50 for Collectors and 45 for Locals.

3.5.2 Rehabilitation Needs Analysis Results

The Need Year of a pavement is defined as the year in which the OCI of the pavement falls to or below a critical value known as the OCI Trigger Level. Several sectional performance characteristics are also considered in selecting the appropriate performance curve to determine the Need Year for all pavement sections in the network.

Table 3.14 shows the rehabilitation needs summary by functional class and for the entire Village's paved roadway network.

Table 3.14: 2018 Network Needs Summary

Functional Class	2018 Network Needs (% lane-length)	2018 Network Needs (lane-km)
Collector	8.6%	0.4
Local	84.4%	8.8
Entire Paved Network	**61.7%**	**9.1**

The summary of the accumulating ten-year program Needs (non-funded scenario) is reported in lane-kilometres for each functional class and the entire network and shown in ***Figure 3.7***.

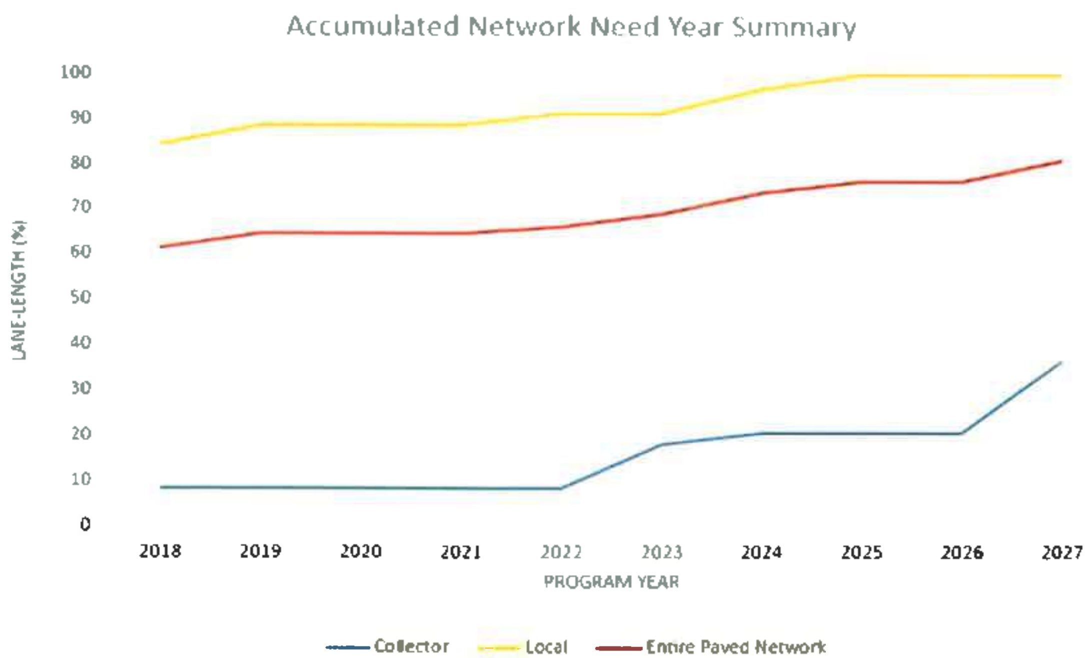


Figure 3.7: Accumulated Needs Summary (2018–2027)

The combined effect of the predicted rehabilitation Needs in each functional class is showing the network as a whole is predicted to have a steady increase in the number of sections that will be at or below the OCI trigger levels, resulting in a significant portion of the entire network being in Need by the end of the programming period (2027) under a non-funded scenario.

Table 3.15 shows the comparison of the reported pavement network rehabilitation backlogs from several MPE pavement management projects in recent years. Although each municipality applies local practices for pavement management, they all apply similar performance assessments and needs-triggering methodologies. As such, they provide a basic datum for the comparison of the Village's current backlog with that of other municipalities in Alberta, in the first year of their respective programs.

Table 3.15: Municipality Backlog Summary Comparison

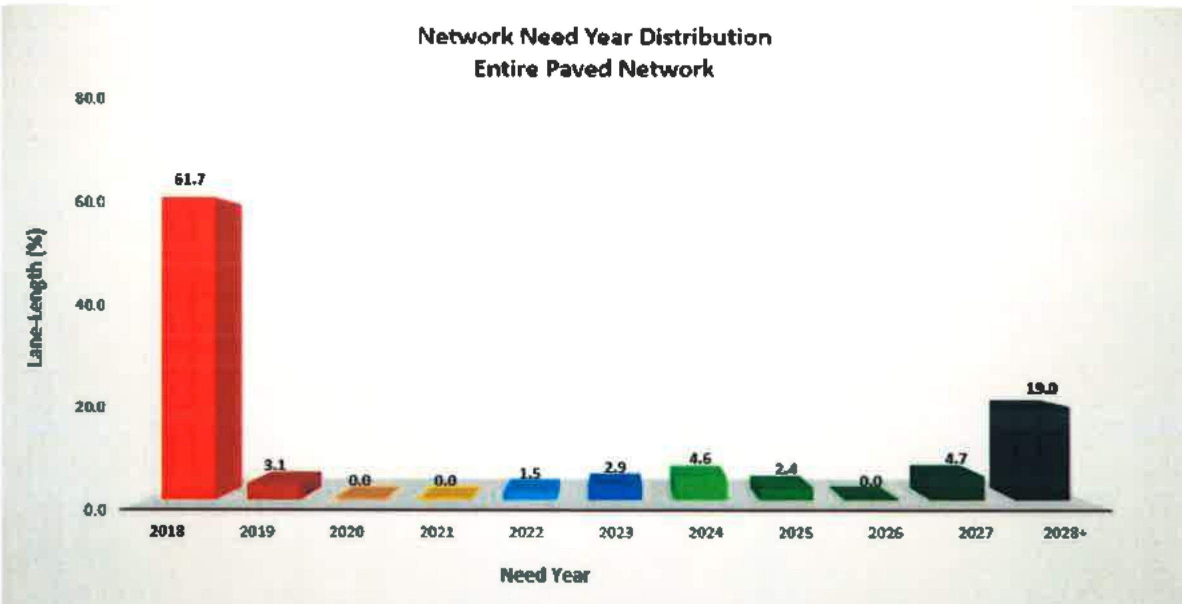
Municipality	Lane-km	Backlog (%)	
		% Network	Survey Year
Ryley, AB	**14**	**61.7**	**2017**
Bassano, AB	40	46.2	2017
Duchess, AB	18	27.2	2017
Smoky Lake, AB	33	54.6	2017
Rosemary, AB	8	77.6	2017
St. Paul, AB	98	49.0	2017
Bruderheim, AB	21	78.5	2015
Mayerthorpe, AB	16	13.7	2015
Willingdon, AB	13	26.1	2015

The 2018 roadway network rehabilitation backlog in the Village is higher than is recommended and higher than most municipalities MPE has conducted studies for in recent years. Network backlogs are considered healthy between the ranges of 10–25% of the network in need of rehabilitation.

Some level of backlog is considered desirable, as it does allow for continual work programs that drive sustainable funding and asset management practices. However, when backlog levels exceed one-quarter of the network, the cost to bring the network back into a healthy range can be high and often exceeds available annual budgets. If additional funding cannot be made available in the early years of the program, the network will continue to deteriorate throughout the programming period due to an underfunding condition.

3.5.2.1 Network Needs Distributions – Entire Paved Network

The Need Year distribution for the Village's Entire Paved Network is presented in ***Figure 3.8***. The distribution shows approximately 9.1 lane-kilometres, or 61.7% of the network, will fall below the minimum level of service, or OCI trigger level, in 2018. Approximately 9.8 lane-kilometres, or 66.4% of the network, will be in Need within the next 5 years (2018–2022), while approximately 12.0 lane-kilometres, or 81.0% of the network, will be in Need within the next 10 years (2018–2027). The remaining 19.0% of the network will become a Need beyond the ten-year programming period.

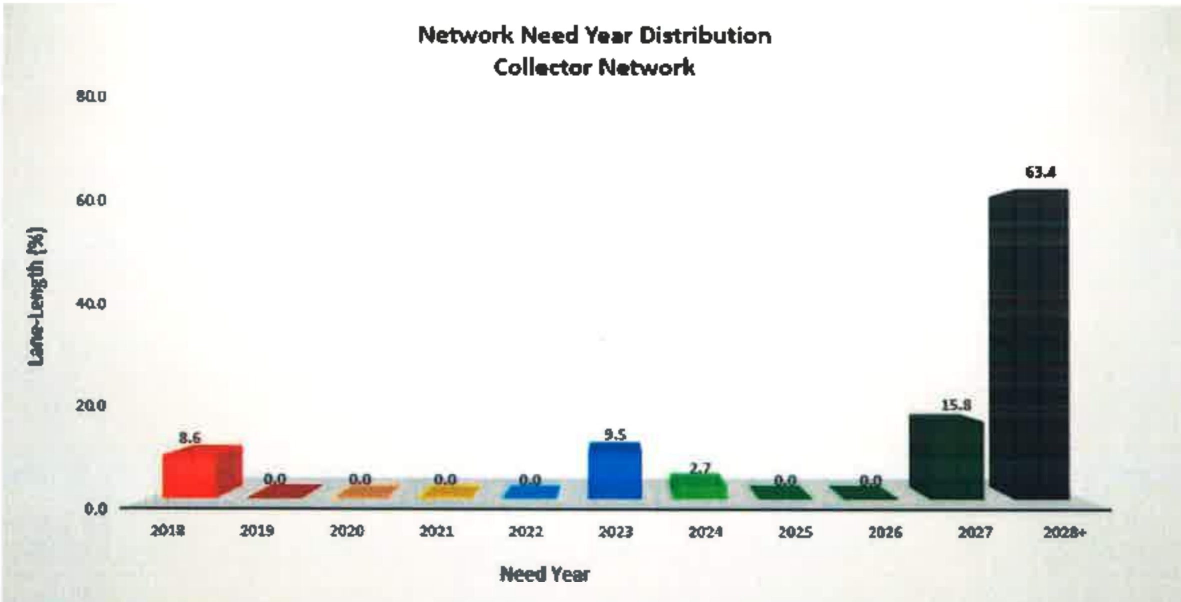


	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028+	Total
LL %	61.7	3.1	0.0	0.0	1.5	2.9	4.6	2.4	0.0	4.7	19.0	100
LL km	9.1	0.5	0.0	0.0	0.2	0.4	0.7	0.4	0.0	0.7	2.8	14.8
Section #	34	2	0	0	1	1	3	1	0	1	6	49

Figure 3.8: Need Year Distribution for Entire Paved Network

3.5.2.2 Network Needs Distributions – Collector Network

The Need Year distribution for the Village's Collector Network is presented in ***Figure 3.9***. The distribution shows approximately 0.4 lane-kilometres, or 8.6% of the network, will fall below the minimum level of service, or OCI trigger level, in 2018. Approximately 1.6 lane-kilometres, or 36.6% of the network, will be in Need within the next 10 years (2018–2027). The remaining 63.4% of the network will become a need beyond the ten-year programming period.

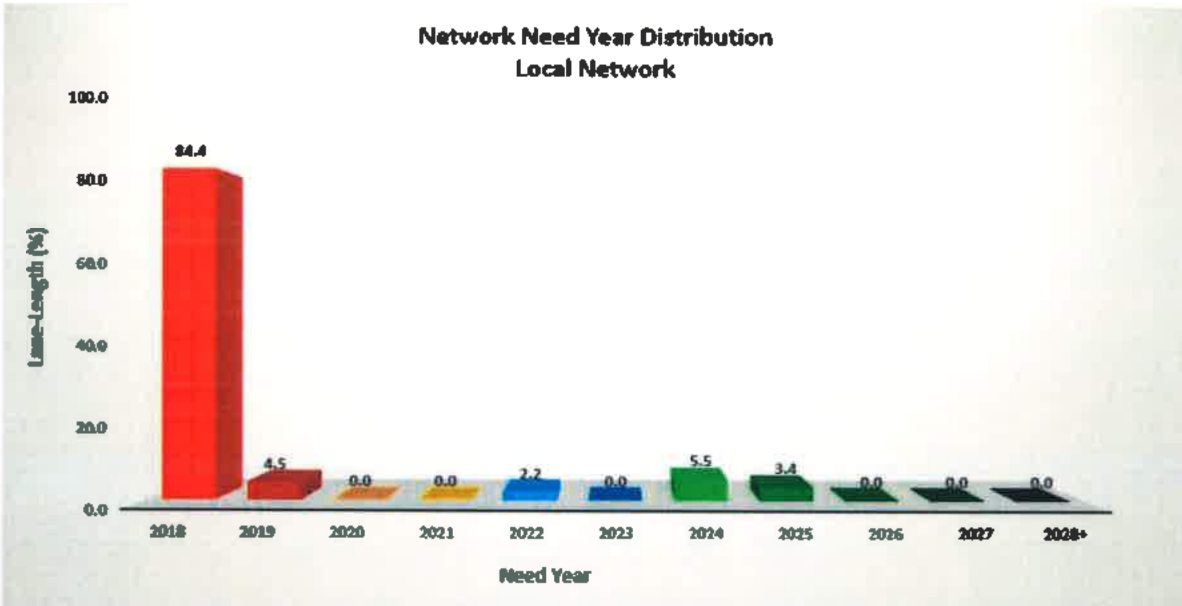


	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028+	Total
LL %	8.6	0.0	0.0	0.0	0.0	9.5	2.7	0.0	0.0	15.8	63.4	100
LL km	0.4	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.7	2.8	4.4
Section #	1	0	0	0	0	1	1	0	0	1	6	10

Figure 3.9: Need Year Distribution for Collector Network

3.5.2.3 Network Needs Distributions – Local Network

The Need Year distribution for the Village's Local Network is presented in ***Figure 3.10***. The distribution shows approximately 8.8 lane-kilometres, or 84.4% of the network, will fall below the minimum level of service, or OCI trigger level, in 2018. Approximately 9.4 lane-kilometres, or 91.1% of the network will be in Need within the next 5 years (2018–2022), while fully 10.4 lane-kilometres, or 100% of the network, will be in Need within the next ten years (2018–2027).



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028+	Total
LL %	84.4	4.5	0.0	0.0	2.2	0.0	5.5	3.4	0.0	0.0	0.0	100
LL km	8.8	0.5	0.0	0.0	0.2	0.0	0.6	0.4	0.0	0.0	0.0	10.4
Section #	33	2	0	0	1	0	2	1	0	0	0	39

Figure 3.10: Need Year Distribution for Local Network

3.5.3 Priority Programming Analysis Results

The following section summarizes the results of the priority programming analysis run in the RUBIX rMD application. ***Table 3.16*** presents the budget program results by budget scenario, network subset, and impact on the overall network performance.

Table 3.16: Village of Ryley Priority Programming Summary

Budget ID	Budget Scenario	10-Year Budget	2018		10 Year (2027)	
			OCI	%DEF	OCI	%DEF
Do Nothing	No Funding	$0	41	61.4	12	80.8
Need Driven	Unconstrained	$1.68M	79	0.0	54	0.0
$160,000/year	Annual Fixed Funding	$1.6M	44	54.3	47	4.7
$250,000–100,000/year	Annual Flexible Funding	$1.6M	46	50.8	46	4.7

3.5.3.1 Entire Network Scenarios

The Do Nothing and Need Driven optimizations run on the Entire Paved Network show the impact on the network performance of these two theoretical scenarios. The analysis is run with these scenarios as a 'what if' reference datum. The analysis results show the Entire Paved Network requires $1.68M over the next ten years to address all the current and predicted deficiencies.

Table 3.17 and ***Table 3.18*** show the annual funding levels and performance impact on the network of the two theoretical budget scenarios.

Table 3.17: Do Nothing (No Funding)

Year	Do Nothing Budget	Actual Spent	OCI	% Deficient
2018	$0	0	**41**	**61.4**
2019	$0	0	36	64.6
2020	$0	0	30	64.6
2021	$0	0	25	64.6
2022	$0	0	22	66.2
2023	$0	0	19	69.0
2024	$0	0	17	73.7
2025	$0	0	15	76.1
2026	$0	0	14	76.1
2027	$0	0	**12**	**80.8**
Total	**$0**	**0**		

Table 3.18: Need Driven Program (Unlimited Funding)

Year	Need Driven Budget	Actual Spent	OCI	% Deficient
2018	$1,306,774	$1,306,774	**79**	**0%**
2019	$64,081	$64,081	78	0%
2020	$0	$0	75	0%
2021	$0	$0	71	0%
2022	$28,569	$28,569	69	0%
2023	$60,722	$60,722	66	0%
2024	$84,508	$84,508	65	0%
2025	$41,290	$41,290	62	0%
2026	$0	$0	57	0%
2027	$89,784	$89,784	**54**	**0%**
Total	**$1,675,729**	**$1,675,729**		

Figure 3.11 illustrates the program summaries for the Entire Paved Network.

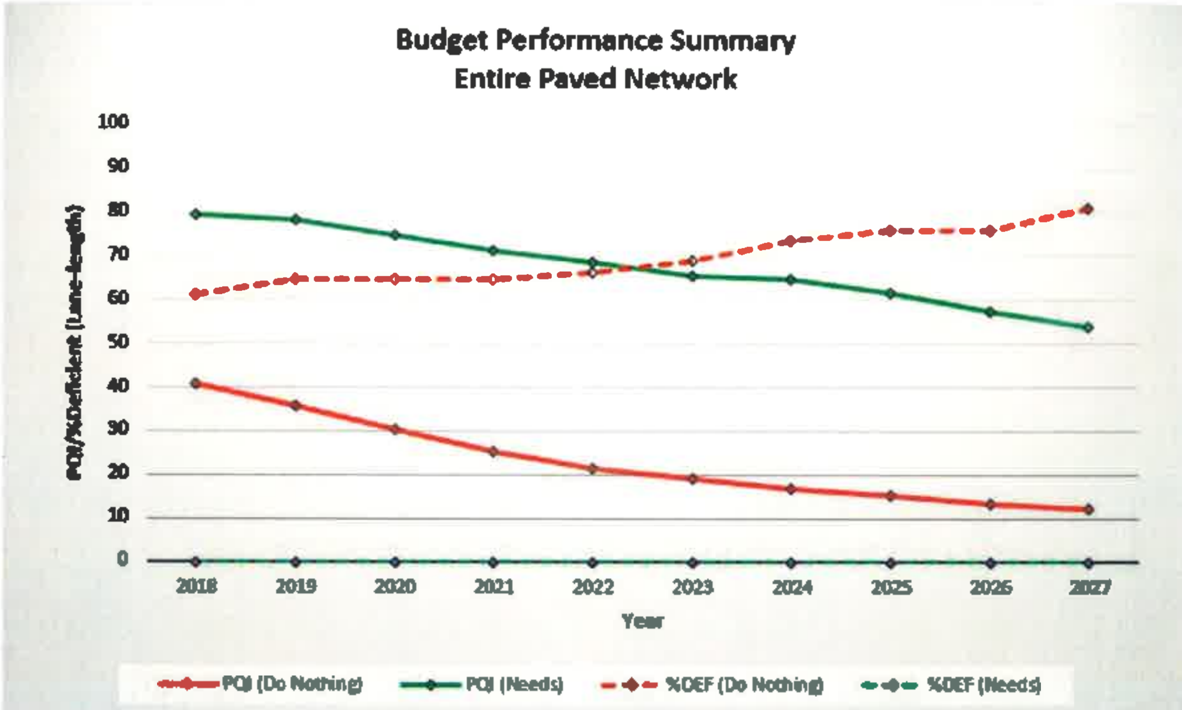


Figure 3.11: Need Driven and Do Nothing Program Performance

3.5.3.2 Network Budget Scenarios

The funding budgets run on the Entire Paved Network show the performance impact of the two budget scenarios selected for the analysis. The budget scenarios analyzed are a Fixed annual budget of $160,000/year, and a Flexible annual budget where the network is funded at $250,000/year for the first four years and $100,000/year for the final six years of the ten-year programming period. These budget scenarios show more realistic budget planning options that would meet the majority of the identified rehabilitation needs.

The Fixed and Flexible funding scenarios show the ten-year network OCI is predicted to be 47 and 46, respectively. The predicted ten-year backlog is 4.7% in each scenario.

Table 3.19 and ***Table 3.20*** show the annual funding levels and performance impact on the network of the two budget scenarios run on the Entire Paved Network.

Table 3.19: $1.6M Fixed Program Summary

Year	Annual Budget	Actual Spent	OCI	% Deficient
2018	$160,000	$159,904	**44**	**54.3**
2019	$160,000	$156,397	44	50.5
2020	$160,000	$159,156	43	42.6
2021	$160,000	$152,839	43	34.9
2022	$160,000	$134,638	42	29.5
2023	$160,000	$156,233	44	24.1
2024	$160,000	$155,414	47	20.3
2025	$160,000	$157,889	49	13.7
2026	$160,000	$137,486	49	6.2
2027	$160,000	$104,310	**47**	**4.7**
Total	**$1,600,000**	**$1,474,265**		

Table 3.20: $1.6M Flexible Program Summary

Year	Annual Budget	Actual Spent	OCI	% Deficient
2018	$250,000	$246,230	**46**	**50.8**
2019	$250,000	$246,693	46	42.2
2020	$250,000	$247,630	48	30.1
2021	$250,000	$246,369	52	17.6
2022	$100,000	$99,827	52	14.0
2023	$100,000	$92,647	53	11.9
2024	$100,000	$96,981	53	11.4
2025	$100,000	$82,487	51	9.1
2026	$100,000	$97,592	48	3.9
2027	$100,000	$65,191	**46**	**4.7**
Total	**$1,600,000**	**$1,521,648**		

Figure 3.12 illustrates the annual funding program summaries for the Entire Paved Network.

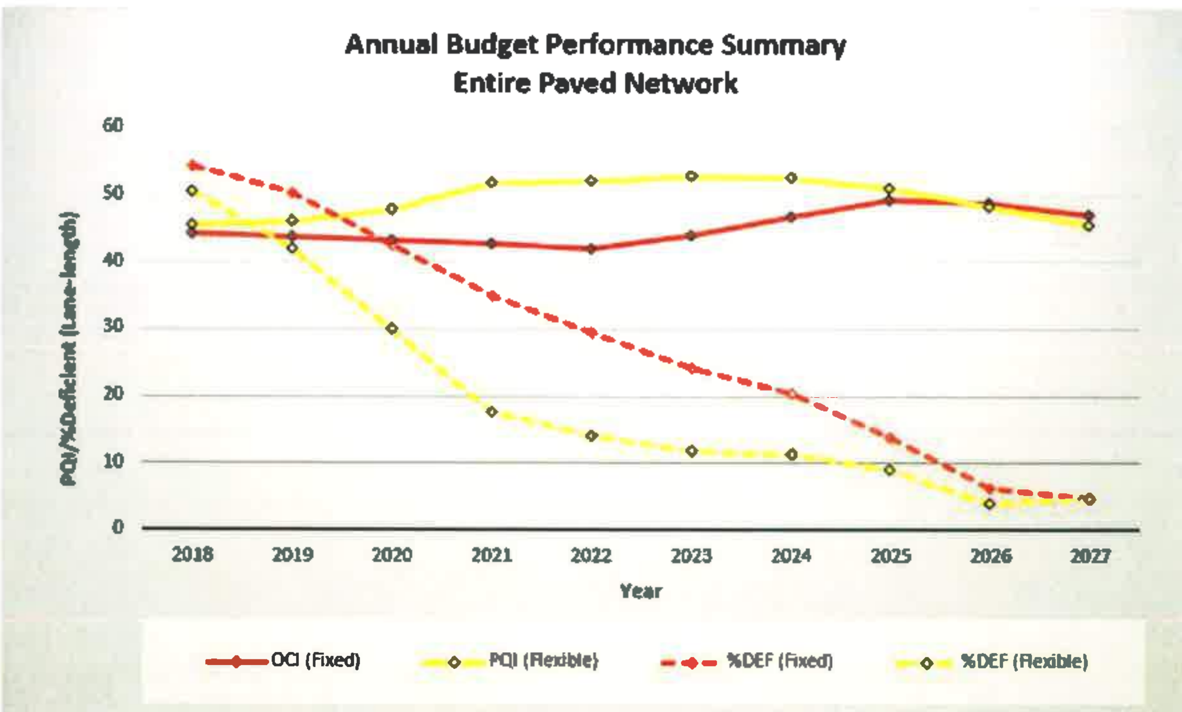


Figure 3.12 Annual Funding Program Performance

The results of the two annual budget analysis runs show the Village's road network will have essentially the same predicted performance at the end of the ten-year programming period.

The Fixed budget scenario shows an overall actual budget cost of $1.47M to achieve a predicted OCI of 47 and a backlog of 4.7% in 2027. The Flexible budget scenario shows a slightly higher overall cost of $1.52M to achieve a predicted OCI of 46 and a backlog of 4.7% in 2027.

The results show that the overall budget costs and predicted performance of the roadway network under the two scenarios are very similar. However, it should be noted that the Flexible budget approach, where the current backlog is addressed earlier in the programming period, does show an improved network level of service throughout most of the programming period. If funding options do become available, it is recommended that the Village plan roadway works with an emphasis on reducing the current backlog of 9.1 lane-kilometres as early in the planning cycle as is feasible.

3.6 Conclusions and Recommendations

PRESENT CONDITION

The analysis of the pavement condition results indicate the majority of the Village's road network is providing a marginal level of service given the network average OCI is 50. The Collector network is showing an OCI of 89 which is very good and reflective of the fact that most of the pavements in the Collector network have been recently rehabilitated. The Local network is showing poor level of performance with an OCI of 35.

The 2018 rehabilitation needs backlog is 61.7%. Typical backlog targets are between the ranges of 10%–25%. The Village has a higher than recommended roadway rehabilitation backlog, and reducing this to a more manageable level should be the focus in the early stages of the next ten-year planning phase.

The overall network average RCI of 38 (average IRI = 5.40 m/km) shows poor ride quality in the network. The Local network is showing the lowest ride quality with an RCI of 32 (average IRI = 6.13 m/km), which is below the network average. The Collector network is showing better ride quality with an RCI of 55 (average IRI = 3.61 m/km).

The overall network average PDI of 45 shows a marginal performance from a pavement distress perspective. The network shows the most deterioration with respect to the environmental cracking, potholes, alligator cracking, and raveling. The results show the Local network is the most distressed with a PDI score of 25. The Collector network is showing a very good PDI of 95.

REHABILITATION PROGRAMMING

The results of the rehabilitation needs and priority programming analysis show the roadway network will require approximately $1.68M over the next ten years. This will result in a predicted network OCI of 54 and 0% backlog in 2027. The 'Do Nothing' scenario shows the network will deteriorate to a predicted OCI of 12, with a backlog of 80.8% in 2027.

Due to the current high level of backlog in the network, nearly all the budget allocations are required in the first five years of the program (2018–2022), with the remaining approximately $276,000 being required over the last five years of the program.

The results of the two annual budget analysis runs show that the Village's road network will have essentially the same predicted performance at the end of the ten-year programming period.

The Fixed budget scenario shows an overall actual budget cost of $1.47M to achieve a predicted OCI of 47 and a backlog of 4.7% in 2027. The Flexible budget scenario shows a slightly higher overall cost of $1.52M to achieve a predicted OCI of 46 and a backlog of 4.7% in 2027.

The Flexible budget approach, where the current backlog is addressed earlier in the programming period, does show an improved network level of service throughout most of the programming period. If funding options do become available, it is recommended that the Village plan roadway works with an emphasis on reducing the current backlog of 9.1 lane-kilometres as early in the planning cycle as is feasible.

RECOMMENDATIONS

As an ongoing best-practice, it is recommended the Village evaluate the validity of some of its key parametric data used in the 2018 pavement evaluation program, and input into the RUBIX rMD analysis for the purpose of the 2018 reporting. It should be stressed that the analysis within the pavement management system will provide a reliable network level result that will provide an overall indication of the scale of the problem at hand, and will provide recommendations on specific locations where and when the investment in rehabilitation would be beneficial, but does partially rely on the accuracy of the supplied parametric data.

Where and when possible, currently assumed override or default values, as well as decision criterion for the following parameters, should be updated with actual data:

- Attributes used in Performance Prediction Modeling (traffic volumes, structural layer types and thicknesses, and subgrade strength), as well as the life-span validity of the curves themselves should be reviewed by the Village to ensure they reflect local knowledge of current conditions.
- Rehabilitation strategies and their associated unit rates should be reviewed prior to annual economic and priority programming re-analysis to ensure present industry costs are accurately accounted for and treatment options are appropriate for the conditions of the network.

- The Village's decision matrices, which are used for rehabilitation strategy selection, were implemented based on experience in similar municipalities in Alberta. As such, they represent a baseline starting point for the Village's pavement management programming. It is recommended that the decision matrices be reviewed periodically as the pavement management practice in the Village matures, to ensure the recommendations continue to reflect the Village's decision-making processes.

In 2018, the Village of Ryley Pavement Condition Assessment project initiated the move to an established pavement management approach. MPE recommends the Village continue with this important initiative by conducting condition surveys at regular intervals going forward. Many municipalities collect their condition data in three-to-five-year cycles and monitor the deterioration through the use of an asset (pavement) management system application in the interim years. MPE can provide the Village with the support to update and monitor the ongoing performance of the roadway network and actively plan the rehabilitation and required funding at present and in the future.

4.0 SIDEWALK ASSESSMENT

4.1 Executive Summary

The Village is responsible for the administration of a sidewalk network totalling approximately 6 kilometres. A sidewalk inventory map with defect locations and a corresponding spreadsheet were prepared to help the Village view the current sidewalk condition. A GIS file that also identifies the location of the sidewalk defects will be provided to the Village separate from the report.

MPE performed a general assessment of the sidewalks in the Village. This assessment included a site visit where defects were identified and recorded using the rRate Program. rRate is an iPad condition rating application that allows users to collect and map infrastructure attribute locations, images, sketches, and other information based on user-defined specifications. Inspection forms are simple XML files and can be customized to user's needs.

Defects identified during the walkthrough included corner breaks, corner spalling, faulting, joint spalling, linear cracking, large patching, small patching, scaling, and shattered slabs. Other observations included obstructions such as vegetation encroachment and trip hazards. The overall condition of the sidewalks was evaluated based on the frequency of defects found in a particular area. The defects were logged based on the number of slabs/panels affected within a segment.

4.2 Project Overview

4.2.1 Background

The Village is responsible for the administration of a sidewalk network totalling approximately 6 kilometres. This network forms a valuable asset to be managed in a cost-effective manner in order to provide a desirable level of service to the stakeholders of the network.

4.2.2 Scope and Objectives

As part of the asset management study, the Village retained the services of MPE to undertake a sidewalk inventory. The breakdown of the current data collection and reporting is as follows:

- Collection of surface distress on the entire sidewalk network (5.895 kilometres)
- Preparation of a sidewalk defect map and spreadsheet
- Creation of sidewalk shapefiles and defects to the Village

Figure S1.1 to ***Figure S1.4*** show the 2017 sidewalk condition, defects, and locations.

The sidewalk network definition used for the purpose of the 2017 sidewalk evaluation project is based on the Village's current GIS sidewalk file, created by MPE with input from the Village. The network definition maintains a direct link to the GIS database; the segments shown on the map correspond with the spreadsheet (see ***Appendix I***).

The sidewalk defect survey recorded the severity and the number of slabs/panels affected per segment. Typical defects identified in the Village can be seen in ***Appendix J***.

The following ten defects and obstructions were inventoried:

Distress Name	Distress Equivalent
C-BRK	Corner Break
C-SPL	Corner Spalling
FAULT	Faulting
J-SPL	Joint Spalling
L-CRK	Linear Crack
L-PAT	Large Patch
S-PAT	Small Patch
SCAL	Scaling
SHAT	Shatter Slab
TRPHZD	Trip Hazard

LEGEND
—— SIDEWALK COVERAGE

MPE Engineering Ltd.

VILLAGE OF RYLEY

INFRASTRUCTURE ASSESSMENT AND 10 YEAR CAPITAL PLAN
SIDEWALK COVERAGE

SCALE: 1:10000	DATE: DECEMBER 2017	JOB: 5582-001-00	DRAWING: FIG S1.1

LEGEND
- POOR
- FAIR
- GOOD

MPE Engineering Ltd.

VILLAGE OF RYLEY

INFRASTRUCTURE ASSESSMENT AND 10 YEAR CAPITAL PLAN
SIDEWALK CONDITION

SCALE: 1:10000	DATE: DECEMBER 2017	JOB: 5582-001-00	DRAWING: FIG S1.2

LEGEND
- HIGH
- MEDIUM
- LOW

MPE Engineering Ltd.

VILLAGE OF RYLEY

INFRASTRUCTURE ASSESSMENT AND 10 YEAR CAPITAL PLAN
SIDEWALK DEFECTS

SCALE: 1:10000	DATE: DECEMBER 2017	JOB: 5562-001-00	DRAWING: FIG S1.3

LEGEND:
- FAULTS
- TRIP HAZARDS
- OBSTRUCTIONS

MPE Engineering Ltd.

VILLAGE OF RYLEY	
INFRASTRUCTURE ASSESSMENT AND 10 YEAR CAPITAL PLAN SIDEWALK FAULTS, TRIP HAZARDS AND OBSTRUCTIONS	
SCALE: 1:10000	DATE: DECEMBER 2017
JOB: 5582-001-00	DRAWING: FIG S1.4

4.3 Conclusions and Recommendations

The sidewalks in the Village are in good to fair condition and require a minimum amount of slab/panel replacements in order to provide a safe pedestrian transportation system. There were 27 trip hazards, 8 obstructions, and 19 faults identified during the survey. The shattered slab locations require single/multiple slabs to be replaced and once this is done, the sidewalk can be upgraded from poor/fair to a good overall condition. MPE recommends the Village focus on replacing the segments of sidewalk that see the most use and are in poor condition. Overall, MPE recommends that sidewalk repairs be unified with road and infrastructure projects in order to reduce the effective cost of the replacements.

5.0 TEN-YEAR CAPITAL PROJECTION

5.1 General

As outlined in earlier sections of this report, the sanitary infrastructure within the Village is reaching the end of its expected life and is beginning to show significant deficiencies. The Ten-Year Capital Plan, presented in ***Figure M1.3*** in ***Appendix M*** and ***Table 5.1***, outlines a preferred action plan in which the Village begins to rejuvenate the local infrastructure system.

Projects were selected based on likelihood of failure, potential for property damage, and because they represented an opportunity to combine multiple road sections into a unified project, which will result in lower overall costs.

MPE generally recommends that road segments requiring complete rehabilitation of all underground infrastructure be prioritized. Coordinating repairs eliminates separate road reconstruction following each utility upgrade, improves the structural quality of the road compared to straight cut utility installation, and reduces the overall timeframe for utility repair or replacement. Combining infrastructure repairs in this manner can have various effects on the cost of repairs in the short term, but long-term analysis shows an overall reduction in capital expenditure.

5.2 Ten-Year Capital Projection

MPE has prepared a ten-year capital projection that outlines a proposed schedule for project delivery based on municipal needs.

Projects identified in the ten-year capital projection are shown in ***Figure M1.3*** in ***Appendix M***. Approximate costs for these projects have been calculated in a Class "D" cost estimate. Estimates for the cost of the rehabilitation projects conservatively assume that each full rehabilitation project will require reconstruction of the affected road. In reality, a proof-roll test will be conducted during the preliminary design to determine if the reconstruction is beneficial, and some segments of road will only require milling and overlay of unaffected surfaces. Also, future CCTV programs will provide insight as to whether or not a section of pipe can be rehabilitated rather than replaced. ***Table 5.1*** outlines the projects selected for the ten-year capital projection and the associated cost estimates for those items.

5.3 Yearly Upgrades

TEN-YEAR CAPITAL PROJECTION – 2018

49 Street Reconstruct (50 Avenue to 52 Avenue)

The sanitary sewer under this section is exhibiting moderate to severe sagging throughout. There is minor to moderate cracking throughout, and severe cracking/broken pipe closer to the Community Centre. This is a result of the base being compromised. This will be replaced with 200 mm PVC by open cut, including new manholes and services, and the road surface will be replaced at the same time.

Main Lift Station Upgrades

Phase 1 upgrades as outlined in the MPE assessment report [see ***Appendix L*** and ***Appendix N*** (for 2018 cost estimate)].

2018 CCTV Program

Complete CCTV of the sanitary lines in the 2019 and 2020 priorities.

TEN-YEAR CAPITAL PROJECTION – 2019

54 Avenue Reconstruct (50 Street to 51 Street)

The sanitary sewer under this section is exhibiting moderate to severe sagging and joint displacement. This is a result of the base being compromised. There are moderate encrustation issues throughout. This will be replaced with 200 mm PVC by open cut, including new manholes and services, and the road surface will be replaced at the same time.

Main Lift Station Upgrades

Phase 2 upgrades as outlined in the MPE assessment report [see ***Appendix L*** and ***Appendix N*** (for 2019 cost estimate)].

TEN-YEAR CAPITAL PROJECTION – 2020

54 Avenue Rehabilitation (48 Street to 50 Street)

The sanitary sewer under this section has a broken/collapsed portion and has encrustation throughout. This is a result of the pipe material failing. This will be considered for CIPP repair or for pipe bursting replacement with HDPE pipe. The road section will be treated with a mill and 50 mm overlay.

2020 CCTV Program

Complete CCTV of the sanitary lines in the 2021 and 2022 priorities.

TEN-YEAR CAPITAL PROJECTION – 2021

56 Avenue Reconstruct (50 Street to 49 Street)

The sanitary sewer under this section has a broken/collapsed portion and has encrustation throughout. This is a result of the pipe material failing. This will be replaced with 200 mm PVC by open cut, including a new manhole to reduce the length of the main as well as services, and the road surface will be replaced at the same time. If the road surface is in good condition, and the remainder of the pipe is in good condition, a portion could be lined instead of replaced.

TEN-YEAR CAPITAL PROJECTION – 2022

50 Street Rehabilitation (51 Avenue to 52 Avenue)

The sanitary sewer under this section has some sagging and has some minor cracking throughout. This is a result of the pipe material failing. This will be considered for CIPP repair or for pipe bursting replacement with HDPE pipe. The road section will be treated with a mill and 50 mm overlay.

50 Street Rehabilitation (53 Avenue to 54 Avenue)

The sanitary sewer under this section has some sagging and has moderate cracking throughout. This is a result of the pipe material failing. This will be considered for CIPP repair or for pipe bursting replacement with HDPE pipe. The road section will be treated with a mill and 50 mm overlay.

2022 CCTV Program

Complete CCTV of the sanitary lines in the 2023 and 2024 priorities.

TEN-YEAR CAPITAL PROJECTION – 2023

50 Street Rehabilitation (52 Avenue to 53 Avenue)

The sanitary sewer under this section has some sagging and has severe cracking throughout. This is a result of the pipe material failing. This will be considered for CIPP repair or for pipe bursting replacement with HDPE pipe. The road section will be treated with a mill and 50 mm overlay.

TEN-YEAR CAPITAL PROJECTION – 2024

51 Avenue Reconstruct (51 Street to Midblock)

The sanitary sewer under this section has severe cracking throughout. This is a result of the pipe material failing. This will be replaced with 200 mm PVC by open cut, including new manholes and services, and the road surface will be replaced at the same time.

2024 CCTV Program

Complete CCTV of the sanitary lines in the 2025 and 2026 priorities.

TEN-YEAR CAPITAL PROJECTION – 2025

50 Avenue Rehabilitation (53 Street to Midblock)

The sanitary sewer under this section is exhibiting moderate sagging throughout and minor to moderate cracking throughout. This is a result of the base being compromised as well as pipe material failure. This will be replaced with 200 mm PVC by open cut, including a new manhole to reduce the length of the main as well as services, and the road surface will be replaced at the same time.

50 Avenue Rehabilitation (Midblock to 51 Street)

The sanitary sewer under this section has some minor sagging and has moderate cracking throughout. This is a result of the pipe material failing. This will be considered for CIPP repair or for pipe bursting replacement with HDPE pipe.

TEN-YEAR CAPITAL PROJECTION – 2026

55 Avenue Reconstruct (51 Street to 50 Street)

The sanitary sewer under this section is exhibiting moderate cracking throughout. This is a result of pipe material failure. This will be replaced with 200 mm PVC by open cut, including a new manhole to reduce the length of the main as well as services, and the road surface will be replaced at the same time.

2026 CCTV Program

Complete CCTV of the sanitary lines in the 2027 priorities.

TEN-YEAR CAPITAL PROJECTION – 2027

53 Avenue Rehabilitation (51 Street to 50 Street)

The sanitary sewer under this section has some minor sagging and has moderate encrustation throughout. This will be considered for CIPP repair or for pipe bursting replacement with HDPE pipe. The road section will be treated with a mill and 50 mm overlay.

Table 5.1: Projects – Ten-Year Capital Projection

Description		Cost
General Items		
2018	49 Street Reconstruct (50 Ave. to 52 Ave.)	$700,000.00
2018	Main Lift Station Upgrades	$101,116.25
2018	2018 CCTV Program (Allowance)	$15,000.00
2019	54 Avenue Reconstruct (50 St. to 51 St.)	$545,000.00
2019	Main Lift Station Upgrades	$151,000.00
2020	54 Avenue Rehabilitation (48 St. to 50 St.)	$310,000.00
2020	2020 CCTV Program (Allowance)	$15,000.00
2021	56 Avenue Reconstruct (50 St. to 49 St.)	$545,000.00
2022	50 Street Rehabilitation (51 Ave. to 52 Ave.)	$140,000.00
2022	50 Street Rehabilitation (53 Ave. to 54 Ave.)	$130,000.00
2022	2022 CCTV Program (Allowance)	$15,000.00
2023	50 Street Rehabilitation (52 Ave. to 53 Ave.)	$125,000.00
2024	51 Avenue Reconstruct (51 St. to Midblock)	$280,000.00
2024	2024 CCTV Program (Allowance)	$15,000.00
2025	50 Avenue Reconstruct (53 St. to 51 St.)	$510,000.00
2026	55 Avenue Reconstruct (51 St. to 50 St.)	$525,000.00
2026	2026 CCTV Program (Allowance)	$15,000.00
2027	53 Avenue Rehabilitation (51 St. to 50 St.)	$180,000.00
Subtotal (Rounded to the nearest $5000)		$4,315,000.00
Contingency (25%)		$1,080,000.00
Engineering and Testing (15%)		$810,000.00
TOTAL		**$6,205,000.00**

The ten-year capital projection includes $4,315,000.00 in expenditure on infrastructure within the Village of Ryley for a total cost of **$6,205,000.00 when contingency and engineering are included**. MPE recognizes that the development of a ten-year capital projection is an iterative process and is prepared to make alterations and changes to the projects brought forward in this section as required.

6.0 CLOSURE

This Municipal Infrastructure Assessment and Ten-Year Capital Projection has been prepared and finalized with input from Village Staff. The projects identified in ***Table 5.1*** have been prioritized to meet the Village's specific infrastructure needs. The Village is encouraged to develop a project implementation plan to deal with priorities to keep its infrastructure in good operating order and to retain the integrity of the overall system. It is recommended that possible government funding sources and programs be identified for use in budget deliberations to determine which projects may be feasible.

The Village of Ryley should consider the priority projects identified in this report and its appendices for the development of future staging plans. It is suggested that the identified "high-priority" underground infrastructure projects and priority overlays be considered primary priorities, with the remaining projects deemed as secondary or other priorities.

APPENDIX A

Determination of Ride Comfort Index

Pavement roughness may be classified into three types:

- The most commonly used roughness measurement relates to the longitudinal profile of the pavement, generally along the wheel path and involves a range of wave amplitudes and frequencies related to the smoothness of ride.
- The second type is transverse profile roughness and is generally perpendicular to the direction of travel with hydro-planning (rut depths) and vehicle maneuver considerations being important. Information with respect to transverse profile is very useful at the detailed project level of rehabilitation analysis, but not for the network level pavement management.
- A third type of roughness is micro-roughness, as determined by the surface texture of the pavement; this type is related to skid resistance.

At the network level of pavement management, the longitudinal roughness is of prime importance and thus, in this project, is the only type of roughness considered.

In order to represent a pavement's performance from a user perspective, a Ride Comfort Index (RCI) is determined. Acceptable performance can be gauged from a lack of persistent complaints by the traveling public and/or maintenance personnel. This complaint level is representative of a pavement's ability to carry traffic under normal operating conditions while meeting the expectations of the users.

Ride comfort can be determined by asking drivers of automobiles for their considered opinions. A systematic approach is to form a panel of raters made up of a group of local people who represent the average user of the road system and then have them rate the riding quality of a given pavement. This rating is based on the "feel" of the road they experience and describes the riding comfort as "good," "fair," "poor," etc. It would not be very practical to have the entire network evaluated in this manner for obvious reasons; therefore, a simpler, more convenient method is employed.

The longitudinal roughness of a road section is collected using a specially equipped van with two piezo-electric accelerometer and five laser sensors mounted rigidly to the front bumper. An on-board micro-processor transforms the acceleration and sensor readings to an International Roughness Index (IRI). In this way, all roadway distortions affecting ride are measured by vertical actions imposed on the vehicle. It is generally accepted the movement felt by a passenger would be a consequence of the movement of the vehicle; therefore, this provides for a reliable comparison between subjective ride ratings and objective mechanical measurements as collected by a test unit.

Once the network has been surveyed for roughness, sections may be rated by a panel of stakeholders such that the entire range of roughness numbers is covered. The panel's rating of "very good" to "very poor" are then converted onto a scale of zero (0) to 100, where zero represents an unacceptable ride comfort and 100 represents the best possible ride comfort. The next step involves a correlation of these converted ratings to the collected roughness numbers.

The resulting regression equation obtained from the correlation analysis represents the total spectrum of riding comfort versus unit measured roughness. ***Figure A.1*** provides a graphical presentation typical of this relationship. Once this is done, all roughness numbers from the collection unit can be converted to a Ride Comfort Index (RCI). This developed procedure allows for an economical, consistent representation of the acceptability of all sections within a municipality's road network.

When a municipality has established an IRI-RCI correlation, it should remain reasonably stable for several years, although of course, much more frequent recalibration of the roughness device may be needed. It should be noted that panel ratings might change with time and/or region. This is primarily due to the range of serviceability levels experienced by the users and to a lesser degree, to the changes in the overall serviceability spectrum of the specific network in a region and changes in vehicle characteristics.

RCI MODEL

The current Model to convert measured IRI (mm/m) to an RCI index score in the analysis is as follows:

$$RCI = 10 \times (8.72 - 2.2 \times Ln(IRI))$$

where

IRI = International Roughness Index (mm/m or m/km)

Figure A.1 graphically shows the relationship between IRI and RCI used for the analysis.

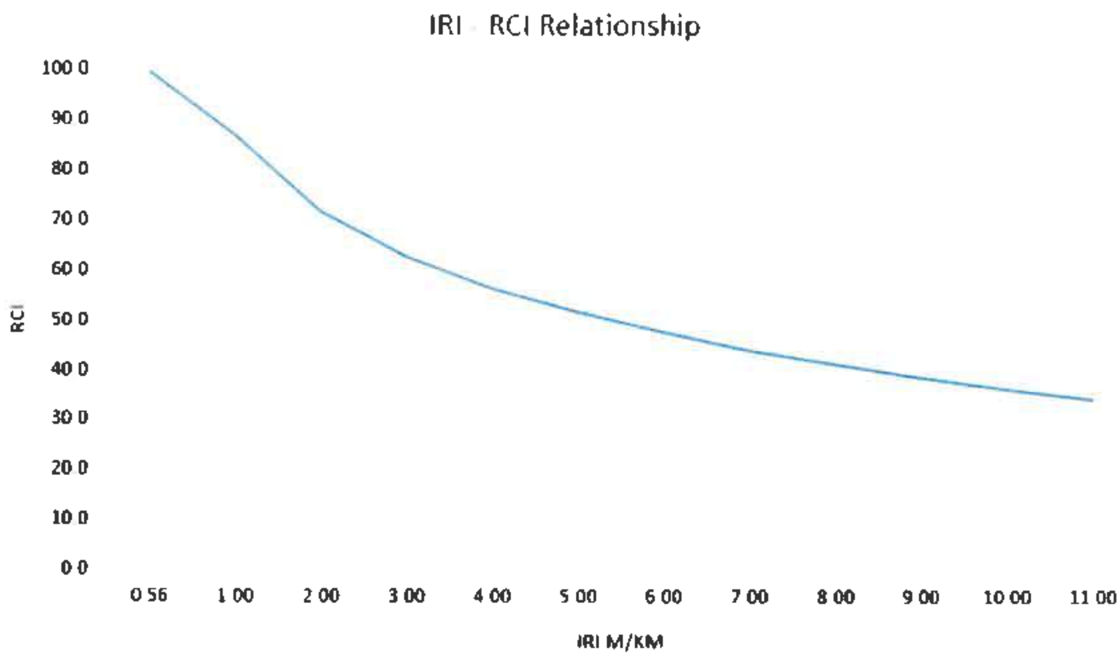


Figure A.1: IRI–RCI Model

RCI values determined at 30-metre intervals were used to calculate sectional equivalents. These sectional values were then used to generate a summary distribution and mean for the network.

APPENDIX B

Determination of Pavement Distress Index

The Pavement Distress Index (PDI) is a measure of physical pavement cracking, deformations, and surface defects collectively referred to as distresses. This provides an excellent indicator of material deficiency, rate of deterioration, structural adequacy, environmental, and soil type problems. The PDI is, therefore, a key indicator of pavement performance, which may be used to monitor the condition of the network, assess future needs, establish ranking, and optimize expenditures. It will also provide information to monitor the performance of various design, rehabilitation, and maintenance techniques and to provide information for identifying candidate projects for maintenance and improvement programs.

The procedure described herein was developed as a means of converting the flexible pavement surface distress ratings produced by the operators of the survey unit into index values between zero (0) and 100. This includes the production of indicators for individual distress types at each station, the production of one index value for each station (i.e., combining all types of distress into one value), and the production of one index value for an entire pavement section.

DISTRESS CODES

The pavement distress manifestations evaluated by the raters are recorded in the survey unit in a coded form that ranges from 00 (no distress) to 25 (severe throughout). The first digit is the severity and the second digit is the extent as described in ***Table B.1***.

Table B.1: Severity and Extent Codes

Numeric Code	Severity Code Definition	Extent Code Definition
0	None/Slight	None
1	Moderate	Few
2	Severe	Intermittent
3	--	Frequent
4	--	Extensive
5	--	Throughout

For example, if alligator cracking on a flexible pavement is found to be moderate in severity and extensive in occurrence, a value of '14' would be recorded, the '1' indicating moderate severity and the '4' indicating extensive occurrence.

There are 12 types of distresses considered in the formulation of PDI as indicated in ***Table B.2***. A code is assigned to each distress type for every station sampled along the length of a pavement section.

Table B.2: Distress Types

Item #	Distress Types	Abbrev.
1	Patching	Pat
2	Rippling and Shoving	Rip
3	Raveling and Streaking	Rav
4	Flushing and Bleeding	Flu
5	Deformation and Distortions	Dis
6	Progressive Edge Cracking	Edg
7	Alligator Cracking	Alg
8	Potholes	Pot
9	Map Cracking	Map
10	Longitudinal Cracking	Lon
11	Transverse Cracking	Trn
12	Wheel Track Rutting	Rut

DISTRESS SCORES

To summarize the data for each section, the distresses are combined into one index PDI, which is calculated using the deduct point system. The deduct point system deducts points from the PDI for each type, severity, and density of recorded distresses. The amount deducted is a function of the extent, type, and severity of the distress. The DVs (Deduct Values) provide the weightings for the relative importance of the distresses/severity levels in terms of the pavement performance, in calculating the PDI. The DV model equation, distress density form, and the DV model coefficients 'a' and 'b' for the distresses included in PDI calculation are listed in ***Table B.3***.

Table B.3: Pavement Distress Deduct Value Model Coefficients

Distress Type		Distress Density %	Severity – Slight		Severity – Moderate		Severity – Severe	
Code	Name		Coef. A	Coef. B	Coef. A	Coef. B	Coef. A	Coef. B
Alg	Alligator Cracking	% Area	0.039	0.4136	0.284	0.3421	0.455	0.2839
Map	Map Cracking	% Area	-1.052	0.8114	-0.619	0.7034	-0.209	0.5878
Lon	Longitudinal Cracking	% Lineal/Area	-0.531	0.6419	-0.075	0.4808	0.187	0.4997
Trn	Transverse Cracking	% Lineal/Area	-0.531	0.6419	-0.075	0.4808	0.187	0.4997
Edg	Edge Cracking	% Area	-0.536	0.5538	-0.055	0.3960	0.171	0.3855
Flu	Bleeding	% Area	-1.134	0.6962	-0.563	0.6067	-0.241	0.5655
Dst	Distortion	% Area	-0.666	0.6533	-0.076	0.5511	0.295	0.3930
Rut	Rutting	% Area	-0.307	0.5507	0.117	0.4016	0.306	0.3711
Rpl	Rippling	% Area	-0.490	0.7179	-0.007	0.5152	0.292	0.3844
Rav	Raveling	% Area	-0.812	0.5202	-0.065	0.3471	0.214	0.3670
Pat	Patching/Utility Cuts	% Area	-0.871	0.4383	-0.719	0.4878	-0.338	0.4737
Pot	Potholes	% Area	0.664	0.5162	1.024	0.5780	1.102	0.3879

INDIVIDUAL DISTRESS DEDUCT VALUES

The equation to calculate the individual distress DV is as follows:

$DV_i = 10^{\wedge} (a + b * LOG(\%Area))$

where

%Area = percent area of the distress/severity occurrence

The DV for a distress type is the sum of the combined severity-extend deduction for that distress type.

ADJUSTED DISTRESS SCORES

The Total Deduct Value (TDV) is then calculated as the sum of the individual distress values:

$TDV = sum(DV_i)$

The Adjusted Deduct Value (ADV) is then calculated from the TDV based on the number of equivalent distresses (NED) present. The NED is calculated as the sum of the ratios of each distress value to the maximum distress value (DV_{max}). The DV_{max} is the largest DV observed for the data. This can be expressed as:

$$NED = sum(DV_i / DV_{max})$$

where

DV_i = distress value for distress/severity level

DV_{max} = highest distress value observed

The ADV is calculated using the following equation:

$$ADV = 10 \times (-0.5 \times LOG(NED) + LOG(TDV))$$

The ADV–TDV correlation is graphically presented in ***Figure B.1***.

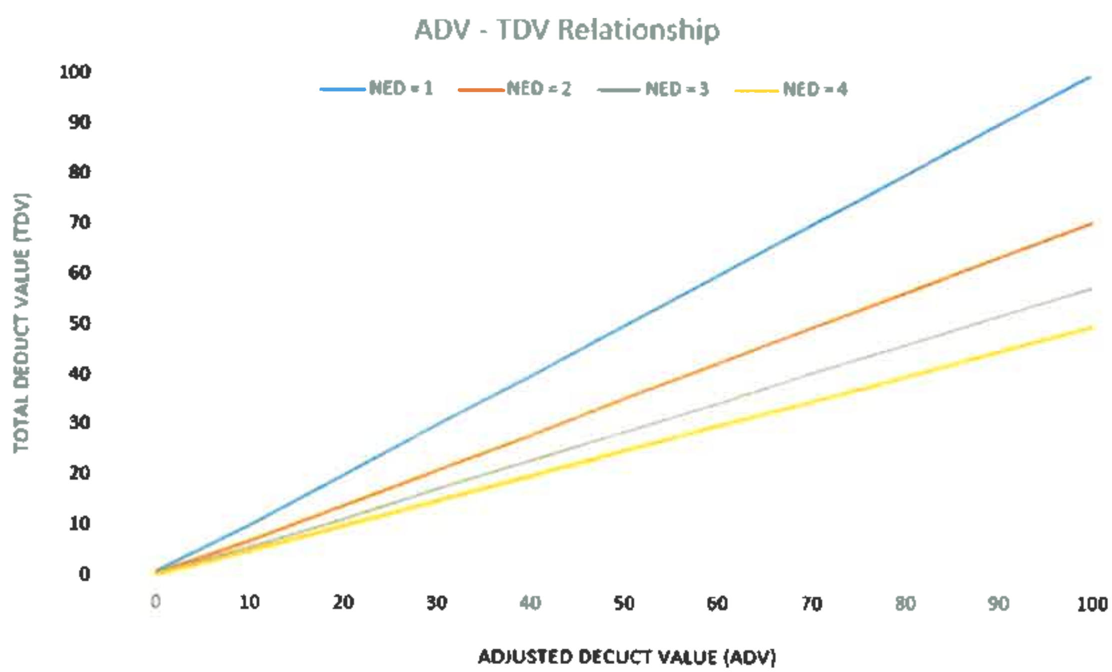


Figure B.1: ADV and TDV Correlation

PAVEMENT DISTRESS INDEX (PDI)

Final PDI scores are calculated as follows:

$PDI = PDI_M - ADV$

where

PDI_M is the Maximum PDI score of 100

The PDI for each pavement section is determined after all stations have been processed. This involves evaluating the contribution of each of the 12 individual distress items to the section PDI.

PDI values determined at 30-metre intervals were used to calculate sectional equivalents. These sectional values were then used to generate a summary distribution and mean for the network.

APPENDIX C

Determination of Overall Condition Index

The Overall Condition Index (OCI) is used to provide a single overall assessment of pavement quality. The OCI is based on one or more of the basic Performance Indicators: the Pavement Distress Index (PDI), the Ride Comfort Index (RCI), and the Structural Adequacy Index (SAI).

The OCI models used in the analysis are as follows:

Model 1

$OCI = 0.3456 + 0.7988*RCI + 0.0454*PDI^2$

This model is applied to sections that <u>do not</u> have SAI scores.

Model 2

$OCI = 1.8455 + 0.2052*SAI + 0.0957*RCI*PDI$

This model is applied to sections that have SAI scores.

APPENDIX D

Decision Matrices

COLLECTOR NETWORK

Matrices

Highway | Arterial | Collector | Local | Lane

				LOAD								
				GOOD			FAIR			POOR		
				CONS								
				GOOD	FAIR	POOR	GOOD	FAIR	POOR	GOOD	FAIR	POOR
EMV	GOOD	MAT	GOOD	4	4	5	5	5	6	[illegible]	[illegible]	[illegible]
			FAIR	4	5	5	5	6	6	[illegible]	[illegible]	[illegible]
			POOR	5	5	6	6	6	6	[illegible]	[illegible]	[illegible]
	FAIR		GOOD	5	5	6	6	6	7	[illegible]	[illegible]	[illegible]
			FAIR	5	5	6	7	7	7	[illegible]	[illegible]	[illegible]
			POOR	6	6	7	7	7	7	[illegible]	[illegible]	[illegible]
	POOR		GOOD	7	7	7	7	7	7	[illegible]	[illegible]	[illegible]
			FAIR	7	7	7	7	7	[illegible]	[illegible]	[illegible]	[illegible]
			POOR	7	7	7	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LOCAL NETWORK

Matrices

Highway | Arterial | Collector | Local | Lane

				LOAD								
				GOOD			FAIR			POOR		
				CONS								
				GOOD	FAIR	POOR	GOOD	FAIR	POOR	GOOD	FAIR	POOR
EMV	GOOD	MAT	GOOD	4	4	4	4	4	5	5	7	7
			FAIR	4	4	4	4	4	5	5	7	7
			POOR	4	4	4	4	5	5	7	7	7
	FAIR		GOOD	4	5	5	5	5	5	5	7	7
			FAIR	5	5	5	5	5	5	7	7	7
			POOR	5	5	5	5	5	7	7	8	8
	POOR		GOOD	5	5	5	5	5	5	8	8	8
			FAIR	5	5	5	5	5	7	8	8	8
			POOR	5	5	5	5	7	8	8	8	8

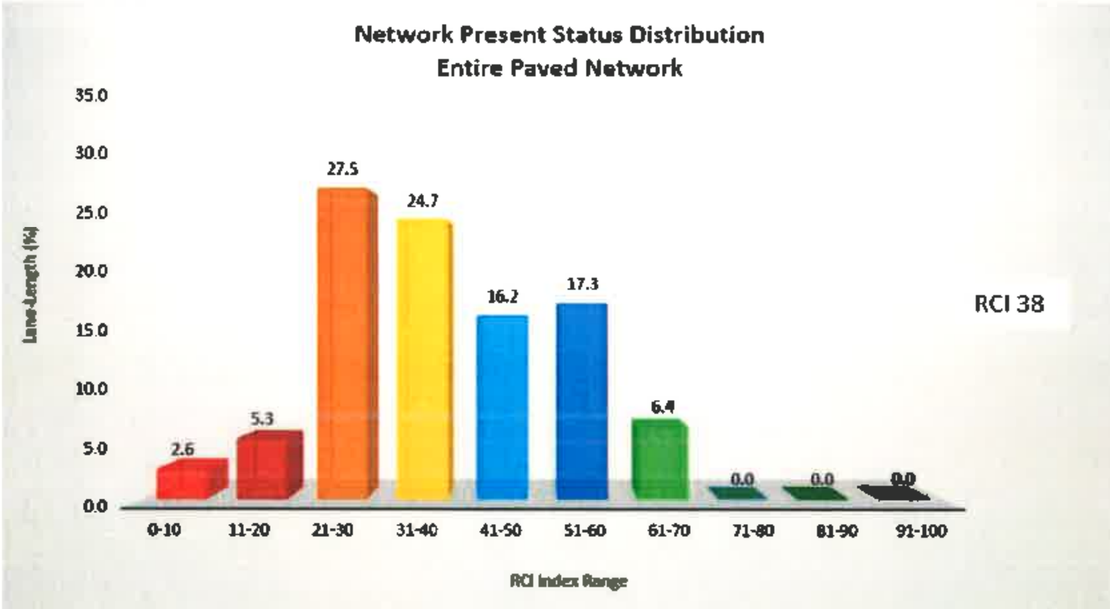
REHABILITATION ALTERNATIVES

Rehab Alternatives

ID	Workclass	Description	Cost	Gain
1	rehab	Micro Surface	$63,250.00	25
2	rehab	Overlay 50mm	$124,250.00	50
3	rehab	Overlay 75mm	[illegible]	60
4	rehab	Edge Mill and Overlay 50mm	$146,250.00	55
5	rehab	Full Mill and Overlay 50mm	$171,000.00	60
6	rehab	Full Mill and Overlay 75mm	$207,000.00	70
7	rehab	Full Mill and Overlay + [illegible]	[illegible]	[illegible]
8	rehab	Local Reconstruction	$675,000.00	100
9	rehab	Collector Reconstruction	$495,000.00	100
10	rehab	Arterial Reconstruction	[illegible]	100
11	rehab	Highway Reconstruction	$1,125,000.00	100

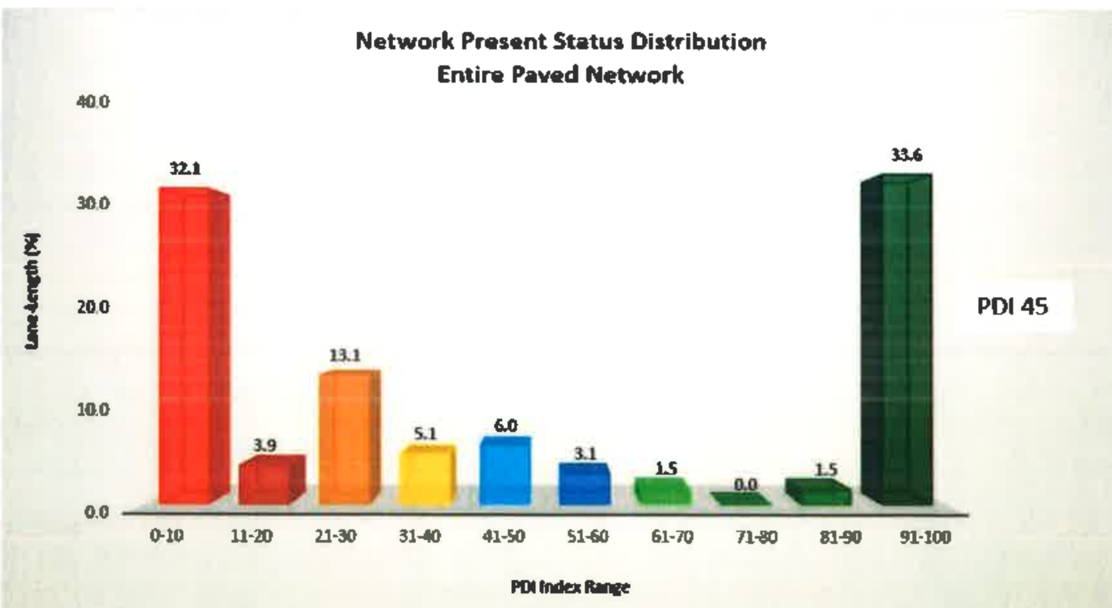
APPENDIX E

2018 Present Status Distributions by Functional Class



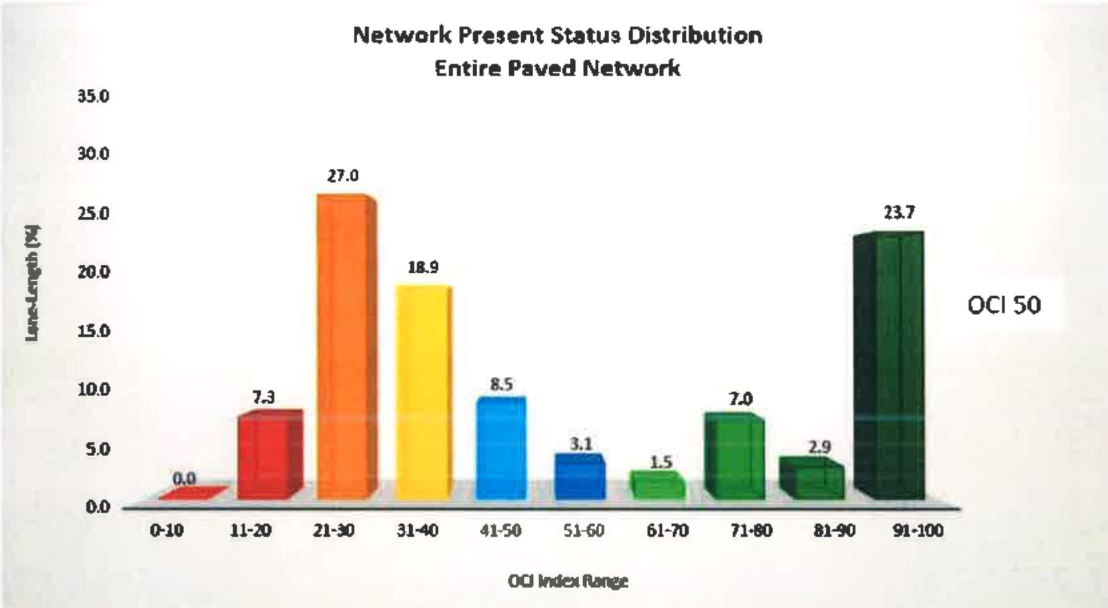
	RCI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	2.6	5.3	27.5	24.7	16.2	17.3	6.4	0.0	0.0	0.0	100.0
LL km	0.4	0.8	4.1	3.7	2.4	2.6	1.0	0.0	0.0	0.0	14.8

Figure F.1: RCI Distribution for Entire Paved Network



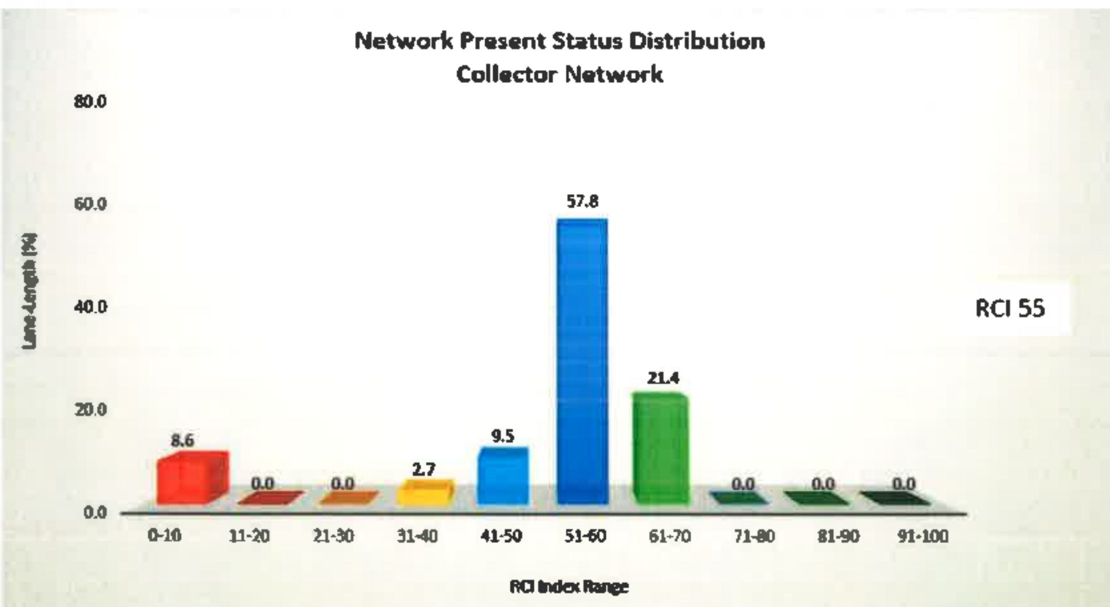
	PDI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	32.1	3.9	13.1	5.1	6.0	3.1	1.5	0.0	1.5	33.6	100.0
LL km	4.7	0.6	1.9	0.8	0.9	0.5	0.2	0.0	0.2	5.0	14.8

Figure F.2: PDI Distribution for Entire Paved Network



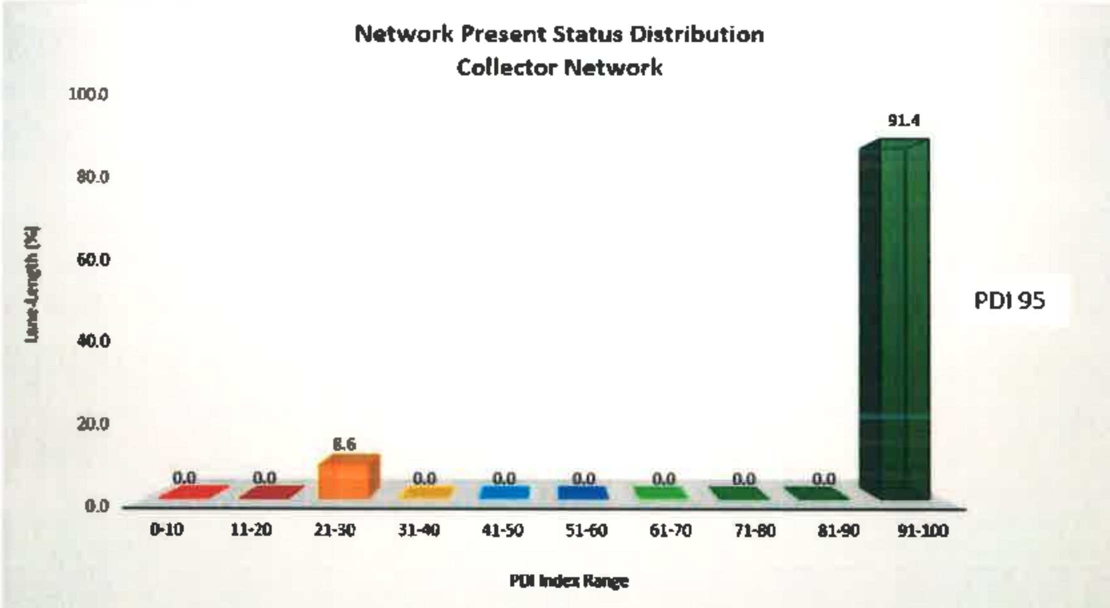
	OCI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	0.0	7.3	27.0	18.9	8.5	3.1	1.5	7.0	2.9	23.7	100.0
LL km	0.0	1.1	4.0	2.8	1.3	0.5	0.2	1.0	0.4	3.5	14.8

Figure F.3: OCI Distribution for Entire Paved Network



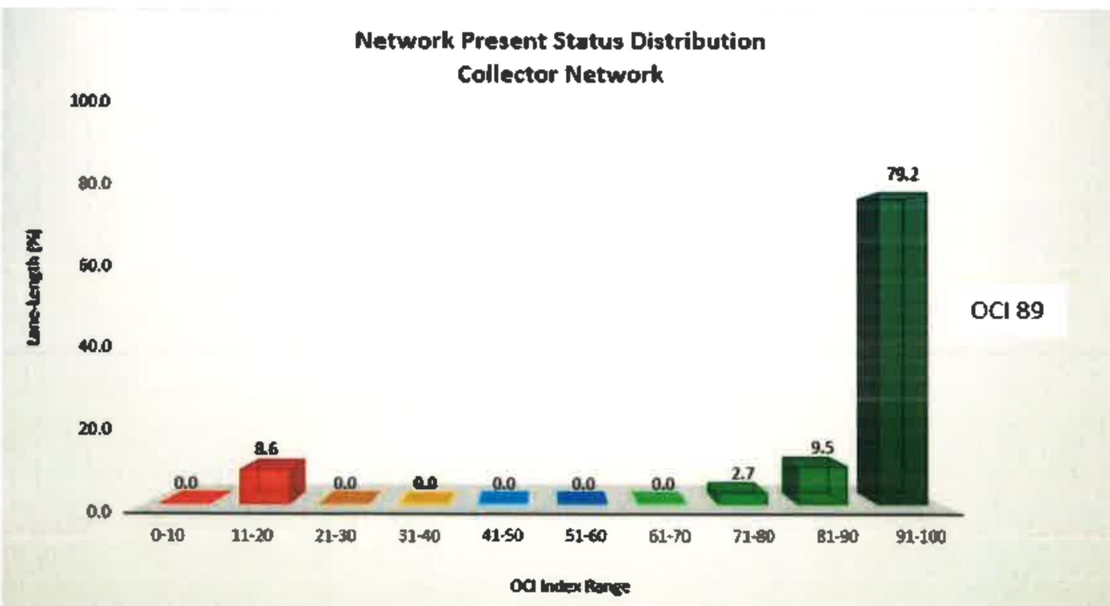
	RCI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	8.6	0.0	0.0	2.7	9.5	57.8	21.4	0.0	0.0	0.0	100.0
LL km	0.4	0.0	0.0	0.1	0.4	2.6	1.0	0.0	0.0	0.0	4.4

Figure F.4: RCI Distribution for Collector Network



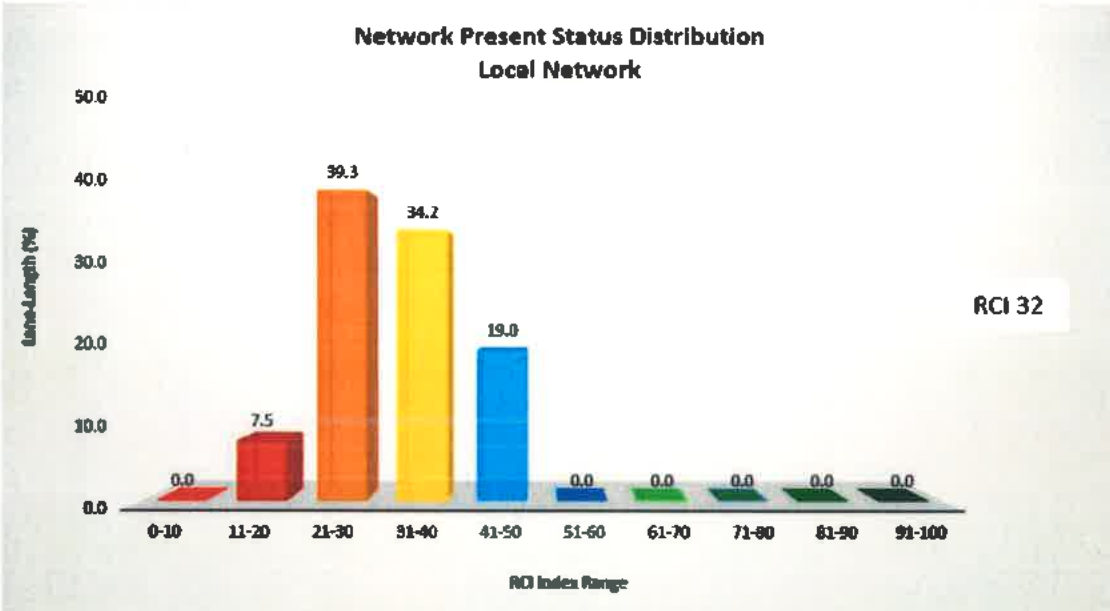
	PDI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	0.0	0.0	8.6	0.0	0.0	0.0	0.0	0.0	0.0	91.4	100.0
LL km	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	4.1	4.4

Figure F.5: PDI Distribution for Collector Network



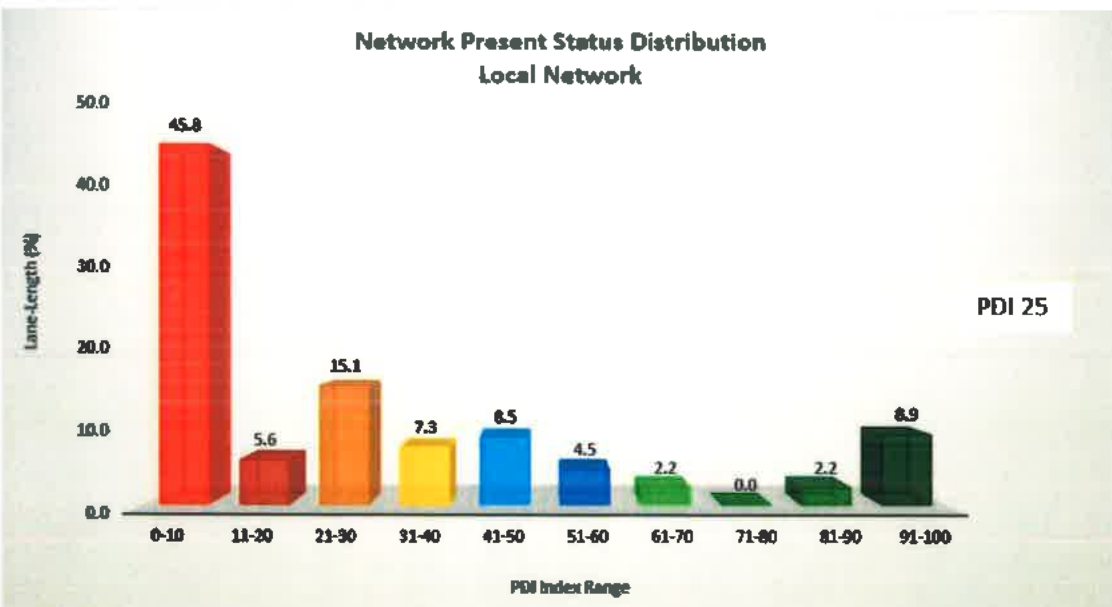
	OCI INDEX RANGE										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	0.0	8.6	0.0	0.0	0.0	0.0	0.0	2.7	9.5	79.2	100.0
LL km	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.4	3.5	4.4

Figure F.6: OCI Distribution for Collector Network



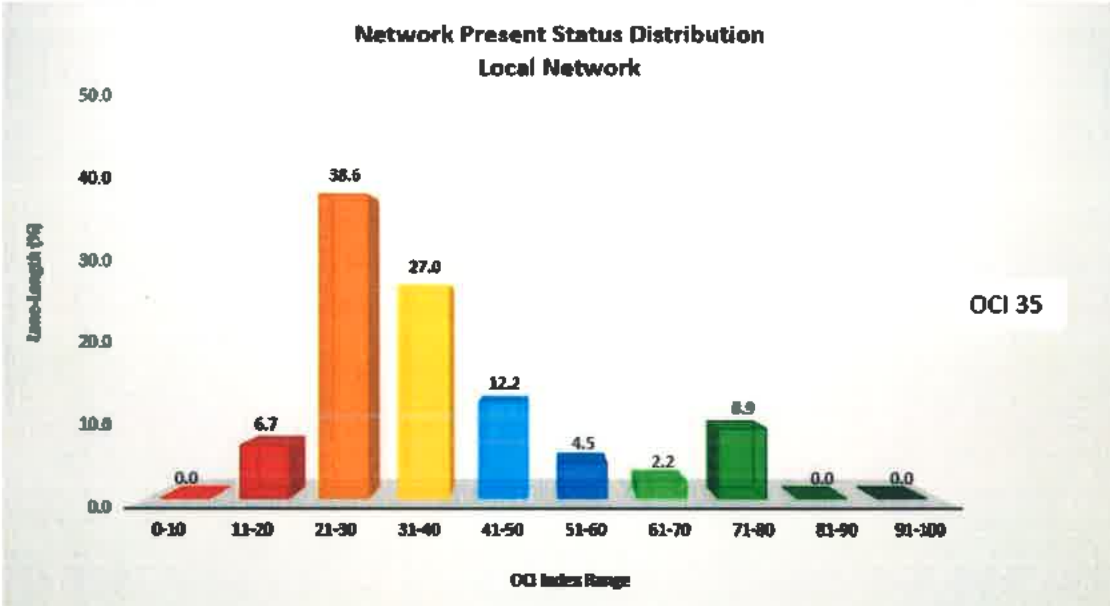
RCI INDEX RANGE	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	0.0	7.5	39.3	34.2	19.0	0.0	0.0	0.0	0.0	0.0	100.0
LL km	0.0	0.8	4.1	3.5	2.0	0.0	0.0	0.0	0.0	0.0	10.4

Figure F.7: RCI Distribution for Local Network



PDI INDEX RANGE	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	45.8	5.6	15.1	7.3	8.5	4.5	2.2	0.0	2.2	8.9	100.0
LL km	4.7	0.6	1.6	0.8	0.9	0.5	0.2	0.0	0.2	0.9	10.4

Figure F.8: PDI Distribution for Local Network



OCI INDEX RANGE	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL
LL %	0.0	6.7	38.6	27.0	12.2	4.5	2.2	8.9	0.0	0.0	100.0
LL km	0.0	0.7	4.0	2.8	1.3	0.5	0.2	0.9	0.0	0.0	10.4

Figure F.9: OCI Distribution for Local Network

APPENDIX F

2018 Network Present Status – Section Listing

VILLAGE OF RYLEY

2018 ROAD NETWORK PRESENT STATUS

SORT: STREET NAME AND SEGMENT ID

SEGMENT ID	STREET	FROM	TO	FUNC	PAVE	LANE-KM	LANES	LENGTH (m)	WIDTH (m)	AREA (m²)	OCI NEED YEAR	OCI	PDI	RCI	IRI (m/km)	DATA YEAR	AADT	EGT (mm)	SUBGRADE	REHAB. ALTERNATIVE	COST (PW)	CURVE CLASS
47545	49 Street	52 Avenue	51 Avenue	Local	AC	0.233	2	116.3	10.5	1221	2018	35.9	25.4	37.0	4.78	2017	29	505	Strong	Edge Mill and Overlay 50mm	$33,063.16	5
82734	49 Street	55 Avenue	54 Avenue	Local	AC	0.225	2	112.8	9.1	1039	2018	43.7	59.9	29.9	5.98	2017	28	505	Strong	Edge Mill and Overlay 50mm	$32,047.64	5
113323	49 Street	54 Avenue	53 Avenue	Local	AC	0.220	2	110.1	10.5	1156	2018	31.4	43.7	24.1	8.59	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,273.87	5
134832	49 Street	51 Avenue	50 Avenue	Local	AC	0.224	2	111.9	10.5	1175	2018	28.3	31.6	25.4	6.72	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,794.09	5
183822	49 Street	57 Avenue	56 Avenue	Local	AC	0.235	2	117.9	9.0	1061	2019	54.9	56.8	46.1	3.74	2017	23	505	Strong	Edge Mill and Overlay 50mm	$32,570.46	5
252622	49 Street	56 Avenue	55 Avenue	Local	AC	0.224	2	112.0	9.0	1008	2018	33.5	41.6	26.8	6.50	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,882.20	5
383756	49 Street	53 Avenue	52 Avenue	Local	AC	0.221	2	110.5	10.5	1160	2018	47.3	48.7	41.4	4.35	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,410.84	5
75510	50 Avenue	51 Street	50 Street	Collector	AC	0.239	2	119.5	13.0	1553	2035	100.0	100.0	67.5	1.91	2017	120	585	Strong	Edge Mill and Overlay 50mm	$20,441.34	5
97844	50 Avenue	47 Street	Highway 854	Collector	AC	0.685	2	342.5	8.0	2740	2028	95.9	100.0	58.9	2.51	2017	343	585	Strong	Full Mill and Overlay 50mm	$85,413.11	4
122341	50 Avenue	53 Street	51 Street	Collector	AC	0.700	2	349.8	13.0	4548	2027	92.6	97.9	57.1	2.66	2017	350	585	Strong	Full Mill and Overlay 50mm	$89,284.12	4
159995	50 Avenue	51 Street	53 Street	Collector	AC	0.118	2	59.1	13.0	768	2024	78.1	100.0	32.9	5.53	2017	59	585	Strong	Full Mill and Overlay 50mm	$16,520.43	5
186199	50 Avenue	56 Street	53 Street	Collector	AC	0.711	2	355.5	13.0	4618	2033	100.0	100.0	67.8	2.02	2017	355	585	Strong	Edge Mill and Overlay 50mm	$65,639.84	4
332613	50 Avenue	48 Street	47 Street	Collector	AC	0.484	2	242.0	8.0	1936	2028	96.3	100.0	59.4	2.42	2017	242	585	Strong	Full Mill and Overlay 50mm	$60,361.25	4
343248	50 Avenue	50 Street	49 Street	Collector	AC	0.340	2	170.0	13.0	2210	2029	91.0	100.0	52.8	2.95	2017	170	585	Strong	Full Mill and Overlay 50mm	$41,198.13	5
377495	50 Avenue	49 Street	48 Street	Collector	AC	0.351	2	175.4	8.0	1403	2029	90.1	100.0	51.7	3.18	2017	175	585	Strong	Full Mill and Overlay 50mm	$42,497.36	5
12453	50 Street	51 Avenue	50 Avenue	Local	AC	0.225	2	112.3	19.8	2224	2018	37.0	25.1	38.4	4.54	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,927.78	5
61108	50 Street	56 Avenue	55 Avenue	Local	AC	0.228	2	114.0	12.3	1402	2018	31.5	11.1	34.1	5.11	2017	29	505	Strong	Edge Mill and Overlay 50mm	$32,399.43	5
133181	50 Street	53 Avenue	52 Avenue	Local	AC	0.223	2	111.4	12.3	1370	2018	26.8	0.1	31.7	5.90	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,663.76	5
133978	50 Street	55 Avenue	54 Avenue	Local	AC	0.225	2	112.7	12.3	1387	2018	21.9	0.1	23.1	7.22	2017	28	505	Strong	Edge Mill and Overlay 50mm	$32,044.69	5
210283	50 Street	54 Avenue	53 Avenue	Local	AC	0.222	2	110.1	12.3	1354	2018	26.2	3.0	28.4	6.90	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,278.94	5
234544	50 Street	57 Avenue	56 Avenue	Local	AC	0.061	2	30.5	12.3	375	2018	29.3	0.1	32.4	5.41	2017	8	505	Strong	Edge Mill and Overlay 50mm	$8,670.99	5
335605	50 Street	52 Avenue	51 Avenue	Local	AC	0.232	2	115.9	19.8	2294	2018	29.0	0.1	32.0	5.71	2017	29	505	Strong	Edge Mill and Overlay 50mm	$32,934.21	5
96324	51 Avenue	51 Street	50 Street	Local	AC	0.360	2	179.9	12.3	2213	2018	19.2	7.7	19.4	8.89	2017	45	505	Strong	Edge Mill and Overlay 50mm	$51,127.46	5
283447	51 Avenue	50 Street	49 Street	Local	AC	0.338	2	169.1	12.3	2080	2018	17.2	0.1	17.3	8.93	2017	42	505	Strong	Edge Mill and Overlay 50mm	$48,067.59	5
30136	51 Street	57 Avenue	55 Avenue	Local	AC	0.114	2	56.8	9.0	511	2018	30.5	9.2	33.3	5.67	2017	14	505	Strong	Edge Mill and Overlay 50mm	$16,149.08	5
34271	51 Street	51 Avenue	50 Avenue	Local	AC	0.225	2	112.8	10.5	1184	2022	66.7	84.7	38.4	4.51	2017	28	505	Strong	Edge Mill and Overlay 50mm	$28,569.43	5
43484	51 Street	54 Avenue	53 Avenue	Local	AC	0.224	2	111.9	10.5	1175	2018	26.4	5.8	28.5	6.51	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,794.33	5
47383	51 Street	55 Avenue	54 Avenue	Local	AC	0.224	2	111.9	9.0	1007	2018	43.8	30.2	45.3	3.69	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,791.38	5
83374	51 Street	50 Avenue	Highway 14	Collector	AC	0.382	2	191.2	7.5	1434	2018	13.4	26.6	8.4	15.63	2017	191	585	Strong	Full Mill and Overlay 50mm	$63,535.10	5
154263	51 Street	53 Avenue	52 Avenue	Local	AC	0.222	2	111.0	10.5	1165	2024	73.5	97.8	33.1	6.06	2017	28	505	Strong	Edge Mill and Overlay 50mm	$26,551.12	5
336993	51 Street	52 Avenue	51 Avenue	Local	AC	0.228	2	114.1	10.5	1198	2019	54.1	64.7	39.6	4.46	2017	29	505	Strong	Edge Mill and Overlay 50mm	$31,510.13	5
71135	52 Avenue	50 Street	49 Street	Local	AC	0.340	2	170.0	10.5	1785	2018	24.4	0.1	26.3	6.65	2017	43	505	Strong	Edge Mill and Overlay 50mm	$48,320.34	5
163885	52 Avenue	51 Street	50 Street	Local	AC	0.358	2	179.0	10.5	1879	2018	21.8	5.6	22.8	7.33	2017	45	505	Strong	Edge Mill and Overlay 50mm	$50,864.77	5
115531	52 Avenue	54 Street	52 Street	Local	AC	0.763	2	381.6	10.5	4006	2018	22.0	4.2	23.1	7.74	2017	95	505	Strong	Edge Mill and Overlay 50mm	$108,449.30	5
135754	52 Avenue	53 Street	51 Street	Local	AC	0.346	2	173.2	10.5	1818	2024	74.7	91.3	41.8	4.24	2017	43	505	Strong	Edge Mill and Overlay 50mm	$41,410.46	5
31788	52 Street	53 Avenue	52 Avenue	Local	AC	0.220	2	110.2	10.5	1157	2018	38.6	46.8	31.5	5.56	2017	28	505	Strong	Edge Mill and Overlay 50mm	$31,315.71	5
357010	52 Street	End	53 Avenue	Local	AC	0.101	2	50.6	10.5	531	2018	34.7	31.0	35.3	5.44	2017	13	505	Strong	Edge Mill and Overlay 50mm	$14,364.43	5
21641	53 Avenue	52 Street	51 Street	Local	AC	0.341	2	170.5	10.5	1790	2018	27.4	4.5	29.8	5.93	2017	43	505	Strong	Edge Mill and Overlay 50mm	$48,451.38	5
142247	53 Avenue	End	52 Street	Local	AC	0.081	2	40.7	10.5	428	2018	22.6	27.7	19.6	7.97	2017	10	505	Strong	Edge Mill and Overlay 50mm	$11,574.19	5
142812	53 Avenue	51 Street	50 Street	Local	AC	0.355	2	177.6	10.5	1865	2025	78.1	96.6	40.7	4.51	2017	44	505	Strong	Edge Mill and Overlay 50mm	$41,299.34	5
263362	53 Avenue	50 Street	49 Street	Local	AC	0.341	2	170.5	10.5	1790	2018	30.2	23.5	30.3	6.16	2017	43	505	Strong	Edge Mill and Overlay 50mm	$48,452.60	5
81643	54 Avenue	50 Street	49 Street	Local	AC	0.341	2	170.5	10.5	1790	2018	32.0	25.2	32.1	5.90	2017	43	505	Strong	Edge Mill and Overlay 50mm	$48,453.49	5
165919	54 Avenue	49 Street	End	Local	AC	0.249	2	124.4	10.5	1306	2018	42.5	1.3	48.8	3.31	2017	31	505	Strong	Edge Mill and Overlay 50mm	$35,355.02	5
278608	54 Avenue	51 Street	50 Street	Local	AC	0.353	2	176.3	10.5	1851	2018	28.2	14.5	29.8	6.31	2017	44	505	Strong	Edge Mill and Overlay 50mm	$50,107.28	5
251340	54 Street	57 Avenue	52 Avenue	Local	AC	0.204	2	102.0	10.5	1071	2019	32.3	32.3	40.0		2017	26	505	Strong	Edge Mill and Overlay 50mm	$28,995.21	5
379492	55 Avenue	51 Street	50 Street	Local	AC	0.352	2	175.8	10.5	1846	2018	23.0	1.9	24.4	7.57	2017	44	505	Strong	Edge Mill and Overlay 50mm	$49,976.28	5
332799	55 Avenue	50 Street	49 Street	Local	AC	0.341	2	170.5	10.5	1790	2018	42.7	23.3	46.0	5.77	2017	41	505	Strong	Edge Mill and Overlay 50mm	$48,451.27	5
293825	56 Avenue	50 Street	49 Street	Local	AC	0.344	2	171.8	10.5	1803	2018	30.6	6.6	33.8	5.54	2017	43	505	Strong	Edge Mill and Overlay 50mm	$48,836.47	5
387017	56 Street	50 Avenue	Highway 14	Collector	AC	0.422	2	210.9	3.0	1607	2023	80.9	99.8	40.3	5.41	2017	211	585	Strong	Full Mill and Overlay 50mm	$60,722.29	4

APPENDIX G

Fixed Annual Budget Program Listing

VILLAGE OF RYLEY

$1.6M FIXED BUDGET PROGRAM

SORT: REHAB YEAR, STREET NAME, AND SEGMENT ID

SEGMENT ID	STREET	FROM	TO	FUNC	PAVE	LANE-KM	LANES	LENGTH (m)	WIDTH (m)	AREA (m^2)	REHAB. YEAR	REHAB. ALTERNATIVE	COST (PW)	OCI NEED YEAR	OCI	PDI	RCI	IRI (m/Km)	DATA YEAR	CURVE CLASS
315531	52 Avenue	54 Street	52 Street	Local	BGB	0.763	2	383.6	10.5	4006	2018	Edge Mill and Overlay 50mm	$111,607.92	2018	22.0	4.2	29.1	7.74	2017	5
142247	53 Avenue	End	52 Street	Local	BGB	0.081	2	40.7	10.5	423	2018	Edge Mill and Overlay 50mm	$11,911.30	2018	22.6	27.7	19.6	7.97	2017	5
165619	54 Avenue	49 Street	End	Local	BGB	0.249	2	124.4	10.5	1306	2018	Edge Mill and Overlay 50mm	$36,384.78	2018	42.5	1.3	48.5	3.51	2017	5
47545	49 Street	52 Avenue	51 Avenue	Local	BGB	0.233	2	116.3	10.5	1221	2019	Edge Mill and Overlay 50mm	$33,063.16	2018	35.3	25.4	37.0	4.78	2017	5
294544	50 Street	57 Avenue	56 Avenue	Local	BGB	0.061	2	30.5	12.3	375	2019	Edge Mill and Overlay 50mm	$8,670.99	2018	29.3	0.1	32.4	9.41	2017	5
36303	51 Avenue	51 Street	50 Street	Local	BGB	0.360	2	179.9	12.3	2213	2019	Edge Mill and Overlay 50mm	$51,127.48	2018	19.2	7.7	19.4	8.89	2017	5
83384	51 Street	50 Avenue	Highway 14	Collector	BGB	0.382	2	191.2	7.5	1434	2019	Full Mill and Overlay 50mm	$63,535.10	2018	13.4	26.6	8.4	15.63	2017	5
160835	52 Avenue	51 Street	50 Street	Local	BGB	0.358	2	179.0	10.5	1879	2020	Edge Mill and Overlay 50mm	$49,425.20	2018	21.8	5.6	22.8	7.33	2017	5
357010	52 Street	End	53 Avenue	Local	BGB	0.101	2	50.6	10.5	531	2020	Edge Mill and Overlay 50mm	$13,961.78	2018	34.7	31.9	38.3	5.44	2017	5
274608	54 Avenue	51 Street	50 Street	Local	BGB	0.353	2	176.3	10.5	1851	2020	Edge Mill and Overlay 50mm	$48,689.15	2018	28.2	14.5	29.8	8.81	2017	5
392799	55 Avenue	50 Street	49 Street	Local	BGB	0.341	2	170.5	10.5	1790	2020	Edge Mill and Overlay 50mm	$47,060.01	2018	42.7	28.3	46.0	5.77	2017	5
30126	51 Street	57 Avenue	55 Avenue	Local	BGB	0.114	2	56.8	9.0	511	2021	Edge Mill and Overlay 50mm	$15,247.92	2018	30.5	9.2	33.3	5.67	2017	5
263362	53 Avenue	50 Street	49 Street	Local	BGB	0.341	2	170.5	10.5	1790	2021	Edge Mill and Overlay 50mm	$45,748.81	2018	30.2	23.5	30.3	6.16	2017	5
61643	54 Avenue	50 Street	49 Street	Local	BGB	0.341	2	170.5	10.5	1790	2021	Edge Mill and Overlay 50mm	$45,749.65	2018	32.0	25.2	32.1	5.90	2017	5
293825	56 Avenue	50 Street	49 Street	Local	BGB	0.344	2	171.8	10.5	1803	2021	Edge Mill and Overlay 50mm	$46,092.37	2018	30.6	6.6	33.8	5.54	2017	5
71135	52 Avenue	50 Street	49 Street	Local	BGB	0.340	2	170.0	10.5	1785	2022	Edge Mill and Overlay 50mm	$44,332.69	2018	24.4	0.1	26.3	6.65	2017	5
21641	53 Avenue	52 Street	51 Street	Local	BGB	0.341	2	170.5	10.5	1790	2022	Edge Mill and Overlay 50mm	$44,454.37	2018	27.4	4.5	28.8	5.93	2017	5
379492	55 Avenue	51 Street	50 Street	Local	BGB	0.352	2	175.8	10.5	1846	2022	Edge Mill and Overlay 50mm	$45,951.98	2018	23.0	1.9	24.4	7.57	2017	5
52704	49 Street	55 Avenue	54 Avenue	Local	BGB	0.226	2	112.8	9.3	1049	2023	Edge Mill and Overlay 50mm	$28,570.74	2018	45.7	59.9	29.3	5.98	2017	5
383256	49 Street	53 Avenue	52 Avenue	Local	BGB	0.221	2	110.5	10.5	1160	2023	Edge Mill and Overlay 50mm	$28,008.03	2018	47.3	48.7	41.4	4.31	2017	5
12453	50 Street	51 Avenue	50 Avenue	Local	BGB	0.225	2	112.3	19.8	2224	2023	Edge Mill and Overlay 50mm	$28,463.88	2018	37.0	25.1	38.4	4.54	2017	5
289447	51 Avenue	50 Street	49 Street	Local	BGB	0.338	2	169.1	12.3	2080	2023	Edge Mill and Overlay 50mm	$42,852.66	2018	17.2	0.1	17.3	8.93	2017	5
47383	51 Street	55 Avenue	54 Avenue	Local	BGB	0.224	2	111.9	9.0	1007	2023	Edge Mill and Overlay 50mm	$28,342.28	2018	49.8	30.2	45.3	3.69	2017	5
113323	49 Street	54 Avenue	53 Avenue	Local	BGB	0.220	2	110.1	10.5	1156	2024	Edge Mill and Overlay 50mm	$27,097.03	2018	31.4	43.7	24.1	8.59	2017	5
252622	49 Street	56 Avenue	55 Avenue	Local	BGB	0.224	2	112.0	9.0	1008	2024	Edge Mill and Overlay 50mm	$27,584.17	2018	33.5	43.6	26.8	6.50	2017	5
159905	50 Avenue	51 Street	51 Street	Collector	BGB	0.118	2	59.1	13.0	768	2024	Full Mill and Overlay 50mm	$17,007.75	2024	79.1	100.0	36.6	5.10	2017	5
61108	50 Street	56 Avenue	55 Avenue	Local	BGB	0.228	2	114.0	12.3	1402	2024	Edge Mill and Overlay 50mm	$28,066.88	2018	31.5	11.3	34.3	5.13	2017	5
345605	50 Street	52 Avenue	51 Avenue	Local	BGB	0.232	2	115.9	19.8	2294	2024	Edge Mill and Overlay 50mm	$28,530.15	2018	29.0	0.1	32.0	5.71	2017	5
21788	52 Street	53 Avenue	52 Avenue	Local	BGB	0.220	2	110.2	10.5	1157	2024	Edge Mill and Overlay 50mm	$27,128.08	2018	33.6	46.8	31.5	5.56	2017	5
134832	49 Street	51 Avenue	50 Avenue	Local	BGB	0.224	2	111.9	10.5	1175	2025	Edge Mill and Overlay 50mm	$26,762.98	2018	28.3	31.6	25.4	6.72	2017	5
133181	50 Street	53 Avenue	52 Avenue	Local	BGB	0.223	2	111.4	12.3	1370	2025	Edge Mill and Overlay 50mm	$26,652.44	2018	28.3	0.1	31.7	5.90	2017	5
193978	50 Street	55 Avenue	54 Avenue	Local	BGB	0.225	2	112.7	12.3	1387	2025	Edge Mill and Overlay 50mm	$26,973.93	2018	21.9	0.1	23.1	7.22	2017	5
240283	50 Street	54 Avenue	53 Avenue	Local	BGB	0.220	2	110.1	12.3	1354	2025	Edge Mill and Overlay 50mm	$26,329.35	2018	26.2	3.0	28.4	6.90	2017	5
43494	51 Street	54 Avenue	53 Avenue	Local	BGB	0.224	2	111.9	10.5	1175	2025	Edge Mill and Overlay 50mm	$26,765.19	2018	26.4	5.8	28.5	6.31	2017	5
291340	54 Street	57 Avenue	52 Avenue	Local	BGB	0.204	2	102.0	10.5	1071	2025	Edge Mill and Overlay 50mm	$24,407.00	2018	32.3	32.3	40.0		2017	5
183822	49 Street	57 Avenue	56 Avenue	Local	BGB	0.236	2	117.9	9.0	1061	2026	Edge Mill and Overlay 50mm	$27,416.50	2019	54.9	56.8	46.1	3.74	2017	5
34271	51 Street	51 Avenue	50 Avenue	Local	BGB	0.226	2	112.8	10.5	1184	2026	Edge Mill and Overlay 50mm	$26,211.78	2022	58.7	84.7	38.4	4.51	2017	5
396693	51 Street	52 Avenue	51 Avenue	Local	BGB	0.228	2	114.1	10.5	1198	2026	Edge Mill and Overlay 50mm	$26,523.96	2019	54.1	64.7	39.6	4.46	2017	5
387017	56 Street	50 Avenue	Highway 14	Collector	BGB	0.422	2	210.9	8.0	1687	2026	Full Mill and Overlay 50mm	$57,333.82	2023	80.3	99.3	40.3	5.43	2017	4
154263	51 Street	53 Avenue	52 Avenue	Local	BGB	0.222	2	111.0	10.5	1165	2027	Edge Mill and Overlay 50mm	$25,069.69	2024	73.5	97.8	33.3	6.06	2017	5
395754	52 Avenue	52 Street	51 Street	Local	BGB	0.346	2	173.2	10.5	1818	2027	Edge Mill and Overlay 50mm	$39,118.55	2024	74.7	91.3	41.8	4.24	2017	5
142812	53 Avenue	51 Street	50 Street	Local	BGB	0.355	2	177.6	10.5	1865	2027	Edge Mill and Overlay 50mm	$40,121.74	2025	78.3	96.6	40.7	4.51	2017	5

APPENDIX H

Flexible Annual Budget Program Listing

VILLAGE OF RYLEY

$1.6M FLEXIBLE BUDGET PROGRAM

SORT: REHAB YEAR, STREET NAME, AND SEGMENT ID

SEGMENT ID	STREET	FROM	TO	FUNC.	PAVE	LANE-KM	LANES	LENGTH (m)	WIDTH (m)	AREA (m²)	REHAB. YEAR	REHAB. ALTERNATIVE	COST (PW)	OCI NEED YEAR	OCI	PDI	RCI	IRI (m/Km)	DATA YEAR	CURVE CLASS
96303	51 Avenue	51 Street	50 Street	Local	BGB	0.360	2	179.9	12.3	2213	2018	Edge Mill and Overlay 50mm	$52,616.63	2018	19.2	7.7	19.4	6.89	2017	5
30128	51 Street	57 Avenue	55 Avenue	Local	BGB	0.114	2	56.8	9.0	511	2018	Edge Mill and Overlay 50mm	$16,619.44	2018	50.5	9.2	53.5	5.67	2017	5
83394	51 Street	50 Avenue	Highway 14	Collector	BGB	0.382	2	191.2	7.5	1434	2018	Full Mill and Overlay 50mm	$65,385.64	2018	13.4	26.6	8.4	15.63	2017	5
315531	52 Avenue	54 Street	53 Street	Local	BGB	0.763	2	381.6	10.5	4006	2018	Edge Mill and Overlay 50mm	$111,607.92	2018	22.0	4.2	23.1	7.24	2017	5
160885	52 Avenue	51 Street	50 Street	Local	BGB	0.358	2	179.0	10.5	1879	2019	Edge Mill and Overlay 50mm	$50,864.77	2018	21.8	5.6	22.8	7.33	2017	5
61643	54 Avenue	50 Street	49 Street	Local	BGB	0.341	2	170.5	10.5	1790	2019	Edge Mill and Overlay 50mm	$48,453.49	2018	32.0	25.2	52.1	5.90	2017	5
274608	54 Avenue	51 Street	50 Street	Local	BGB	0.353	2	176.3	10.5	1851	2019	Edge Mill and Overlay 50mm	$50,107.28	2018	29.2	14.5	29.8	6.81	2017	5
392799	55 Avenue	50 Street	49 Street	Local	BGB	0.341	2	170.5	10.5	1790	2019	Edge Mill and Overlay 50mm	$48,451.27	2018	42.7	23.3	46.0	5.77	2017	5
289825	56 Avenue	50 Street	49 Street	Local	BGB	0.344	2	171.8	10.5	1803	2019	Edge Mill and Overlay 50mm	$48,816.47	2018	30.6	6.6	33.8	5.54	2017	5
289447	51 Avenue	50 Street	49 Street	Local	BGB	0.338	2	169.1	12.3	2080	2020	Edge Mill and Overlay 50mm	$46,707.19	2018	17.7	0.1	17.3	8.93	2017	5
71135	52 Avenue	50 Street	49 Street	Local	BGB	0.340	2	170.0	10.5	1785	2020	Edge Mill and Overlay 50mm	$46,852.79	2018	24.4	0.1	26.3	6.65	2017	5
21641	53 Avenue	52 Street	51 Street	Local	BGB	0.341	2	170.5	10.5	1790	2020	Edge Mill and Overlay 50mm	$47,080.60	2018	27.4	4.5	23.8	5.93	2017	5
142247	53 Avenue	End	52 Street	Local	BGB	0.081	2	40.7	10.5	428	2020	Edge Mill and Overlay 50mm	$11,246.61	2018	22.6	27.7	19.6	7.97	2017	5
263362	53 Avenue	50 Street	49 Street	Local	BGB	0.341	2	170.5	10.5	1790	2020	Edge Mill and Overlay 50mm	$47,081.30	2018	30.2	23.5	30.3	6.16	2017	5
379492	55 Avenue	51 Street	50 Street	Local	BGB	0.352	2	175.8	10.5	1846	2020	Edge Mill and Overlay 50mm	$48,561.86	2018	23.0	1.9	24.4	7.57	2017	5
47545	49 Street	52 Avenue	51 Avenue	Local	BGB	0.233	2	116.3	10.5	1221	2021	Edge Mill and Overlay 50mm	$31,218.14	2018	35.9	25.4	37.0	4.78	2017	5
82704	49 Street	55 Avenue	54 Avenue	Local	BGB	0.226	2	112.8	9.3	1049	2021	Edge Mill and Overlay 50mm	$30,259.29	2018	43.7	59.9	29.9	5.98	2017	5
383256	49 Street	53 Avenue	52 Avenue	Local	BGB	0.221	2	110.5	10.5	1160	2021	Edge Mill and Overlay 50mm	$29,650.09	2018	47.3	48.7	41.4	4.31	2017	5
12453	50 Street	51 Avenue	50 Avenue	Local	BGB	0.225	2	112.3	19.8	2224	2021	Edge Mill and Overlay 50mm	$30,146.12	2018	57.0	25.1	58.4	4.54	2017	5
63108	50 Street	56 Avenue	55 Avenue	Local	BGB	0.228	2	114.0	12.3	1402	2021	Edge Mill and Overlay 50mm	$30,591.45	2018	31.5	11.3	34.3	5.13	2017	5
345605	50 Street	52 Avenue	51 Avenue	Local	BGB	0.232	2	115.9	19.8	2294	2021	Edge Mill and Overlay 50mm	$31,096.39	2018	29.0	0.1	32.0	5.71	2017	5
47983	51 Street	55 Avenue	54 Avenue	Local	BGB	0.224	2	111.9	9.0	1007	2021	Edge Mill and Overlay 50mm	$30,017.33	2018	43.8	30.7	45.3	3.69	2017	5
165619	54 Avenue	49 Street	End	Local	BGB	0.249	2	124.4	10.5	1306	2021	Edge Mill and Overlay 50mm	$33,382.31	2018	42.5	1.3	48.8	3.31	2017	5
113323	49 Street	54 Avenue	53 Avenue	Local	BGB	0.220	2	110.1	10.5	1156	2022	Edge Mill and Overlay 50mm	$28,668.49	2018	31.4	49.7	24.1	8.56	2017	5
252622	49 Street	56 Avenue	55 Avenue	Local	BGB	0.224	2	112.0	9.0	1008	2022	Edge Mill and Overlay 50mm	$29,214.41	2018	33.5	43.6	26.8	6.50	2017	5
21780	52 Street	53 Avenue	52 Avenue	Local	BGB	0.220	2	110.2	10.5	1157	2022	Edge Mill and Overlay 50mm	$28,731.37	2018	38.6	46.8	31.5	5.56	2017	5
357010	52 Street	End	53 Avenue	Local	BGB	0.101	2	50.6	10.5	531	2022	Edge Mill and Overlay 50mm	$13,182.67	2018	34.7	31.9	33.3	5.44	2017	5
134832	49 Street	51 Avenue	50 Avenue	Local	BGB	0.224	2	111.9	10.5	1175	2023	Edge Mill and Overlay 50mm	$29,344.70	2018	28.3	31.6	25.4	6.72	2017	5
133181	50 Street	53 Avenue	52 Avenue	Local	BGB	0.223	2	111.4	12.3	1370	2023	Edge Mill and Overlay 50mm	$29,227.62	2018	28.8	0.1	31.7	5.90	2017	5
294534	50 Street	57 Avenue	56 Avenue	Local	BGB	0.061	2	30.5	12.3	375	2023	Edge Mill and Overlay 50mm	$7,730.26	2018	29.5	0.1	32.4	5.41	2017	5
33494	51 Street	54 Avenue	53 Avenue	Local	BGB	0.224	2	111.9	10.5	1175	2023	Edge Mill and Overlay 50mm	$28,944.91	2018	26.4	5.8	28.5	6.31	2017	5
159905	50 Avenue	51 Street	51 Street	Collector	BGB	0.118	2	59.1	13.0	768	2024	Full Mill and Overlay 50mm	$17,007.75	2024	78.1	100.0	36.6	5.10	2017	5
193978	50 Street	55 Avenue	54 Avenue	Local	BGB	0.225	2	112.7	12.3	1387	2024	Edge Mill and Overlay 50mm	$27,799.58	2018	21.9	0.1	23.1	7.22	2017	5
240283	50 Street	54 Avenue	53 Avenue	Local	BGB	0.220	2	110.1	12.3	1354	2024	Edge Mill and Overlay 50mm	$27,096.22	2018	26.2	3.0	28.4	6.90	2017	5
251340	54 Street	57 Avenue	52 Avenue	Local	BGB	0.204	2	102.0	10.5	1071	2024	Edge Mill and Overlay 50mm	$25,117.89	2018	32.5	32.3	40.0		2017	5
183822	49 Street	57 Avenue	56 Avenue	Local	BGB	0.236	2	117.9	9.0	1061	2025	Edge Mill and Overlay 50mm	$28,215.04	2019	54.3	56.8	46.1	3.74	2017	5
34271	51 Street	51 Avenue	50 Avenue	Local	BGB	0.225	2	112.8	10.5	1184	2025	Edge Mill and Overlay 50mm	$26,975.23	2022	66.7	84.7	38.4	4.51	2017	5
336033	51 Street	52 Avenue	51 Avenue	Local	BGB	0.228	2	114.1	10.5	1198	2025	Edge Mill and Overlay 50mm	$27,296.50	2019	54.1	54.7	39.6	4.46	2017	5
335754	52 Avenue	52 Street	51 Street	Local	BGB	0.346	2	173.2	10.5	1818	2026	Edge Mill and Overlay 50mm	$40,257.92	2024	74.7	91.3	41.3	4.24	2017	5
387017	56 Street	50 Avenue	Highway 14	Collector	BGB	0.422	2	210.9	8.0	1687	2026	Full Mill and Overlay 50mm	$57,333.82	2021	83.9	99.8	40.3	5.43	2017	4
154263	51 Street	53 Avenue	52 Avenue	Local	BGB	0.222	2	111.0	10.5	1165	2027	Edge Mill and Overlay 50mm	$25,069.69	2024	73.5	97.8	33.3	6.06	2017	5
142812	53 Avenue	51 Street	50 Street	Local	BGB	0.355	2	177.6	10.5	1865	2027	Edge Mill and Overlay 50mm	$40,131.74	2025	78.3	96.6	40.7	4.51	2017	5

APPENDIX I

Network Definition

Defects and Locations Provided Electronically

Village of Ryley
Network Defintion

Segment/Asset_ID	Atb_Location	Atb_From	Atb_To	LENGTH
134832E	49 Street	51 Avenue	50 Avenue	130
377496N	50 Avenue	49 Street	48 Street	155
332613N	50 Avenue	48 Street	47 Street	221
97844N	50 Avenue	47 Street	End	101
343246N	50 Avenue	50 Street	49 Street	156
75510N	50 Avenue	51 Street	50 Street	153
123243N	50 Avenue	Start	51 Street	207
294544E	50 Street	56 Avenue	57 Avenue	13
61108E	50 Street	55 Avenue	56 Avenue	94
61108W	50 Street	56 Avenue	55 Avenue	99
193978W	50 Street	55 Avenue	54 Avenue	94
193978E	50 Street	55 Avenue	56 Avenue	93
240283W	50 Street	54 Avenue	53 Avenue	97
345605E	50 Street	51 Avenue	52 Avenue	95
133181E	50 Street	52 Avenue	53 Avenue	93
133181W	50 Street	53 Avenue	52 Avenue	93
12453E	50 Street	50 Avenue	51 Avenue	98
12453W	50 Street	51 Avenue	50 Avenue	119
345605W	50 Street	52 Avenue	51 Avenue	147
240283E	50 Street	53 Avenue	54 Avenue	97
96303N	51 Avenue	50 Street	51 Street	156
289447S	51 Avenue	50 Street	49 Street	157
153464N	51 Avenue	51 Street	End	243
289447N	51 Avenue	49 Street	50 Street	157
395754N	52 Avenue	51 Street	52 Street	158
160885N	52 Avenue	50 Street	51 Street	157
71135N	52 Avenue	49 Street	50 Street	156
71135S	52 Avenue	50 Street	49 Street	157
357010W	52 Street	End	53 Avenue	46
142247S	53 Avenue	End	52 Street	29
21641N	53 Avenue	51 Street	52 Street	150
21641S	53 Avenue	52 Street	51 Street	152
142812S	53 Avenue	51 Street	50 Street	157
263362S	53 Avenue	50 Street	49 Street	156
61643N	54 Avenue	49 Street	50 Street	156
165619N	54 Avenue	End	49 Street	48
165619S	54 Avenue	49 Street	End	72
274608S	54 Avenue	51 Street	50 Street	156
61643S	54 Avenue	50 Street	49 Street	158
274608N	54 Avenue	50 Street	51 Street	155
379492N	55 Avenue	50 Street	51 Street	156
379492S	55 Avenue	51 Street	50 Street	158
392799S	55 Avenue	50 Street	49 Street	156
289825N	56 Avenue	49 Street	50 Street	159
289825S	56 Avenue	50 Street	49 Street	135

APPENDIX J

Village of Ryley Typical Sidewalk Defects (Images)

Typical defect images for the Village of Ryley Sidewalk survey 2017.

Good Sidewalk: Segment/Asset_Id 379492N

Faulting: Segment/Asset_Id 61643S

Scaling: Segment/Asset_Id 123243N

Obstruction: Segment/Asset_Id 332613N

Shattered Slab: Segment/Asset_Id 343246N

Spalling: Segment/Asset_Id 71135S

Typical defect images for the Village of Ryley Sidewalk survey 2017.

Trip Hazard: Segment/Asset_Id 153464N

Trip Hazard: Segment/Asset_Id 75510N

Linear Cracking: Segment/Asset_Id 165619N

Corner Break: Segment/Asset_Id 332613N

APPENDIX K

Sanitary Models

Sanitary Sewer System Design - EXISTING SYSTEM

VILLAGE OF RYLEY

From MH	To MH	Pop. Density (p/unit)	Notes	Added Area (ha)	Total Area (ha)	Added Pop.	Total Pop.	Total Pop. (in Thousands)	Avg. Flow (L/s)	Peak Factor	Peak DWF (L/s)	Added Area (ha)	Total Area (ha)	Avg. Flow (L/s)	Peak Factor	Peak DWF (L/s)	Average DWF (L/s)	I/I Allow (L/s)	Sag MH's	Tot Sag MH's	MH Inflow (L/s)	PWWF Flow (L/s)	Req. Cap. (L/s)	Dia. (mm)	Grade	Slope (%)	Length (m)	Cap. (L/s)	Cap. Used (%)
Branch 1																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 2																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 3																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 4																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 5																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 6																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 7																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 8																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 9																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 10																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 11																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Branch 12A

Branch 12B

Branch 12C

Branch 12 / Trunk

TRUNK MAIN THROUGH VILLAGE

SPREADSHEET CHECK

TOTAL

Sanitary Sewer System Design - EXISTING SYSTEM

VILLAGE OF RILEY

From MH	To MH	Pop Density (p/unit)	Street	Added Area (ha)	Total Area (ha)	Added Pop	Total Pop	Total Pop (in Thousands)	Avg Flow (L/s)	Peak Factor	Peak DWF (L/s)	C/I Added Area (ha)	C/I Total Area (ha)	C/I Avg Flow (L/s)	C/I Peak Factor	C/I Peak DWF (L/s)	Average DWF (L/s)	I/I Allow (L/s)	Seg MH's	Tot Seg MH's	MH Inflow (L/s)	Peak Flow (L/s)	Req Cap (L/s)	Size (mm)	Slope	Slope (%)	Length (m)	Cap (L/s)	Cap Used (%)
Branch 1																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 2																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 3																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 4																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 5																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 6																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 7																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 8																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 9																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 10																													
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Branch 11																													
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						

Branch 12A

Branch 12B

Branch 12C

Branch 12 - Trunk

Note: Adjusted Formula for Trunk Sizing for Total Population

TRUNKMAIN THROUGH VILLAGE

Note: Adjusted Formula for Trunk Sizing for Total Population

MISSING PIPE DATA

SPREADSHEET CHECK

Number of Persons from Branches

Number of Persons from Trunk Main

TOTAL	[illegible]	matches total population generated from spreadsheet

Time in (d) Sewer [illegible]

APPENDIX L

Lift Station Assessment Draft Report

MPE

Engineering Ltd.

Draft Report for:

Village of Ryley

LIFT STATION ASSESSMENT

Date: May 26, 2017

Proud of our Past... Building the Future

www.mpe.ca

*#101, 10630 172 St.
Edmonton, AB, T5S 1H8
Phone: 780-486-2000
Fax: 780-486-9090*

Engineering Ltd.

Village of Ryley
P.O. Box 230
5005 – 50 St.
Ryley, AB
T0B 4A0

May 26, 2017
File: N:\5582\000-00\L01.Rev1-1.0

Attention: Michael Simpson

Dear Mike:

Re: Lift Station Assessment – Revision 1

We are pleased to submit a draft report, Revision 1, of the above noted project. We appreciate the opportunity to be of service and to have prepared this report on your behalf. If you have any inquiries regarding our report or if clarification is required, please contact the undersigned.

Yours truly,

MPE ENGINEERING LTD.

Ryan Sharpe, P.Eng.
Edmonton Municipal Manager

RS/ik

CORPORATE AUTHORIZATION

This report has been prepared by MPE Engineering Ltd. under authorization of the Village of Ryley. The material in this report represents the best judgment of MPE Engineering Ltd. given the available information. Any use that a third party makes of this report, or reliance on or decisions made based upon it is the responsibility of the third party. MPE Engineering Ltd. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based upon this report.

Should any questions arise regarding content of this report, please contact the undersigned.

MPE ENGINEERING LTD.

Ryan Sharpe, P.Eng.

Professional Seal	Corporate Permit

TABLE OF CONTENTS

List of Tables

List of Figures:

Appendices

1.0 Introduction

The Village of Ryley has retained MPE Engineering Ltd. (MPE) to complete an engineering review of the main lift station for the purposes of provincial and federal grant fund application. This report presents the findings of MPE's review and also includes recommendations for upgrades as well as corresponding estimated capital costs.

Assessment of the Ryley Lift Station was completed to meet the minimum standards for wastewater pump stations as stipulated in the Alberta Environment and Parks (AEP) *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*.

2.0 Background

Ryley's Lift Station is located approximately 400 meters northeast of the Village along Secondary Road 854 and services the entire raw sewage generated by the Village. The Lift Station is a wet well/dry well type configuration with two separate structures made of cast in place reinforced concrete. The dry well features a narrow spiral stairway that opens up to a lower area that houses two vertically mounted end suction centrifugal pumps. Wastewater enters the wet well and is drawn into the pumps in the drywell through suction inlet piping. Wastewater is pumped through a forcemain to the wastewater treatment facility.

All the existing components of the lift station are the original installed at the time of construction of the lift station and have now reached their expected service life. In particular the Lift Station requires upgrading in order for the facility to meet current regulations and best industry practices. The upgrades would involve work within the existing wet well and dry well including pump, piping and valve replacement.

3.0 Existing Facility

3.1 Process Mechanical

The Lift Station contains two vertical frame mounted solids handling pumps siting at the bottom of the dry well and connected by a long coupled shaft to motors located on the main floor slab. Each pump is rated for 15.14 L/s (240 USgpm) flow and 12.2 m (40 ft.) of total dynamic head (TDH). However, after 38 years of operation and the poor state they are in, these pump's performance is expected to be significantly reduced due to wear and tear. In addition, the wastewater pumps have outlived their useful service life and should be replaced. Below is a Figure 1 showing the current state of the pumps.

Figure 1: Existing Wastewater Pumps

In addition, all the piping and valving components of the pumping system in the dry well are severely corroded and exhibit difficulty in operation. The corrosion is attributed to poor ventilation and age of the system.

3.2 Flow Measurement

AEP Standards and Guidelines stipulate that all lift stations be provided with suitable devices for measuring wastewater flow. The existing lift station currently does not have flow measurement capability and relies only on the pump hours and pump rated capacity.

3.3 Heating and Ventilation

The dry well portion of the lift station is heated with a furnace. Operators bring portable gas monitors to site to test the air quality prior to entry into the dry well. Ventilation of the wet well is also important to remove hazardous gases which are associated with raw sewage. It is also required to remove any condensation that may build up near the top of the wet well. Condensation can cause corrosion of piping, ladders, and hatches as well as cause concrete to spall and erode at the top of the wet well. Applicable codes and regulations require a separate wet well ventilation system that is either continuous (minimum 6 air changes per hour) or intermittent (30 air changes per hour). There should not be any interconnection between the wet well and dry well ventilation systems.

3.4 Wet Well

The wet well is concrete structure which sits 5.5 meters below grade. Operation staff indicate that this chamber has not been maintained and there is a significant buildup of solids. Due to lack of ventilation, it is expected that there would be significant deterioration of the wetwell walls. All penetrations and hatches/instrumentation access ports connected to the wet well need to be sealed to provide an air tight seal to avoid gases (i.e. hydrogen sulphide) from entering the building.

3.5 Controls and Alarm Systems

The control system is outdated and should be upgraded with a more functional system including a PLC and HMI. This would allow additional instruments, such as a magnetic flowmeter and level transmitter, to be connected to the lift station controls. The upgrades will also provide more operational flexibility and provide additional historical information for troubleshooting and recording.

Ryley's Lift Station has a beacon and horn for an alarm system but no remote alarming. The horn is no longer functional and the beacon works but is impractical because the Lift Station is located outside the Village's community and only visible by a few traffic by passers.

4.0 Design Parameters

4.1 Population Projections

The population of Ryley saw a steady rise from 2006 to 2011 at a rate of 1.65% but fell slightly in 2016 with an official population noted at 483. The overall population growth over the past decade was therefore 0.53%. For purposes of this report, a population growth rate of 1.0% is deemed reasonable for the Village of Ryley and shall be utilized.

4.2 Historical Wastewater Flows

Daily pump meter readings are recorded by the Village. Records for the years 2015, 2016 and 2017 were made available for this study. However the records for 2015 were only partial missed readings for the first two months of the year and were therefore not used for the assessment. The 2017 readings were available and were used to estimate the monthly minimum, average and maximum flows as shown in Table 1 below.

Table 1: 2016 Estimated Wastewater Flows (m^3/d)

Units	Dry Weather Flow (DWF)	Peak Wet Weather Flow (PWWF)	Infiltration and Inflow (I/I)
(m^3/d)	109	436	327
(Lpcd)	225	903	678

The estimated flow data includes wastewater flows from all sources, including residential, commercial, and industrial. As well, any inflow/infiltration that migrates into the collection system during wet weather events is also accounted for in the data.

Wastewater flows during dry weather periods, typically the fall and winter months, were used to determine the average dry weather flow (DWF). It was determined that the average (October to March) DWF is approximately 109 litres per capita per day (lpcd). Based on the historical population, the average day wastewater flow was determined to be 225 lpcd. Based on the wet weather periods, typically the spring and summer months, the peak wet weather flow (PWWF) was calculated to be approximately 903 lpcd. The difference between PWWF and DWF provides an indication of Inflow/Infiltration (I/I) into the sanitary system. The maximum I/I over the period for which data was reviewed was calculated as 678 lpcd.

4.3 Wastewater Design Flows

Future wastewater flows were calculated based on population projections and per capita wastewater flows. To account for the diurnal fluctuations in wastewater flows, maximum daily flows are calculated based on the peaking factor derived from the Harmon equation:

Table 2: Wastewater Design Flows

YEAR	*POPULATION*	*PF*	*PDWF* (m^3/d)	*I/I* (m^3/d)	*PWWF* (m^3/d)	*PWWF* (USGPM)
2016	483	3.98	433	327	760	139
2036	589	3.94	521	399	921	169

Note: PF = Peak Factor
PWWF = PDWF + I/I

Based on historical wastewater production, the above 2036 flows have been established as the basis of the assessment.

Each pump must be sized for the projected 20 year peak demand of 921 m^3/d (169 USGPM).

5.0 Proposed Upgrades

In order to comply with the applicable codes and to meet the projected 20 year design flows, the following upgrades are recommended:

- Upgrade wastewater pumps with new solids handling centrifugal pumps to meet the 20 year projected demands.
- Upgrade all process piping in the dry well from carbon steel to stainless steel.
- Upgrade all check and isolation valves in the dry well.
- Install a flow measurement device (magnetic flowmeter) to comply with Alberta Environment Requirements.
- Upgrade all lift station controls, instrumentation, UPS, and alarm notification to meet AEP Standards and Guidelines.
    - Include at a minimum:
        - Upgraded control panel with PLC and HMI.
        - Add Level Transmitter to the wet well
        - Add Flood Detection in the dry well
        - Add Magnetic Flow Meter to the discharge piping inside the dry well.
        - Add Phase Monitor
        - Add Alarm Dialer
- Upgrade HVAC system including ventilation systems in both the dry well and wet well.
- Clean wet well of all accumulated debris and solids.
- Plug and seal all wet well slab penetrations and openings.

6.0 Preliminary Cost Estimate

A preliminary cost estimate has been completed for the proposed lift station upgrades. Table 3 and 4 presents a summary of the estimated costs for construction only. Costs for engineering, if required, can be provided separately; an engineering allowance of 12% can be used for budgetary purposes. In order to meet annual budgets and complete the work over the next few years, the costs have been broken up with highest priority items included in Phase 1. In addition to the costs outlined in Tables 3 and 4, we recommend carrying a contingency of $20,000 for each phase for unforeseen items during construction.

Table 3: Preliminary Cost Estimate – Phase 1 (Highest Priority)

Item	Estimated Cost (Not including GST)
Upgrade Pumps	$25,000
Upgrade Piping and Valves	$50,000
Add Autodialer	$5,000
Total	**$80,000**

Table 4: Preliminary Cost Estimate – Phase 2

Item	Estimated Cost (Not including GST)
Add Flowmeter	$5,000
Upgrade Control Panel and Alarms	$30,000
Programming	$5,000
Add Level Transmitter	$5,000
Add Flood Detection in Dry Well	$2,500
Add Phase Monitor	$7,500
HVAC Upgrades	$10,000
Clean Wet Well	$3,500
Seal all Penetrations	$2,500
Total	**$71,000**

APPENDIX M

Overall Drawings and Ten-Year Capital Plan

LEGEND:

- SANITARY MAN OLE
- 150 DIA PIPE GRAVITY SEWER
- 200 DIA PIPE GRAVITY SEWER
- 250 DIA PIPE GRAVITY SEWER
- 150 DIA PIPE FORCEMAIN
- 100 DIA PIPE FORCEMAIN
- UN NOWN PIPE SI E

MPE Engineering Ltd.

VILLAGE OF RYLEY

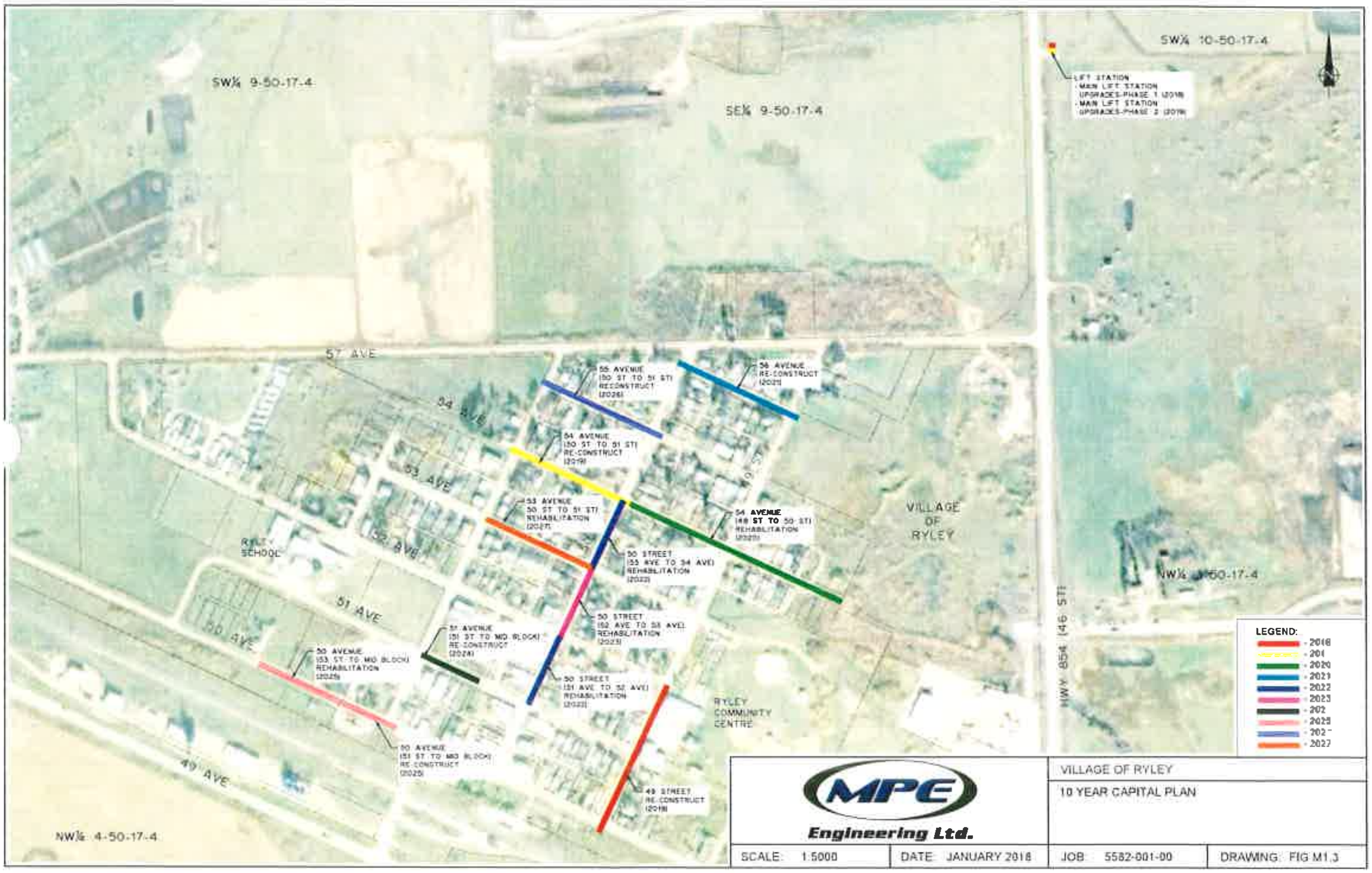
INFRASTRUCTURE ASSESSMENT AND 10 YEAR CAPITAL PLAN
SANITARY SEWER SYSTEM - E ISTING

SCALE: 1:10000	DATE: NOVEMBER 2017	JOB: 5582-001-00	DRAWING: FIG M1.1

LEGEND
- STORM MAN OLE
- CATC BASIN
- STORM PIPE

MPE Engineering Ltd.

VILLAGE OF RYLEY	
INFRASTRUCTURE ASSESSMENT AND 10 YEAR CAPITAL PLAN STORM SEWER SYSTEM - E: ISTING	
SCALE: 1:10000	DATE: NOVEMBER 2017
JOB: 5582-001-00	DRAWING. FIG M1.2


SW¼ 9-50-17-4
SE¼ 9-50-17-4
SW¼ 10-50-17-4
LIFT STATION
- MAIN LIFT STATION UPGRADES-PHASE 1 (2018)
- MAIN LIFT STATION UPGRADES-PHASE 2 (2019)
57 AVE
54 AVE
53 AVE
52 AVE
51 AVE
50 AVE
49 AVE
49 ST
55 AVENUE (50 ST TO 51 ST) RECONSTRUCT (2026)
56 AVENUE RE-CONSTRUCT (2021)
54 AVENUE (50 ST TO 51 ST) RE-CONSTRUCT (2019)
53 AVENUE 50 ST TO 51 ST) REHABILITATION (2027)
54 AVENUE (48 ST TO 50 ST) REHABILITATION (2020)
50 STREET (53 AVE TO 54 AVE) REHABILITATION (2022)
50 STREET (52 AVE TO 53 AVE) REHABILITATION (2023)
51 AVENUE (51 ST TO MID BLOCK) RE-CONSTRUCT (2024)
50 AVENUE (53 ST TO MID BLOCK) REHABILITATION (2025)
50 STREET (51 AVE TO 52 AVE) REHABILITATION (2022)
50 AVENUE (51 ST TO MID BLOCK) RE-CONSTRUCT (2025)
49 STREET RE-CONSTRUCT (2018)
RYLEY SCHOOL
RYLEY COMMUNITY CENTRE
VILLAGE OF RYLEY
HWY 854 (46 ST)
NW¼ 3-50-17-4
NW¼ 4-50-17-4
LEGEND:
- 2018
- 201
- 2020
- 2021
- 2022
- 2023
- 202
- 2025
- 202
- 2027
MPE Engineering Ltd.
VILLAGE OF RYLEY
10 YEAR CAPITAL PLAN
SCALE: 1:5000
DATE: JANUARY 2018
JOB: 5582-001-00
DRAWING: FIG M1.3

APPENDIX N

Lift Station Assessment – Amendment to Draft Report (Revised Cost Estimate)

#101, 10630-172 Street
Edmonton, AB T5S 1H8
Phone: 780-486-2000
Fax: 780-486-9090

MPE Engineering Ltd.

Village of Ryley
P.O. Box 230
5005-50 St.
Ryley, AB
T0B 4A0

March 23, 2018
File: N:\5582\001\Reports\AppendixN

Attention: Michael Simpson

Dear Mike:

Re: Lift Station Assessment
Amendment to Draft Report (Revised Cost Estimate)

The purpose of this letter is to amend the preliminary cost estimate identified in the draft report for the Village of Ryley "Lift Station Assessment". MPE proposed upgrades to the lift station to meet the projected 20 year design flows. As identified in the report, a preliminary cost estimate for Phase 1 and Phase 2 was provided. Renco General Contracting has performed work on the lift station for Phase 1, and additional work/change orders in the amount of $12,671.95 was approved. Progress Certificate No.1 is attached. The supply and install of adding a grinder in the nearest manhole would be estimated to cost $80,000 for Phase 2.

The revised cost estimate shown in the Table below reflects the estimated costs used for the Ten-Year Capital Projection.

Phase	Preliminary Cost Estimate (2017)	Contract Amount	Revised Cost Estimate	Reason for Cost Adjustment
1 (2018)	$80,000.00	$88,444.30	**$101,116.25**	Change Orders as per Progress Claim 1
2 (2019)	$71,000.00	TBD	**$151,000.00**	Addition of grinder in nearest manhole outside of lift station
Total	$151,000.00		$252,116.25	

*Prices shown exclude GST, contingency, and engineering.

As shown, the revised cost estimate for year 2018 and 2019 is **$101,116.25 and $151,000.00** respectively.

Yours Truly,

MPE ENGINEERING LTD.