Village of Duchess

Infrastructure Master Plan

(1447-001-01)

October 2018

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October 12, 2018
File: 14\47\001-01\R01-1.0

Attention: Ms. Yvonne Cosh,
Chief Administrative Officer

Dear Ms. Cosh,

Re: Village of Duchess – Infrastructure Master Plan

We are pleased to submit seven final copies of the above noted study. We thank you for the opportunity to be of service and to have prepared this report on your behalf. We look forward to assisting you in implementing the recommendations within the report.

If you have any inquiries regarding our report or if clarification is required, please contact the undersigned.

Yours truly,

MPE ENGINEERING LTD.

Blake Smith, C.E.T.
Project Technologist

:bs
Enclosure

CORPORATE AUTHORIZATION

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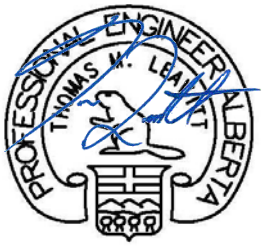

October 12, 2018

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

EXECUTIVE SUMMARY

The Village of Duchess, in undertaking this Infrastructure Master Plan, has developed the background and framework for maintaining and expanding the basic infrastructure needed to support a growing community. Upgrades and improvements have been recommended and preliminary cost estimates prepared in association with the proposed construction works.

Assessments have been undertaken on five major infrastructure elements: roads; water distribution and treatment; wastewater collection and treatment; storm water management; and Village owned buildings.

The existing road network was analysed, deficiencies identified, and repairs and improvements proposed. The proposed improvements range from milling and overlays to complete road structure reconstruction.

Water supply and treatment is provided by the regional water line from the Newell Regional Services Corporation (NRSC) regional water system. The Village's distribution system functions relatively well and maintains adequate pressures in most of the Village during various demands for current and projected scenarios. However, during fire flow conditions the system does not meet the requirements of the Fire Underwriters Survey for a portion of the Village. A number of undersized mains should be upgraded at various locations throughout the network and loops completed in the system. These additions would improve water quality along with system reliability and performance during fire flow conditions.

The existing sanitary collection system cannot handle the current peak dry and wet weather flows. A number of upgrades along Railway Avenue should be completed to eliminate surcharging in the mains and manholes. Video inspections were not completed as part of the project and should be completed to identify the condition and extents of defects of the collection system prior to completing other infrastructure upgrades. The existing lagoon has sufficient capacity to handle the 2038 peak dry and wet weather flows at the 1% growth rate.

The Village primarily relies on surface drainage for storm water management through a system of curb and gutters, swales, culverts, and ditches. Underground storm sewers have been constructed in the central developed area of the Village. New developments will require the construction of Storm Water Management Facilities (SWMF) to detain and treat the storm water from a major event and minimize impact to downstream areas. There are also existing areas in the Village that require a SWMF and culvert upgrades to handle to storm water during major events.

The Village has five buildings that are used for utility operation, maintenance, and public use. The mechanical, electrical, and structural components of these buildings were assessed and repairs and improvements proposed.

The Capital Cost estimates show that the total infrastructure commitment in this IMP amounts to $7.5 million. The cost estimates were prepared for each improvement independently of others. However, projects could be completed in conjunction with others to use funds more efficiently and avoid duplication of cost on items such as roadwork.

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1.0 INTRODUCTION

1.1 Evaluation Background

The Village of Duchess retained MPE Engineering Ltd. to complete an evaluation of the infrastructure currently owned and maintained by the Village. The purpose of this comprehensive evaluation is to identify deficiencies, to determine future upgrade requirements, and to propose plans to correct existing deficiencies. The evaluation includes potential areas for future development within the Village and the resulting impacts on infrastructure. Figure 1.1 is a location plan showing the Village of Duchess in relation to other communities in southern Alberta. Figure 1.2 illustrates the study area included in the infrastructure evaluation. The study area includes all lands within the Village of Duchess boundary.

1.2 Scope of Work

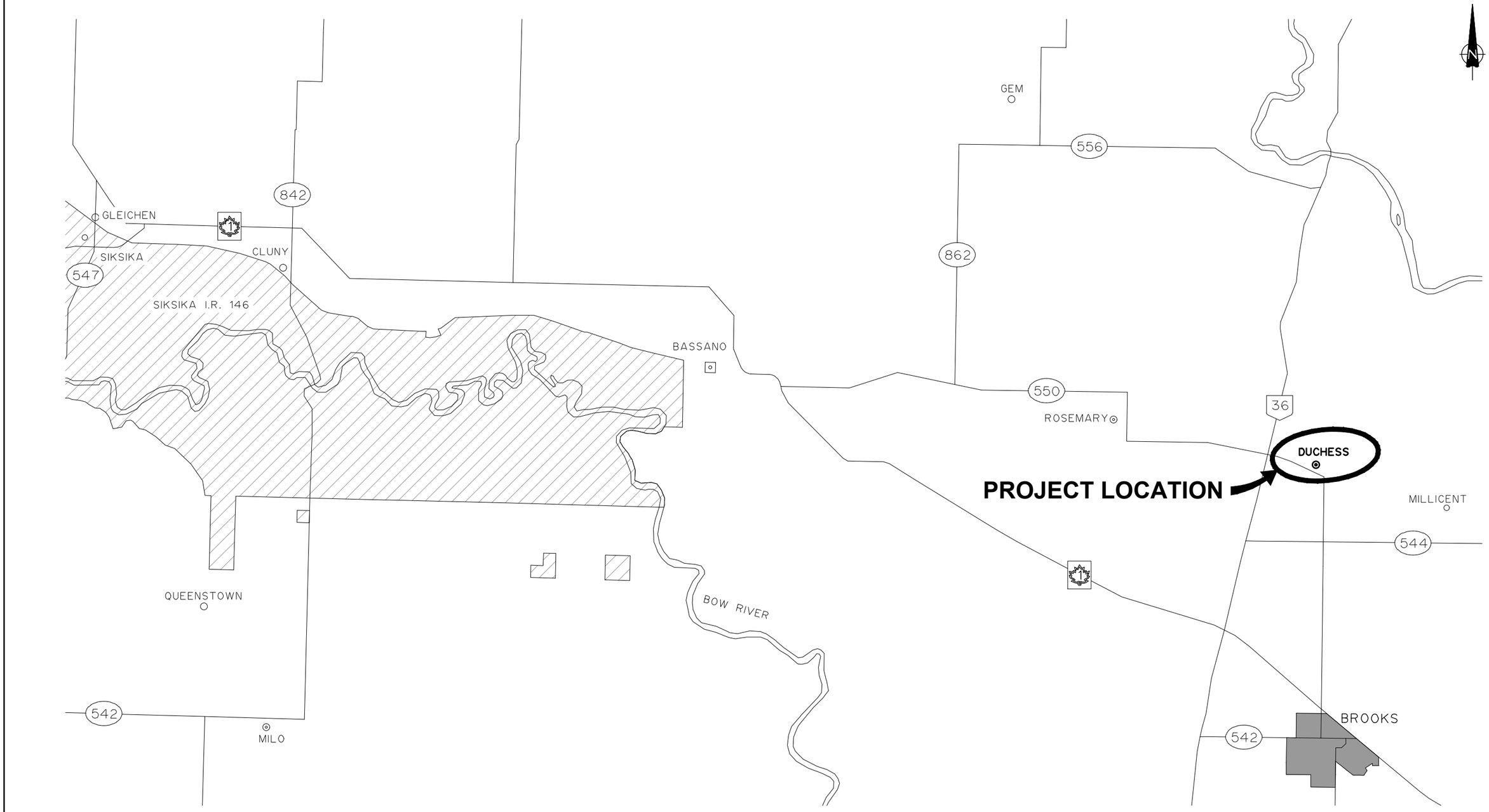
In general, the tasks included in this study are the following:

- Prepare population projections for the Village based on historical data.
- Evaluate the major infrastructure systems, including: roads; water supply, treatment and distribution; wastewater collection and treatment; storm water management, and Village owned buildings.
- Identify deficiencies, both current and projected, in each of the infrastructure systems.
- Develop upgrade strategies to address the deficiencies, including timelines for implementation.
- Prepare cost estimates for the proposed upgrades.
- Prepare an overall plan for the Village to address all major infrastructure issues within the Village over the 20-year planning horizon.

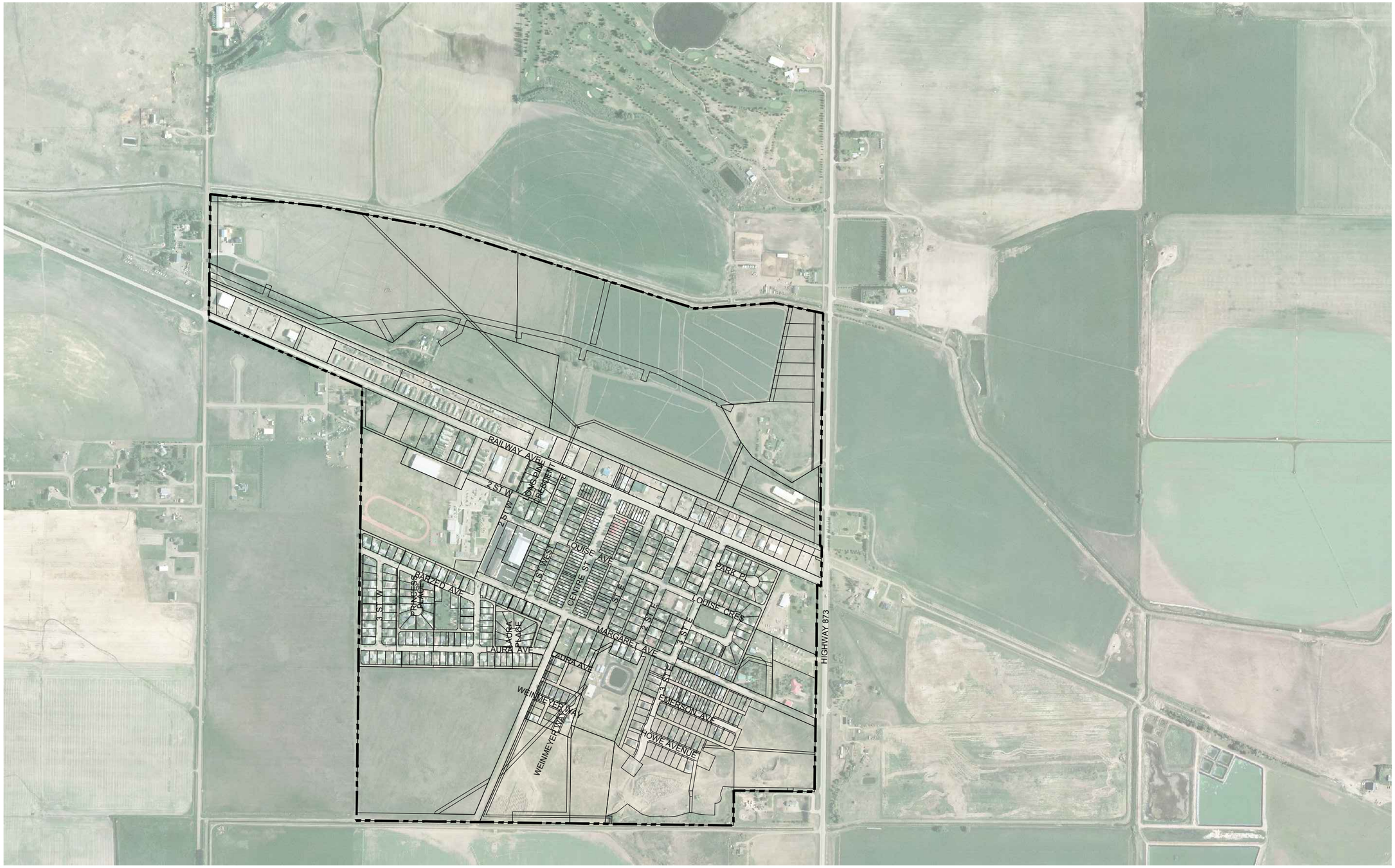
In addition to these main study tasks, each component of the evaluation has its individual specific tasks, which are addressed in each section of the report.

1.3 Site Investigations

As an integral part of this study, a number of site visits were undertaken by MPE personnel. These site visits were conducted to become familiar with the Village, its existing infrastructure and issues that require review and analysis. Topographic surveys were undertaken of key infrastructure components relative to storm water management to determine storm water runoff drainage patterns.



MPE Engineering Ltd.		VILLAGE OF DUCHESS	
		INFRASTRUCTURE MASTER PLAN LOCATION PLAN	
SCALE: 1:250 000	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **1.1**



LEGEND

VILLAGE BOUNDARY

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
SITE PLAN

SCALE: 1:10 000	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **1.2**

2.0 BACKGROUND

2.1 General Description

The Village of Duchess is a community located north of Brooks and the Trans-Canada Highway, 180 km east of Calgary and 120 km west of Medicine Hat. Duchess was incorporated as a Village in 1921. The Village has seen steady population growth to where it now reaches over 1,085 residents.

2.2 Population Projections

Population data was gathered from the 2016 federal census. This data was used to interpolate the current population as well as to project future growth. For the purposes of this study a 1.0% growth rate over the 20 year planning horizon is used, which results in a calculated current (2018) population of 1,107 people and a 20-year (2038) projected population of 1,351. Table 2.1 lists the historic and projected population for the Village at the end of each 5 year period.

Table 2.1 – Projected Populations

Growth Rate Projection	Historical Population	Projected Population				
%/yr	2016 Census	2018	2023	2028	2033	2038
1.0%	1,085	1,107	1,163	1,223	1,285	1,351

In assigning projected population to proposed development areas, assumptions were made with respect to population density. For the urban residential development of Duchess, a value of 25 people per gross hectare was adopted for future development.

3.0 ROADS

3.1 Background

The Village of Duchess road network consists of an arrangement of local and arterial roadways. The road network was developed in a grid pattern with roads aligned primarily north-south and east-west. The Village is primarily accessed from Highway 873 on the east side and Highway 550 on the west. The primary east-west arterial road is Railway Avenue. Land use adjacent to the Village boundary is of an agricultural setting and the outlying road network generally consists of a series of rural, local undivided gravel roadways.

3.2 Purpose and Scope

The purpose of this evaluation was to gather the following existing road information:

- Complete an inventory of all roads, sidewalks, curb and gutters, ditches and swales.
- Conduct field inspections to identify required road repair upgrades.
- Establish a road condition rating system and rate the condition of each road.
- Make recommendations for repairs and enhancement work.
- Prepare cost estimates for the recommended work.
- Prioritize the required repair and enhancement work.

3.3 Existing Roadway Network

3.3.1 Existing Road Classification

To define the roadway classification for the existing roadways, components such as speed limit, width, and roadway intersections were identified and field measured on a block-by-block basis. According to typical roadway standards, the Village's existing roadway network was categorized into arterial and local road classifications. Railway Avenue is located on the north side of the Village and is classified as arterial. The remaining roads are classified as local roads.

3.3.2 Structural Data

The majority of the roads within the Village boundary are paved with hot mix asphalt. The subsurface structures of the roads are largely unknown. Discussions with the Village indicate that roads constructed

after 2006 consist of geotextile fabric, 450 mm of granular material and a minimum of 75 mm of asphalt.

3.3.3 Alignment Data

The existing roadway horizontal alignment data was initially obtained from the Oldman River Regional Services Commission (ORRSC) in the form of cadastral base maps and air photos. This data was then confirmed in the field. All road lengths have been measured from intersection to intersection. There are no road horizontal geometrical alignment deficiencies to note at this time.

3.3.4 Cross Sectional Data

The compiled roadway data revealed varying road widths and several types of curb & gutter and sidewalks throughout the urban roads. The outlying sections of the rural road system utilize an open ditch drainage system alongside the roadway rather than curb & gutter. Curb & gutter and sidewalk systems encountered included the following:

1. Standard type:
    - 150mm high standard curb and gutter with a separate sidewalk.
    - 150mm high standard curb and gutter with a monolithic sidewalk.
2. Rolled type:
    - 150mm high rolled curb and gutter with a separate sidewalk.
    - 150mm high rolled curb and gutter with a monolithic sidewalk.

Details of the varying roadway cross sectional elements can be found in the Road Component Evaluation spreadsheet (Appendix A).

3.4 Existing Roadway Condition Evaluation

3.4.1 Asphalt

The asphalt condition on each block was evaluated on a condition scale of 1 to 100. The rating was determined by quantifying the amount of required road repairs. The road repairs were split into four (4) categories including edge mill and overlay, full mill and overlay, full mill and overlay plus local base repair, and complete road reconstruction. Each repair was given a demerit score based upon the severity and applied to the overall rating. Roads with a rating of greater than 70 are considered to be in “good” condition. Roads with a rating of less than 70 and greater than 50 are considered to be in “fair” condition. Roads with a rating of less than 50 are considered to be in “poor” condition. Refer to

Appendix A for complete details of the condition and evaluation rating for the various roadway components.

3.4.2 Concrete

The concrete roadway components on each block were also evaluated and given a rating of "good", "fair" or "poor". For the curb, gutter, and sidewalks the rating was given based on the percentage of replacement required. Concrete components with identified replacements less than 10% are considered to be in "good" condition. Concrete components with replacements less than 30% but greater than 10% are considered to be in "fair" condition. Concrete components with replacements greater than 30% are considered to be in "poor" condition. Concrete swales were evaluated by visual inspection based on the amount and severity of cracking, spalling, and displacement observed in the field, and given a rating of "good", "fair" or "poor" accordingly.

3.5 Proposed Upgrades

3.5.1 Asphalt

The road evaluation revealed that several roads require minor and major repair work. Much of the repairs identified in the evaluation may be attributed to the age of the existing roadway structure as well as relatively high ground water conditions and storm water ponding. The Road Evaluation Spreadsheet in Appendix A provides details of the upgrades identified for each roadway.

Duchess has approximately 82,800 square metres of road surface, all of which are hot mix asphalt roads. The evaluation identified approximately 24,100 square metres (29%) of hot mix asphalt roads that require improvement in the short term. The improvements will extend the life of the road and prevent the road from progressing to a failed condition in the short term. There are 20,300 square metres (25%) of hot mix asphalt roads that will require improvements in mid term infrastructure plans. The evaluation also identified 38,400 square metres (46%) of hot mix asphalt roads that will require improvements in long term infrastructure plans. The vast majority of the repairs are overlays. The overlays will address the cracking, oxidization and ravelled surface exhibited by the aging pavement. A regular maintenance program involving crack seal treatments and filling potholes will extend the life of asphalt road surfaces.

Refer to Figure 3.1 for an overview of the road system and the overall condition of the roads.

LEGEND

VILLAGE BOUNDARY

ASPHALT MIX

GOOD

FAIR

POOR

Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
ROAD CONDITION OVERVIEW

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **3.1**

3.5.2 Concrete

Duchess has approximately 3,500 square meters of concrete separate sidewalk, of which 75% have a "good" condition rating, and will not require repairs in the short to mid-term. There are 24% of the separate sidewalks with a "fair" rating, which may exhibit noticeable signs of deterioration, minor vertical and/or horizontal displacement, exposed surface, cracked surface and/or minor distortion. The remaining 1% of the separate sidewalks were evaluated in "poor" condition where there may be a missing section of sidewalk, a tripping hazard and/or severely deteriorated structure.

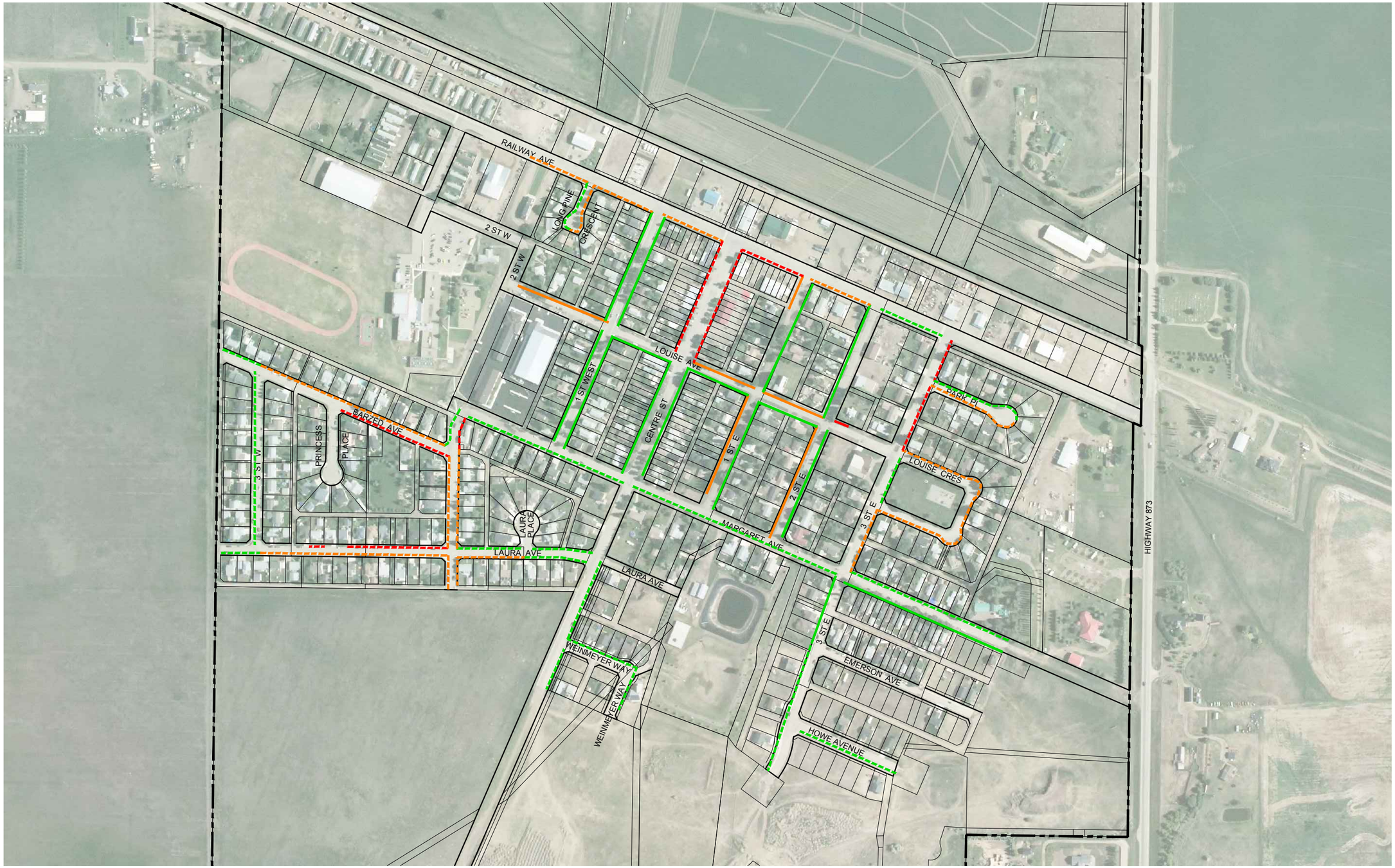
Duchess has approximately 6,600 square meters of concrete monolithic sidewalk, of which 46% have a "good" condition rating, and will not require repairs in the short to mid-term. There are 32% of the monolithic sidewalks with a "fair" rating, which may exhibit noticeable signs of deterioration, minor vertical and/or horizontal displacement, exposed surface, cracked surface and/or minor distortion. The remaining 22% of the monolithic sidewalks were evaluated in "poor" condition where there may be a missing section of sidewalk, a tripping hazard and/or severely deteriorated structure.

Refer to Figure 3.2 for an illustration of the overall condition of the concrete sidewalks. Also, refer to the Road Component Evaluation spreadsheet in Appendix A for more details.

Duchess has approximately 5,400 lineal metres of concrete curb and gutter throughout the Village. 65% of the curb and gutter is rated as "good", with little or no signs of deterioration. 32% of the curb and gutter is rated as "fair". Curb and gutter with a condition rating of "fair" indicates the component is still functioning in the roadway system, however is showing noticeable signs of deterioration requiring repairs in the medium or long term. The remaining 3% is rated as "poor". A condition rating of "poor" indicates a high level of cracking, spalling, or displacement requiring repairs in the short term.

Duchess has approximately 275 lineal metres of concrete swale throughout the Village. 53% of the concrete swale is rated as "good", with little or no signs of deterioration. 47% of the concrete swale is rated as "fair". Concrete swale with a condition rating of "fair" indicates the component is still functioning in the roadway system; however is showing noticeable signs of deterioration requiring repairs in the medium or long term. 0% is rated as "poor". A condition rating of "poor" indicates a high level of cracking, spalling, or displacement requiring repairs in the short term.

Refer to Figure 3.3 for an illustration of the overall condition of the concrete curb and gutter. Also, refer to the Road Component Evaluation spreadsheet in Appendix A for more details.



LEGEND

- VILLAGE BOUNDARY
- SEPARATE SIDEWALK - GOOD CONDITION
- SEPARATE SIDEWALK - FAIR CONDITION
- SEPARATE SIDEWALK - POOR CONDITION
- MONOLITHIC SIDEWALK - GOOD CONDITION
- MONOLITHIC SIDEWALK - FAIR CONDITION
- MONOLITHIC SIDEWALK - POOR CONDITION

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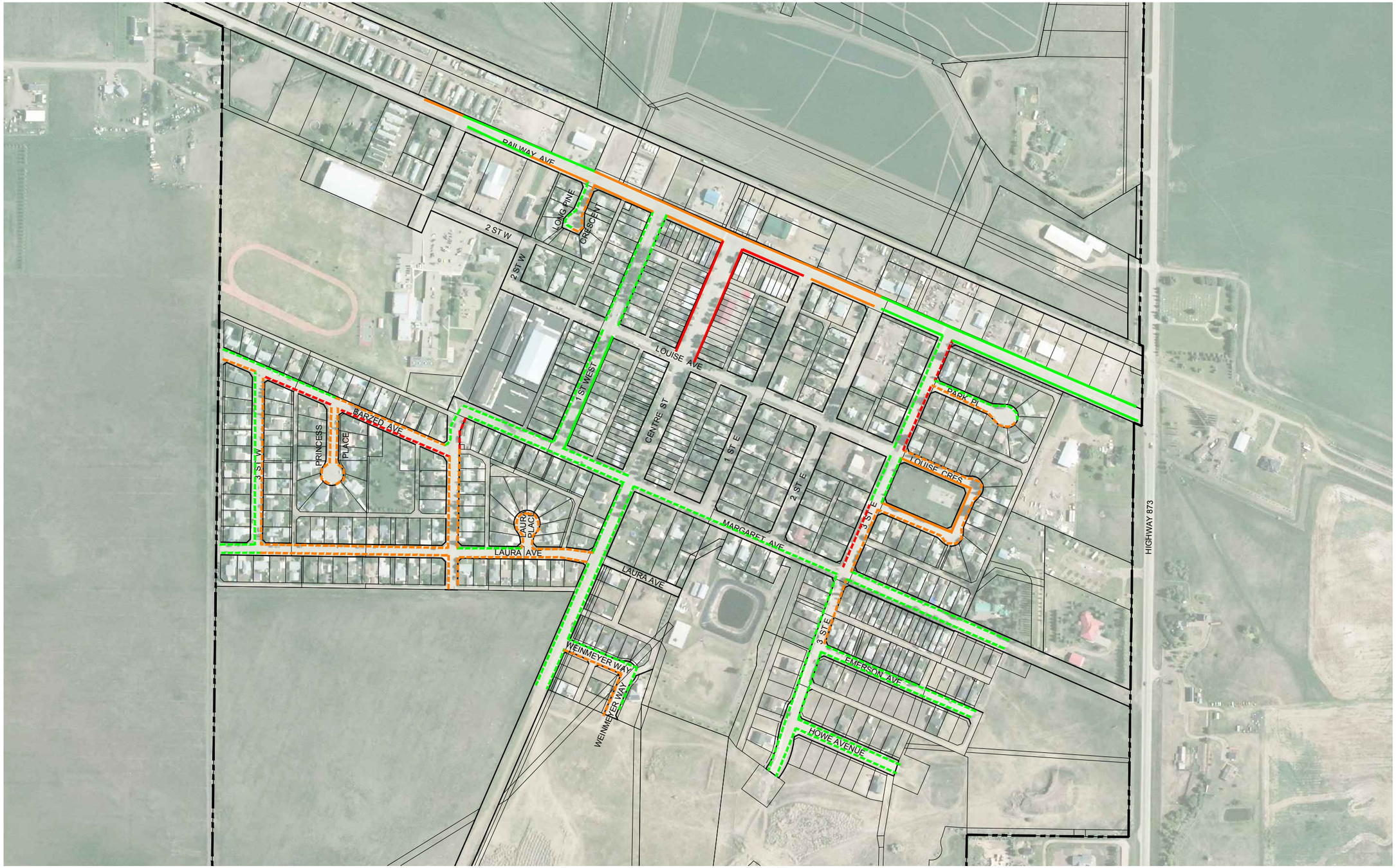
VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
SIDEWALK CONDITION OVERVIEW

SCALE: 1:5000	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **3.2**



LEGEND

- VILLAGE BOUNDARY
- STANDARD CURB AND GUTTER - GOOD CONDITION
- STANDARD CURB AND GUTTER - FAIR CONDITION
- STANDARD CURB AND GUTTER - POOR CONDITION
- ROLLED CURB AND GUTTER - GOOD CONDITION
- ROLLED CURB AND GUTTER - FAIR CONDITION
- ROLLED CURB AND GUTTER - POOR CONDITION

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VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
CURB AND GUTTER CONDITION OVERVIEW

SCALE: 1:5000	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **3.3**

3.6 Cost Estimate

Preliminary cost estimates have been developed to address the identified roadway repairs. Verification of the existing road structures is needed for confirmation of the required works. A summary of the capital road work priorities and costs are shown in Table 3.1.

The details of the cost estimates are included in Appendix A along with the Road Component Evaluation spreadsheet, which includes the required repairs and enhancement recommendations. In order to determine the best course of action, the repair cost and associated priority rating for each road should be further reviewed by the Village within the context of other infrastructure upgrades that may be suggested in this document.

Table 3.1 – Road Evaluation Summary and Cost Estimates

Roadway		Capital Projects		
		Short Term	Medium Term	Long Term
		< 5 Years	5 - 10 Years	10 + Years
10	3rd Street East - End to Howe Ave East		$20,000	
20	3rd Street East - Howe Ave East to Emerson Ave East		$35,000	
30	3rd Street East - Emerson Ave East to Margaret Ave East		$48,000	
40	3rd Street East - Margaret Ave East to Louise Cres East	$49,000	$7,000	
50	3rd Street East - Louise Cres East to Louise Cres East	$31,000		
60	3rd Street East - Louise Cres East to Park Place East	$43,000		
70	3rd Street East - Park Place East to Railway Ave East	$31,000		
80	Howe Avenue East - 3rd St East to Cul de Sac		$58,000	
90	Emerson Avenue East - 3rd St East to End		$70,000	
100	Weinmeyer Way East - Centre St to End		$3,000	$62,000
110	Centre Street - End to Weinmeyer Way East			$25,000
120	Centre Street - Weinmeyer Way East to Laura Ave West			$58,000
130	Centre Street - Laura Ave West to Margaret Ave East		$56,000	$58,000
140	Centre Street - Margaret Ave East to Louise Ave East	$111,000	$6,000	$23,000
150	Centre Street - Louise Ave East to Railway Ave East	$216,000		
160	Park Place East - 3rd St East to Cul de Sac	$45,000	$15,000	$4,000
170	2nd Street East - Margaret Ave East to Louise Ave East		$7,000	$56,000

Table 3.1 – Road Evaluation Summary and Cost Estimates Continued				
180	2nd Street East - Louise Ave East to Railway Ave East			$57,000
190	1st Street East - Margaret Ave East to Louise Ave East		$5,000	$59,000
200	1st Street East - Louise Ave East to Railway Ave East		$7,000	$59,000
210	Laura Place West - Laura Ave West to Cul de Sac		$7,000	$18,000
220	2nd Street West - Alley to Laura Ave West	$18,000	$8,000	
230	2nd Street West - Laura Ave West to Barzed Ave West	$49,000	$13,000	
240	2nd Street West - Barzed Ave West to Margaret Ave West	$15,000		$0
250	Margaret Avenue West - 2nd St West to 1st St West	$60,000		$4,000
260	Margaret Avenue West - 1st St West to Centre St		$44,000	$3,000
270	Margaret Avenue East - Centre St to 1st St East			$43,000
280	Margaret Avenue East - 1st St East to 2nd St East			$39,000
290	Margaret Avenue East - 2nd St East to 3rd St East			$42,000
300	Margaret Avenue East - 3rd St East to Start of Gravel	$131,000		$9,000
310	Laura Avenue West - Range Rd 144A to 3rd St West	$17,000		$2,000
320	Laura Avenue West - 3rd St West to 2nd St West	$95,000	$15,000	$5,000
330	Laura Avenue West - 2nd St West to Laura Place West	$36,000	$4,000	$6,000
340	Laura Avenue West - Laura Place West to Centre St	$46,000	$2,000	$2,000
350	3rd Street West - Laura Ave West to Barzed Ave West	$86,000	$8,000	$2,000
360	Princess Place West - Cul de Sac to Barzed Ave West	$37,000	$6,000	$5,000
370	Barzed Avenue West - Range Rd 144A to 3rd St West	$20,000	$3,000	$0
380	Barzed Avenue West - 3rd St West to Princess Place West	$5,000	$40,000	$2,000
390	Barzed Avenue West - Princess Place West to 2nd St West	$61,000	$8,000	$6,000
400	1st Street West - Margaret Avenue West to Louise Avenue West			$66,000
410	1st Street West - Louise Avenue West to Railway Avenue West			$61,000
420	Long Pine Court West - Cul de Sac to Railway Ave West	$54,000	$4,000	$2,000
430	2nd Street West - Railway Ave West to Louise Ave West		$39,000	
440	Louise Avenue West - 2nd St West to 1st St West		$110,000	$4,000
450	Louise Avenue West - 1st St West to Centre St	$35,000		$6,000
460	Louise Avenue East - Centre St to 1st St East		$4,000	$39,000
470	Louise Avenue East - 1st St East to 2nd St East		$5,000	$37,000
480	Louise Avenue East - 2nd St East to 3rd St East	$47,000		$4,000
490	Louise Crescent East - 3rd St East to 3rd St East	$122,000	$43,000	

Table 3.1 – Road Evaluation Summary and Cost Estimates Continued				
500	Railway Avenue West - Range Road 145 to Brianne Blvd		$115,000	
510	Railway Avenue West - Brianne Blvd to Modular Home Park Entrance	$46,000		
520	Railway Avenue West - Modular Home Park Entrance to Brianne Blvd	$79,000		
530	Railway Avenue West - Brianne Blvd to 2nd St West	$35,000	$2,000	
540	Railway Avenue West - 2nd St West to Long Pine Court West	$213,000	$9,000	$2,000
550	Railway Avenue West - Long Pine Court West to 1st St West	$113,000	$8,000	
560	Railway Avenue West - 1st St West to Centre St	$97,000	$11,000	
570	Railway Avenue East - Centre St to 1st St East	$119,000	$3,000	
580	Railway Avenue East - 1st St East to 2nd St East	$113,000	$9,000	
590	Railway Avenue East - 2nd St East to 3rd St East	$137,000		$5,000
600	Railway Avenue East - 3rd St East to Range Road 144	$309,000		$6,000
	TOTALS	**$ 2,721,000**	**$ 857,000**	**$ 881,000**

*All costs in 2018 dollars.

3.7 Conclusions & Recommendations

It is recommended that the Village of Duchess conduct a geotechnical investigation and evaluation to determine a standard road structure to use for future roadwork projects. The Village should take every opportunity to document and record the structural make-up of existing roads as they are repaired and new roads as they are constructed.

It is recommended that the Village utilize the condition rating system identified to prioritize and implement the roadway repairs and replacement work. Generally, those components with a condition rating of “poor” should be incorporated into the short term maintenance work. Components with a condition rating of “fair” should be incorporated into the mid and long term road infrastructure repair and replacement strategy. Components with a condition rating of “good” should be re-evaluated bi-annually with their condition rating and priority updated as required. Short term is defined as work to be performed within 5 years, midterm is work to be performed in 5 to 10 years, and long term has been defined as work to be performed in 10 years and beyond.

It is recommended that the Village develop and implement an asphalt overlay program for the mid and long term road infrastructure management strategy. Due to the age of some of the paved roads, it would be prudent to undertake structural and surface pavement improvements while the roads are still

capable of receiving an asphalt overlay. In a worst-case scenario, not implementing an asphalt overlay program in a timely fashion would result in the need for total reconstruction of the roads.

It is recommended that the Village continue the current annual maintenance program and ensure it includes crack-sealing and localized asphalt repair (pothole repair). This will limit damage to the road structure by minimizing saturation of the road structure and subgrade.

4.0 WATER DISTRIBUTION

4.1 Background

The Village of Duchess is connected to the regional treated water pipeline supplied from the water treatment plant in the City of Brooks. Therefore, the focus of this section is on water demand, distribution pumping and piping only; as the supply, and treatment aspects are addressed with the regional water line connection.

4.2 Distribution Pumping

Distribution pumping consists of five distribution pumps. Pump one is 10 hp with a capacity of 8.83 l/s, pumps two, three and four are 25 hp with a capacity of 26.69 l/s, and pump five is 50 hp with a capacity of 63.09 l/s. The capacity of pump one is taken from as-built drawings and a pump curve based off the model number, as the pump tag did not have the capacity information. In a scenario where pump four is not operational, the other three pumps have the capacity to supply 110% of the projected max daily design flow satisfying Alberta Environment and Parks (AEP) Guidelines. The max capacity of all five pumps combined is 151.99 l/s (9,119 L/min), which would be the maximum fire flow available to the Village.

4.3 Water Demand

4.3.1 Data Collection

Location of the water mains was largely taken from historical record drawings obtained from the Village. Water consumption records for the Village of Duchess were obtained for the years 2014 through 2017.

4.3.2 Historical Water Consumption

Monthly records and annual reports for the last four years were reviewed to determine historical water demands in the Village of Duchess. Table 4.1 provides a summary of the water consumption record. Based on these historical demands, the following quantities have been adopted as the basis of assessment:

Average Day Demand is 411 litres per capita per day (Lpcd)

Maximum Day Demand is 1,780 Lpcd

Maximum Day to Average Day Ratio is 4.33

Peak Hourly Demand is 3,560 Lpcd or two times Maximum Day Demand

TABLE 4.1 – Historical Water Demands					
Month	**Average Day Flows**				
	2014 (m^3)	**2015 (m^3)**	**2016 (m^3)**	**2017 (m^3)**	**Average (m^3)**
January	318	279	276	307	295
February	375	286	268	286	303
March	406	267	265	300	309
April	381	347	488	341	389
May	477	846	657	614	648
June	619	903	777	695	748
July	878	871	416	923	772
August	584	599	499	842	631
September	411	381	435	584	453
October	386	348	308	307	337
November	329	280	312	304	306
December	277	266	283	263	272
Total Year Usage	160,789	166,068	147,160	169,266	160,821
Population	1,046	1,065	1,085	1,096	
Avg Day (m^3)	441	455	402	464	440
Avg Day (Lpcd)	421	427	372	423	**411**
Max Day (m^3)	1665	1895	1727	1747	1,895
Max Day (Lpcd)	1,592	1,780	1,591	1,594	1,780
Avg to Max Ratio	3.78	4.17	4.28	3.77	**4.33**

4.3.3 Forecast Water Consumption

Using the historical demands and the projected population for the Village of Duchess, future (2038) water demands were calculated. The Village provided input regarding population growth in areas of existing development and areas of potential future development. The projected population growth was allocated to these areas and future demand was calculated.

Per capita consumption for future demands was assumed to remain at 411 Lpcd. Applying this water demand to the projected population the 2038 Average Day and Maximum Day demands equate to 555 m^3/day and 2,403 m^3/day respectively. Table 4.2 summarizes the current and projected water demands for the Village.

Table 4.2 – Current and Projected Water Demands								
Historical Water Demand					Projected Water Demand			
Population (2018)	Per Capita Use (Lpcd)	Average Day (m^3/day)	Max Day (Lpcd)	Max Day (m^3/day)	Population (Year 2038)	Per Capita Use (Lpcd)	Average Day (m^3/day)	Max Day (m^3/day)
1,107	411	440	1,780	1,895	1,351	411	555	2,403

4.3.4 Fire Demand

The two main determinants of fire protection available to a community are based on the effectiveness of the fire fighting force and on the adequacy of the water supply system. Only the adequacy of the water supply system is addressed in this report.

Based on the latest Fire Underwriters Survey (FUS) criteria, a water supply system is considered fully adequate if it can deliver the necessary fire flow at any point in the distribution system for the applicable time period as specified in Table 4.3. It is further specified that the distribution system must be capable of delivering the necessary fire flow when water consumption is at the maximum daily rate of a normal year, i.e. Maximum Daily Flow plus Fire Flow.

The flow rates noted in Table 4.3 were used to measure the ability of the distribution system to deliver water for fire protection throughout the Village.

Table 4.3 – Fire Flow and Duration Requirements		
Facility Type	Fire Flow (L/min)	Fire Flow Duration (hr)
Residential	4,000	1.5
Industrial	7,000	2.0
School	11,000	2.0

4.3.5 Treated Water Storage

The Village of Duchess has a treated water reservoir with a capacity of 1,682 m^3. According to AEP's Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems, treated water storage required for any community where a water treatment plant can only provide the maximum daily design flow is determined by the following empirical relationship:

(A) Fire Protection:	As deemed necessary by the municipality
(B) Equalization Storage:	25% of Projected Maximum Day Demand
(C) Emergency Storage:	15% of Projected Average Day Demand
(D) Ct Disinfection:	As determined by historical data

Total Treated Water Storage Required = (A) + (B) + [the greater of (C) or (D)]

The level of fire protection is the responsibility of the municipality and is addressed in section 4.3.4 of this report. Using the recommended minimum fire protection for residential areas of 4,000 L/min for a duration of 1.5 hours results in 360 m^3 of required fire storage. 25% of the projected max day flow of 2,403 m^3 is 601 m^3, and 15% of the projected average day flow of 555 m^3 is 83 m^3. The sum of these values equates to a total required treated water storage of 1,044 m^3. The current storage of 1,682 m^3 is 638 m^3 above the recommended amount. Using the current capacity of the fire pump of 9,000 L/min for a duration of 2 hours results in 1,080 m^3 of required fire storage and a treated water storage deficit of 82 m^3. Using the recommended minimum fire protection for the school for a duration of 2 hours results in 1,320 m^3 of required fire storage and a treated water storage deficit of 322 m^3.

4.4 Hydraulic Analysis

4.4.1 Introduction

The hydraulic analysis of the water distribution system was completed using Bentley WaterCAD, V8i computer modeling software. Data relevant to the water distribution system was assembled from available proposed drawings and records drawings. Data included pipe materials, diameters, lengths, locations, interconnections, elevations, hydrants, water consumption records, etc. Scenarios were developed for both current and future populations and for the various demands placed on the system (i.e. Average Daily Demand, Maximum Daily Demand, Peak Hourly Demand and Max Day plus Fire Flow Demand). In areas that the distribution system did not meet the required level of service standards,

upgrades were modeled to address the situation.

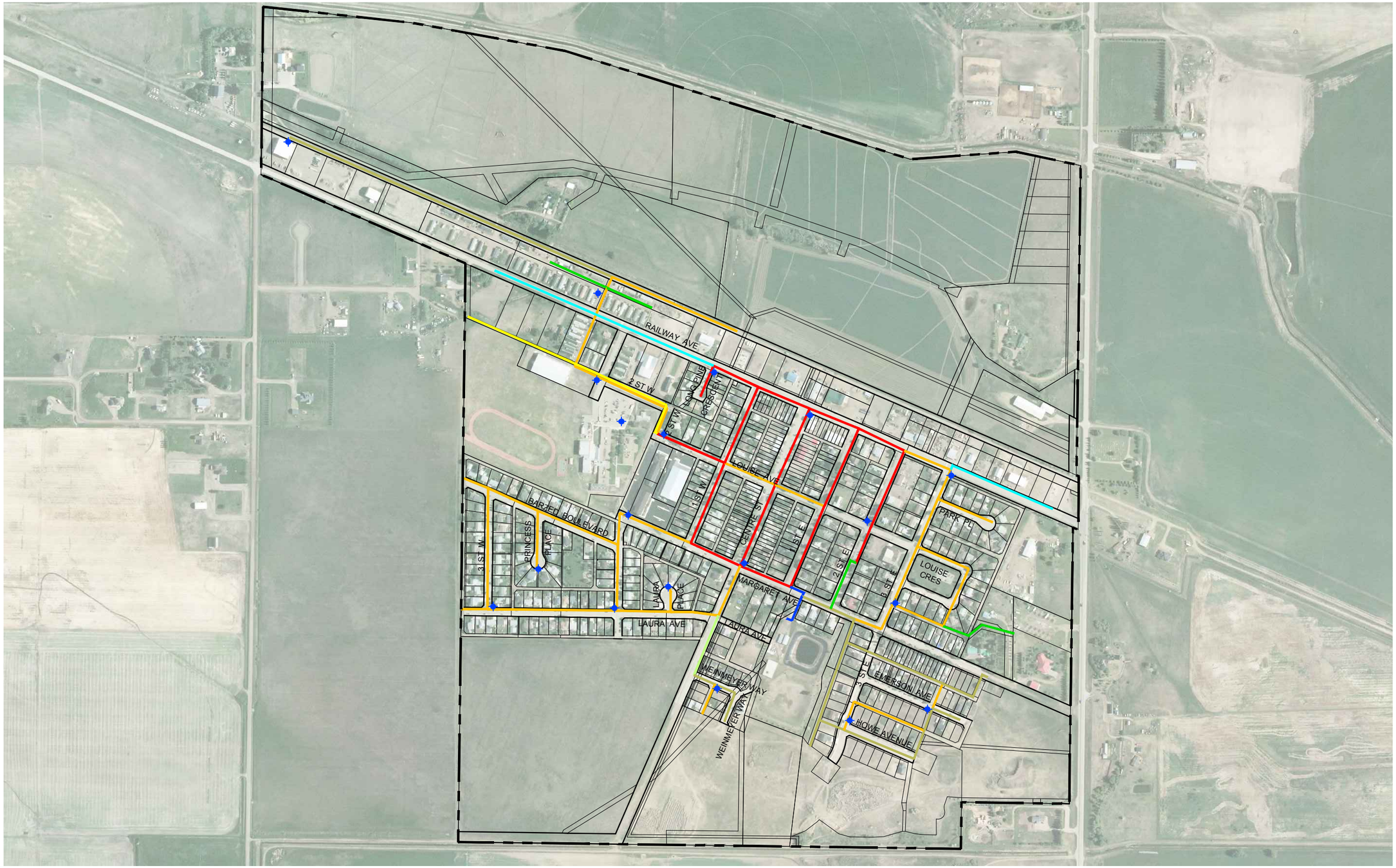
4.4.2 Existing Distribution Analysis

Figure 4.1 shows the existing water distribution system piping network. The existing system consists of a variety of pipes ranging from 50 mm diameter to 250 mm diameter. The distribution pumping system is located at the former water treatment plant and currently operates at a pressure point of 455 kPa (66 psi).

The purpose of the hydraulic analysis was to verify that the existing system, as it now operates, meets the acceptable level of service standards with respect to water delivery. Scenarios were developed for both current (2018) and future (2038) conditions. In addition to analyzing Average Day, Maximum Day and Peak Hour Demands, fire flows were also modeled.

AEP guidelines contain level of service standards for water distribution systems. To meet the level of service standards for Average Day and Maximum Day demands, pressure should be maintained between 345 kPa (50 psi) and 620kPa (90 psi) at all points in the system. For Peak Hour Demand, pressure should be no less than 310 kPa (45 psi). The standard for fire flow analysis is to impose a fire flow when the system is experiencing Maximum Day Demand (i.e., MDD + fire flow) and the resulting residual pressure anywhere in the system should be no less than 138 kPa (20 psi).

In order to allocate demand, population density was determined to be approximately 2.8 people per residential lot. For future demand, a density of 25 people/ha was applied to the areas of future development.



LEGEND

- VILLAGE BOUNDARY
- FIRE HYDRANT
- 75mm HDPE WATER LINE
- 100mm PVC WATER LINE
- 150mm AC WATER LINE
- 150mm PVC WATER LINE
- 50mm UNKNOWN WATER LINE
- 200mm AC WATER LINE
- 200mm PVC WATER LINE
- 250mm PVC WATER LINE

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
WATER DISTRIBUTION SYSTEM
EXISTING

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **4.1**

4.5 Hydraulic Analysis Results

The results of the hydraulic analysis for the existing water distribution system at various demands (i.e. Average Day, Maximum Day and Peak Hour) for both the current (2018) and long term (2038) scenarios show that at the current operating pressure of 455 kPa (66 psi) there is adequate pressure found throughout most of the Village. The homes serviced off the 50 mm line west of the modular home park on 2nd Street W have pressures below the recommended minimum during peak hour demand. The layout and servicing in this area should be confirmed, as there is conflicting information between the GIS and preliminary drawings provided by the Village.

The following summarizes the pressures within the system for the various modeled scenarios:

2018

- Average Day results range between 455 to 490 kPa (66 to 71 psi)
- Max Day results range between 393 to 483 kPa (57 to 70 psi)
- Peak Hour results range between 179 to 469 kPa (26 to 68 psi)

2038

Average Day results range between 455 to 490 kPa (66 to 71 psi)

Max Day results range between 386 to 476 kPa (56 to 69 psi)

Peak Hour results range between 165 to 455 kPa (24 to 66 psi)

Due to a lack of water main looping and undersized mains, the hydraulic model indicates that the current distribution system does not have the capacity to provide the recommended fire flow (4,000 L/min) in 24% of the Village.

Recommended upgrades are outlined below which will increase the level of service of the water distribution system. Detailed results of the hydraulic model are included in Appendix B.

4.6 Proposed Upgrades

To improve flow and pressure during fire flow conditions, dead end pipes can be extended to adjacent lines to form loops. Completing loops in the system also has the added advantage of improving water quality and service reliability. Improved reliability is the result of water having alternative routes to reach a service location if a particular pipe is out of service.

With respect to water quality, water at the end of a dead end line tends to stagnate which causes chlorine residuals to decay, which in turn allows bacteria to grow. An indication of deteriorating water quality is when hydrant flow tests are conducted and black water flows from the hydrant for a significant time before clearing.

Pipes were added and upsized in the computer model and further simulations were run to confirm the impact of these improvements on the water distribution system. Upsizing all mains to a minimum of 150 mm will increase all pressures during peak hour demand to the recommended minimum standard. This will also reduce the insufficient fire coverage of the recommended minimum fire flow (4,000 L/min) from 24% to 20%.

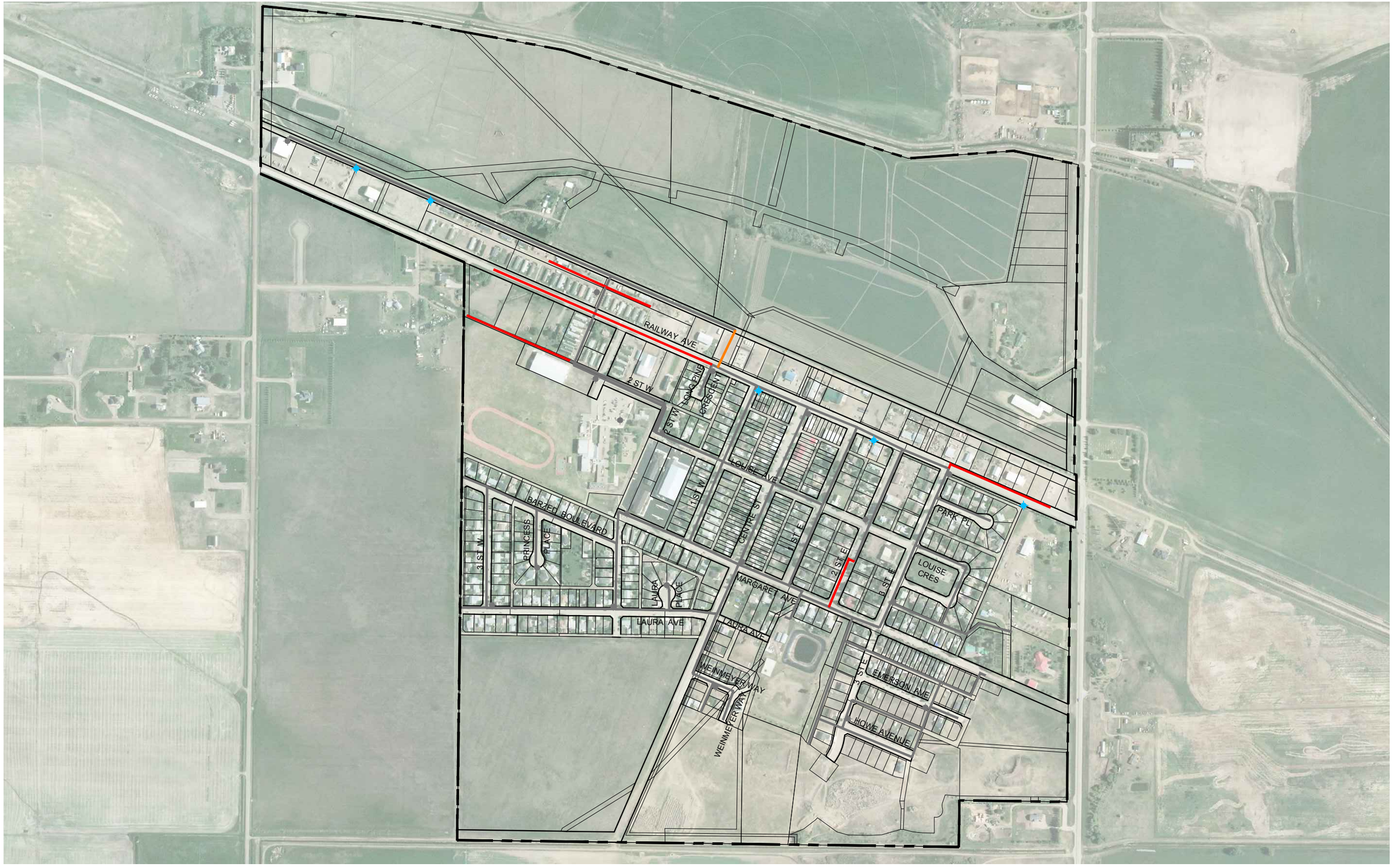
The completion of the loop from Long Pine Crescent to the main on the north side of Railway Avenue will significantly reduce the insufficient fire coverage of the minimum recommended fire flow (4,000 L/min) in the northwest from 24% to 14%.

The completion of the Long Pine Crescent Loop and the upsizing of undersized mains to a minimum of 150 mm will reduce the insufficient fire coverage to 7%.

Major upgrades are required to supply the recommended 11,000 L/min to the school and 7,000 L/min to the commercial/industrial areas northeast of Centre Street.

Fire hydrants should be added along Railway Avenue to decrease the space between hydrants. The FUS recommends a hydrant spacing of 90 m outside of residential areas.

The proposed water distribution system upgrades are shown in Figure 4.2



LEGEND

- VILLAGE BOUNDARY
- EXISTING WATER LINE
- PROPOSED 150mm WATER LINE REPLACEMENT
- PROPOSED 200mm WATER LINE
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
WATER DISTRIBUTION SYSTEM
PROPOSED UPGRADES

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **4.2**

4.7 Cost Estimates

Order of magnitude cost estimates have been prepared for the proposed upgrades to the existing water distribution system. The suggested upgrades will also improve conditions for future development. The addition of the mains as shown on Figure 4.2 would cost approximately $1,340,000 including contingencies and engineering (see Table 4.4). These improvements should be incorporated into the Village's infrastructure enhancement plans. Details of the cost estimates are included in Appendix B.

Table 4.4 – Water Distribution System Proposed Upgrades

Construction Works	Preliminary Cost
Long Pine Crescent Looping	$ 100,000
2nd Avenue East Upsize	$ 90,000
Railway Avenue East Upsize	$ 350,000
Railway Avenue West Upsize	$ 690,000
Proposed Hydrants	$ 110,000
TOTAL	**$ 1,340,000**

4.8 Conclusions and Recommendations

The following conclusions can be made:

- The pressure in the distribution system is slightly below the recommended level of service standard in a few areas.
- Due to the lack of water main looping, the available fire flow is below the recommended level of service standard.
- The distribution system includes pipes that are smaller than 150 mm diameter, which do not meet current AEP guidelines.

The following actions are recommended:

- To meet current guidelines the systematic replacement of all water mains 100 mm (4 inches) diameter or smaller with 150 mm (6 inch) diameter or greater water mains should be undertaken. This can be completed in conjunction with other infrastructure work and as budgets permit.

- It is recommended that the proposed upgrades be incorporated into the Village's infrastructure improvement plan to be completed in conjunction with other infrastructure works that the Village proposes (i.e. roadwork, sanitary and storm sewer) to ensure an efficient use of funds.

- Maintenance should continue to be a systematic part of the Village's activities to protect its investment in infrastructure. Flushing of water lines and operation of valves and hydrants should continue to be a regular and ongoing activity. Unidirectional flushing is the recommended method as it more effective and efficient than opening a hydrant alone.

5.0 SANITARY INFRASTRUCTURE

5.1 Sanitary Collection System

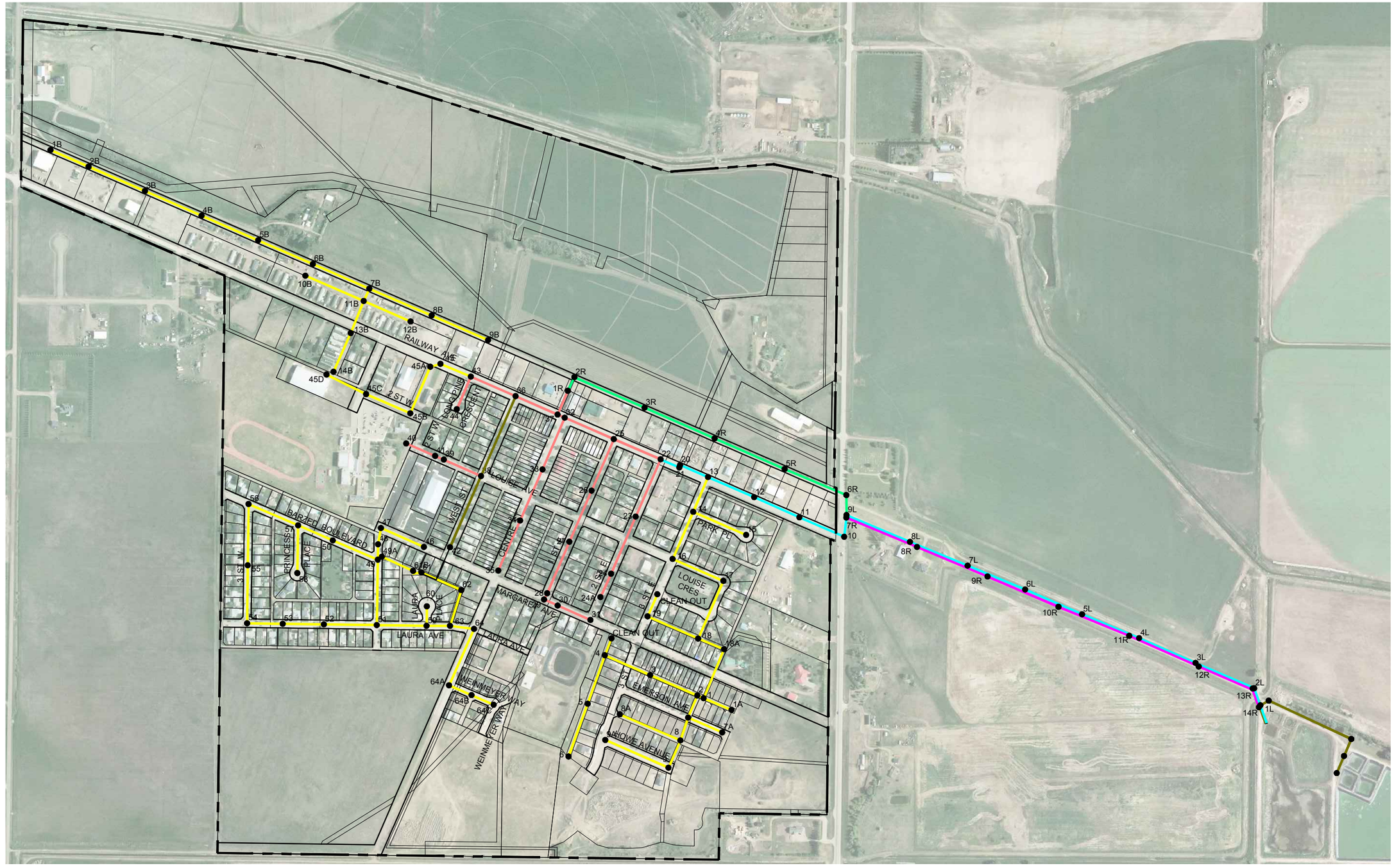
The sanitary collection system in the Village of Duchess consists of a typical network of gravity flow pipes and three lift stations. The wastewater from the northwest corner of the Village drains toward the lift station that is located south of Railway Avenue at Brianne Boulevard. This lift station pumps to a manhole on 2nd Street West. The wastewater from the southwest corner of the Village drains toward the lift station located in the laneway north of Laura Place. This lift station pumps to a manhole located near the intersection of Margaret Avenue and 1st Street West. A very small portion of the central east section of the Village flows to a lift station near the east end of Margaret Avenue. This lift station pumps to a manhole located in the laneway behind Louise Crescent. The remainder of the Village flows to the wastewater stabilization ponds located east of the Village. The sanitary collection network consists of pipes ranging from 200 mm (8 inch) to 375 mm (18 inch) diameter. The network of gravity flow pipes consists of polyvinyl chloride (PVC) and vitrified clay tile (VCT). The existing sanitary collection system is shown in Figure 5.1.

Physical data for the sanitary collection system was obtained from topographic survey information collected by MPE along with preliminary and record drawings provided by the Village.

5.1.1 Current and Projected Wastewater Flows

The historical water demands during dry weather months (January to April and October to December) were used to calculate a wastewater generation rate. The Average Daily wastewater flow rate adopted for the existing residential areas is approximately 325 litres per capita per day (Lpcd). For future residential areas, the dry weather flows are expected to continue to be 325 Lpcd. Maximum flows are calculated based on the peaking factor derived from the Harmon equation.

Flow measurements have not been conducted during wet weather conditions to quantify the levels of inflow and infiltration (I/I) which transpire. Therefore, for the purposes of this report the levels of I/I have been adopted from the City of Lethbridge. The City of Lethbridge uses 2,000 Lpcd for the older developments and 500 Lpcd for new developments. The older areas tend to have foundation tile drains or downspouts connected to the sanitary system and as a result they contribute a much higher I/I flow to the system. These same values have been incorporated into the sanitary flow calculations for this report. Table 5.1 summarizes the current and projected sanitary flows.



LEGEND

- VILLAGE BOUNDARY
- EXISTING SANITARY MANHOLE
- EXISTING 200mm PVC SANITARY PIPELINE
- EXISTING 200mm VCT SANITARY PIPELINE
- EXISTING 250mm PVC SANITARY PIPELINE
- EXISTING 250mm VCT SANITARY PIPELINE
- EXISTING 300mm PVC SANITARY PIPELINE
- EXISTING 375mm PVC SANITARY PIPELINE

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
SANITARY COLLECTION SYSTEM
PIPE SIZE AND TYPE
EXISTING

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **5.1**

Table 5.1 – Current and Projected Wastewater Flows								
	Population	Dry Weather -Residential				Inflow / Infiltration		Total Peak Wet Weather Flow (m^3/day)
		Per Capita Flow (Lpcd)	Average Day (m^3/day)	Harmon Peaking Factor	Peak Flow (m^3/day)	Per Capita Flow (Lpcd)*	Inflow Allowance (m^3/day)	
Current	1,107	325	360	3.77	1,357	2,000	2,214	3,571
Projected (1.0% growth)	1,351	325	439	3.71	1,630	500 / 2,000	2,336	3,966

5.1.2 Collection System Analysis and Condition Assessment

Hydraulic analysis of the sanitary collection system was undertaken using SewerGEMS version 8 computer modeling software. The purpose of the analysis was to recreate the flow conditions in the system for both dry weather flow and wet weather flow. Several scenarios were modelled to analyse the current system as well as proposed infrastructure for servicing new development within the Village boundaries.

The model shows that for dry weather average flows under both current and future conditions no surcharging occurs in the sanitary collection system. The model shows that for peak dry weather and peak wet weather flows for both current and future conditions there is surcharging in the sanitary collection system. Most of the surcharging occurs along Railway Avenue from Long Pine Court to Highway 873.

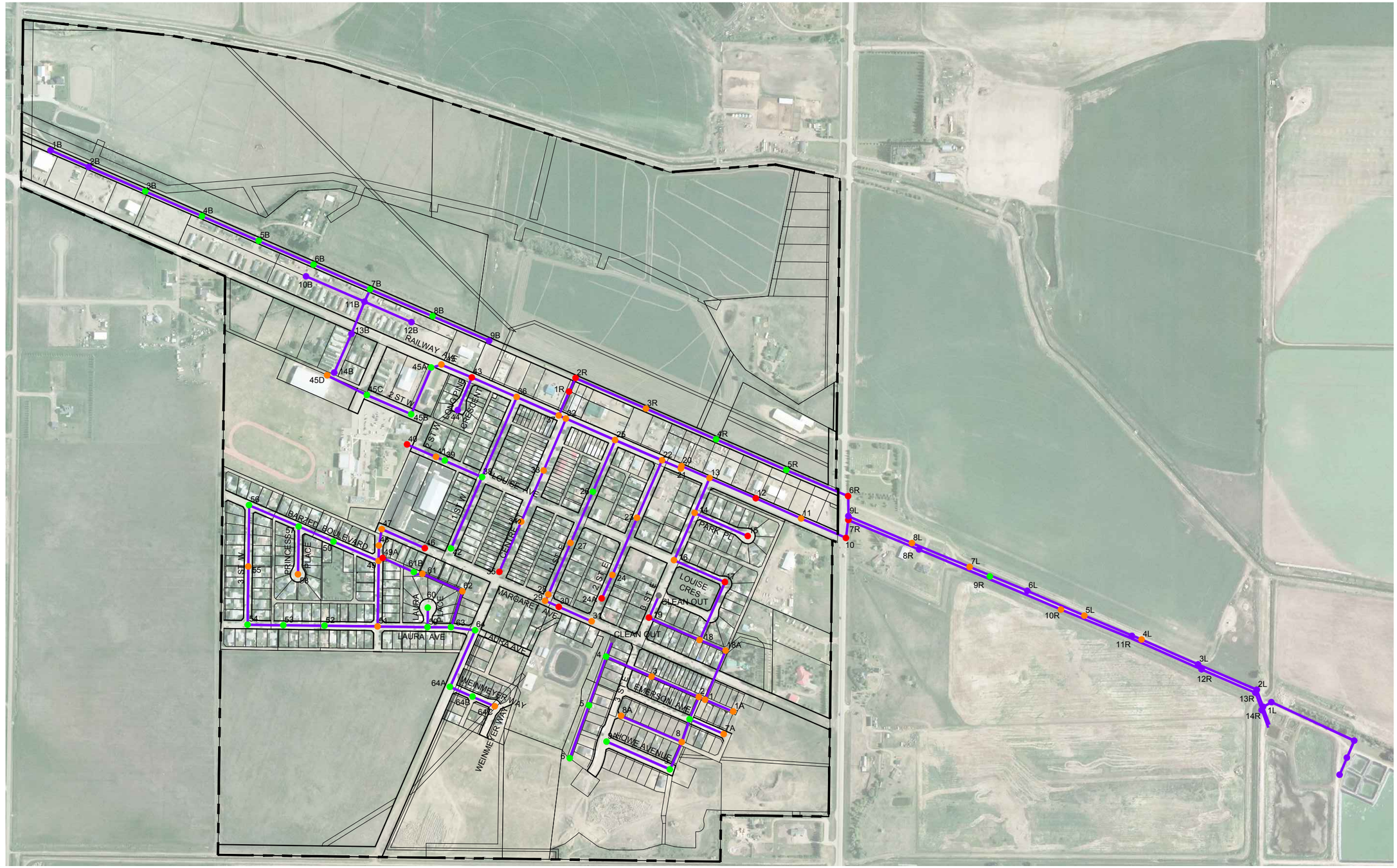
The model shows that for peak wet weather flows for both current and future conditions there is surcharging where the lagoon trunk main and the relief trunk main meet north of Railway Avenue. The surcharging occurs because the relief trunk main invert in S MH 7R is approximately 0.2 m higher than the original lagoon trunk main.

Video inspections of the sanitary collection system were not completed as part of the scope of this report. Many of the older record drawings indicate pipe size only and not the pipe material. Based on the dates of record drawings we have assumed that any pipes in place prior to 1984 are VCT and any pipes installed or replaced after 1984 are PVC.

A visual inspection of the majority of the sanitary manholes was completed during the time of topographical survey and the condition of the manholes was evaluated. The manholes rated in "good" condition showed no signs of structural damage and were relatively clean. The manholes rated in "fair" condition showed minor structural damage and require a minimal amount of cleaning. The manholes rated in "poor" condition showed significant structural damage, high water levels, poor benching, or require a significant amount of cleaning. The condition of the sanitary collection system is shown in Figure 5.2.

5.1.2.1 *Dykstra Lift Station*

The results of the model indicate that the existing Dykstra subdivision lift station has sufficient capacity for the current (2018) and future (2038) average day and peak flows. As no flow monitoring data was available, an assumption was made to follow the City of Lethbridge standard for Inflow/Infiltration of 2,000 Lpcd. This flow was divided evenly over the entire system. The results of the model indicate that the lift station is capable of handling flows at this rate. Discussions with Village personnel indicate that the lift station is not capable of handling the wet weather flows during some larger rain events. This indicates that there are many homes in the area with roof leaders or sump pumps connected to the sanitary collection system. A program to encourage residents to disconnect their pumps from the sanitary system, installing a storm system with storm services to each lot, or upsizing the pumps in the lift station is recommended. The first step would be to install a flow meter in the lift station or an upstream manhole to collect flow data to determine the rate of I/I during the wet weather events to determine proper sizing of upgrades.



LEGEND

- VILLAGE BOUNDARY
- EXISTING SANITARY MANHOLE - GOOD CONDITION
- EXISTING SANITARY MANHOLE - FAIR CONDITION
- EXISTING SANITARY MANHOLE - POOR CONDITION
- EXISTING SANITARY MANHOLE - NOT FOUND / UNKNOWN CONDITION
- EXISTING SANITARY PIPELINE - UNKNOWN CONDITION

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
SANITARY COLLECTION SYSTEM
PIPE AND MANHOLE CONDITION
EXISTING

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **5.2**

5.1.3 Proposed Upgrades

Video inspections of the sanitary mains were not completed as part of the scope of this report. The condition of the mains is not known. It is recommended that video inspections be completed in order to evaluate the condition of the mains and identify required repairs and upgrades.

Most manholes are in fair condition and appear to be functioning as intended. Several manholes were found to have high water levels at the time of inspection and should be investigated to determine the cause of the backup and the appropriate remedial work required. These manholes are S MH 10, S MH 30, S MH 49A, and S MH 1R.

The sanitary main along Railway Avenue from Long Pine Court to Highway 873 is identified as surcharging under current and future peak dry and wet weather conditions. Flow monitoring should be completed during both dry and wet weather periods to determine I/I rates and properly size the upgraded mains.

The section of sanitary main between S MH 37 and S MH 2R should be regraded to remove the high spot at S MH 1R to allow excess flows to be diverted to the relief main without backing up in the Railway Avenue main.

The Dykstra lift station has sufficient capacity under dry weather conditions. Discussions with the Village indicate that the lift station does not have sufficient capacity under certain wet weather conditions. Flow monitoring should be completed during both dry and wet weather periods to determine I/I rates and to determine upgrade requirements.

A few of the sanitary mains (8%) were found to have grades lower than the typical level of service standards. The topographical survey shows that there is one section with reverse grades. These sections of sanitary main should be monitored to ensure downstream flow capacity is maintained. It is recommended that the Village continue to flush these sections of sanitary main regularly to maintain capacity and prevent potential obstruction. A summary of these sections of pipe are found in table 5.2.

Table 5.2 – Sections of Sanitary Main with Flat Grade				
Start MH	**Stop MH**	**Diameter (mm)**	**Slope (%)**	**Recommended Slope (%)**
S MH 29	S MH 28	200	-0.15	0.40
S MH 1	S MH 18A	200	0.22	0.40
S MH 1R	S MH 37	200	0.26	0.40
S MH 6B	S MH 7B	200	0.32	0.40
S MH 53	S MH 52	200	0.32	0.40
S MH 59	S MH 51	200	0.33	0.40
S MH 4	S MH 3	200	0.33	0.40
S MH 8B	S MH 7B	200	0.34	0.40
S MH 6L	S MH 5L	250	0.18	0.28
S MH 8L	S MH 7L	250	0.20	0.28

The proposed upgrades to the existing system are outlined in Figure 5.3.

LEGEND

- VILLAGE BOUNDARY
- EXISTING SANITARY PIPELINE
- EXISTING SANITARY MANHOLE
- SANITARY PIPELINE TO BE REPLACED
- EXISTING SANITARY MANHOLE TO INVESTIGATE

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
SANITARY COLLECTION SYSTEM
PROPOSED UPGRADES

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **5.3**

5.1.4 Cost Estimates

Order of magnitude cost estimates have been completed for the proposed upgrades to the sanitary collection system. Table 5.3 summarizes the costs including contingencies and engineering. Further detail is provided in Appendix C.

Table 5.3 – Sanitary Collection System Cost Estimates

Construction Works	Preliminary Cost
Sanitary Main Condition Assessment	$ 180,000
Inflow/Infiltration Study	$ 40,000
Railway Avenue MH 36 to 1R Regrading	$ 230,000
Total	**$ 450,000**

5.1.5 Conclusions and Recommendations

The following conclusions and recommendations can be made:

- The sanitary collection system in Duchess has adequate capacity to carry average day dry weather flows under current and future conditions.
- The sanitary collection system in Duchess does not have adequate capacity to carry peak dry and wet weather flows under both current and future conditions.
- Sanitary manholes identified in 5.1.2 should be investigated to determine the cause of the high water levels noted during the inspection.
- Video inspections of the sanitary mains should be undertaken in order to assess the condition of the sanitary collection system.
- Flow monitoring should be completed to determine the I/I flow rate to size the Railway Avenue main and the Dykstra lift station upgrades.
- Maintenance should continue to be a systematic part of the Village's activities to protect its investment in infrastructure. Flushing of sewer lines and cleaning of manholes should continue to be a regular and ongoing activity to ensure unobstructed flow in the system.

5.2 Wastewater Treatment

5.2.1 Treatment Process and Infrastructure

The Village of Duchess utilizes wastewater stabilization ponds (lagoons) for treatment of its wastewater. The wastewater lagoons are located on NW Section 28 Township 20 Range 14 West of the 4th Meridian. The wastewater treatment system consists of four (4) equal sized anaerobic cells, one (1) facultative cell and one (1) storage cell. The wastewater lagoons were updated in 2004. The anaerobic cells are operated in series and discharge into the facultative cell. According to AEP regulation, the Village is allowed to release effluent once a year between late spring and fall. The lagoon has been designed to discharge to the Eastern Irrigation District canal located just north of the lagoon. Figure 5.4 illustrates the existing treatment process.

5.2.2 Standards and Guidelines

AEP "Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems" (2012), gives the following minimum standards for wastewater lagoons:

- The facultative cell shall operate at a maximum depth of 1.5 m and retain influent wastewater for at least 60 days based on average daily design flow (ADDF).
- The storage cell shall operate at a maximum depth of 3.0 m and shall retain influent wastewater for a minimum retention period of 12 months based on ADDF.

The Wastewater Treatment facility for the Village of Duchess is regulated under AEP's "Code of Practice for Wastewater Systems Using a Wastewater Lagoon" which became effective July 7, 2004.
The Code of Practice includes the following stipulations:

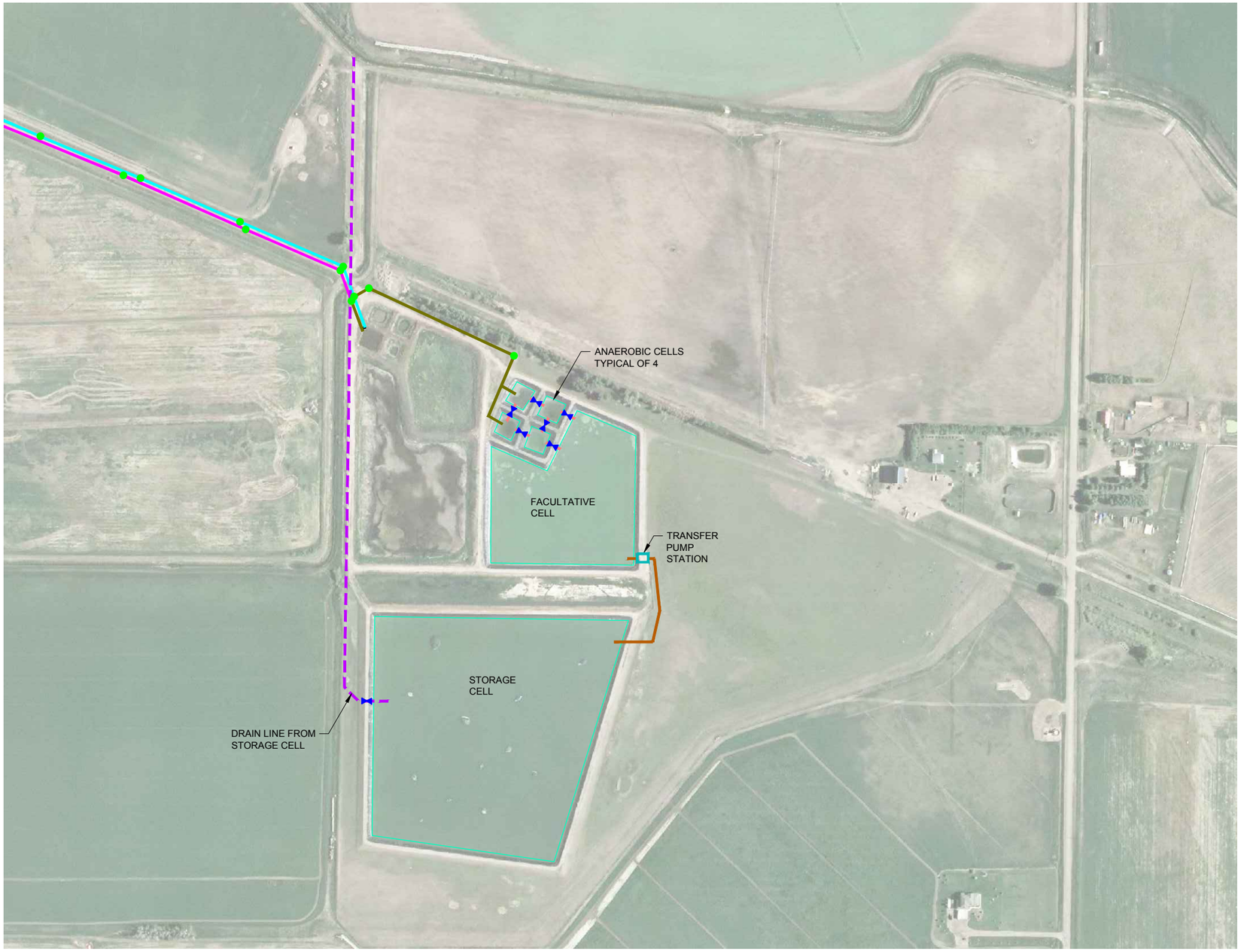
- At least one week prior to wastewater lagoon discharge, notify downstream landowners and retain documentation of the notification given.
- Lagoon discharge is permitted normally once per year between April 1 and November 30.
- Each discharge is to be completed within a period of three consecutive weeks.
- Wastewater lagoon discharges shall not cause flooding of lands or erosion of a watercourse.
- Annual wastewater report is due February 28 of the following year.

NOTES:

1. ANAEROBIC CELLS (4):
   - VOLUME = 3920m^3
   - RETENTION TIME = 10 DAYS
2. FACULTATIVE CELL (1):
   - VOLUME = 32 930m^3
   - RETENTION TIME = 75 DAYS
3. STORAGE CELL (1):
   - VOLUME = 185 320m^3
   - RETENTION TIME = 514 DAYS

ALBERTA ENVIRONMENT AND PARKS
MINIMUM REQUIREMENTS:

1. ANAEROBIC CELLS (4):
   - RETENTION TIME = 8 DAYS
2. FACULTATIVE CELL (1):
   - RETENTION TIME = 60 DAYS
3. STORAGE CELL (1):
   - RETENTION TIME = 365 DAYS



LEGEND

- 150mm HDPE TRANSFER LINE
- 250mm PVC SANITARY LINE
- 300mm PVC SANITARY LINE
- 300mm HDPE TRANSFER LINE
- 375mm PVC SANITARY LINE
- 400mm PVC DRAIN LINE
- EXISTING SANITARY MANHOLE
- EXISTING VALVE
- EXISTING TRANSFER STRUCTURE

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
SANITARY TREATMENT SYSTEM PROCESS
EXISTING

SCALE: 1:5000	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **5.4**

5.2.3 Treatment Capacity Assessment

The capacity of the existing wastewater treatment system was determined based on record drawings provided by the Village of Duchess.

ADDF is used along with the record drawing volumes to determine the corresponding retention times for each cell. The retention times were determined for both the current and 20-year projected flows. Historical dry weather water usage data was reviewed and was used as a basis for the analysis. Other communities within southern Alberta that meter their sanitary flows have been shown to have an ADDF of approximately 6% to 11% higher than their average dry weather flows. As the Village of Duchess has no sanitary flow data, the average dry weather water usage and the above relationship was used to determine an approximate ADDF of 10% above the average dry weather usage.

Table 5.4 summarizes the estimated volume and the current and 20-year projected retention times for each cell.

Table 5.4: Lagoon Treatment System

Treatment Cell	Volume	Retention Time (days)		
	(m^3)	Current	20 Year (1.0% growth)	AEP Requirement
Anaerobic Cells (4)	3,920	10	9	8
Facultative Cell	32,930	91	75	60
Storage Cell	185,320	514	422	365
Total	**222,170**	**615**	**506**	**429**

In accordance with AEP Standards and Guidelines, the existing system has adequate total capacity to handle the current and 20-year projected ADDF.

An onsite inspection of the transfer structures was not completed at the time of the sanitary manholes inspection and is recommended to observe the condition and confirm the wastewater flow paths.

5.2.4 Conclusions and Recommendations

The existing wastewater treatment system operated by the Village of Duchess has adequate capacity to handle the current and 20-year projected wastewater flows. Since the wastewater flows have been based on water usage data, it is recommended that the Village implement a flow monitoring program to collect wastewater flow data, which would make a more accurate analysis of the capacity of the lagoon possible and allow the Village to more accurately determine when upgrades would be required.

6.0 STORM WATER MANAGEMENT

6.1 Background

The Village of Duchess has a generally flat topography sloping from the southwest to the northeast with a total elevation drop of approximately 5 meters.

Storm water drainage patterns and catchment areas within the study area were delineated based on surveys of drainage works and topographical data. Discussions with Village personnel also helped determine problem areas, such as those that experience recurring ponding or flooding.

The analysis of the study area included conducting surveys of the storm water systems and drainage patterns, as well as developing a computer model to determine pre and post development runoff and storm water storage requirements.

6.2 Existing Storm Water System

6.2.1 Major Overland Drainage

Much of Duchess is reliant on overland drainage to convey storm water runoff. The overland or major drainage system typically relies on surface drainage along curbs and gutters along paved roads, and swales, ditches, and culverts along unpaved roads. As its name implies, the major drainage system is designed to carry runoff from larger less frequent storms. Typically, major systems are designed for the 1:100 year storm event.

The study area is divided into 17 main catchment areas as shown on Figure 6.1. Catchments A and B encompass the north and north west sections of the Village and drain north to the Eastern Irrigation District (E.I.D.) canal. This area is largely undeveloped with the storm water runoff draining by overland flow.

Catchments C, D and E are large areas of undeveloped land located along the northern developed edge of the Village. Catchments C and D are largely undeveloped with the storm water runoff draining by overland flow to the Highway 873 ditch at the eastern Village boundary. Catchment E drains to a ditch, which flows north to the E.I.D. canal.

Catchment F is a large, undeveloped area located along the western edge of the Village boundary. This area drains by overland flow to a culvert under Railway Avenue near the Bartman modular home park, which ultimately flows to the E.I.D. canal north of the Village.

Catchment areas G and H are located on the western edge of the developed portion of the Village. This area includes the developed school area and the modular home parks adjacent to Railway Avenue. The areas drain by overland flow to a ditch system, which ultimately flows to the E.I.D. canal north of the Village.

Catchment I includes the area from the Duchess school to the south Village boundary. Approximately half of the area is developed. The catchment drains overland to the underground storm system at the corner of Margaret Avenue and 2 Street W. A storm water drainage pond with a design capacity of 1,434 m^3 located at the west end of Margaret Avenue serves as an overflow for storm water run-off that exceeds the capacity of the underground system. This pond is pumped to the underground storm system which outlets to the north of the developed Village.

Catchment J is located in the interior of the developed Village area and is completely developed. The area drains by overland flow to catch basins where it enters the underground storm system, which outlets at the Highway 873 ditch to the east.

Catchment areas K, L, M, P and Q are partially developed areas at the east edge of the Village boundary, which drain by overland flow to the Highway 873 ditch at the east. The runoff ultimately flows east under Highway 873 through a culvert.

Catchment N is located in the southern portion of the Village and is partially developed. The area drains by overland flow to a storm pond located within the catchment.

Catchment O is located at the southeast corner of the developed area of the Village. The area is partially developed. The developed portion flows overland to the underground storm system and outlets to a storm pond at the south Village boundary. The undeveloped portion flows overland to the storm pond.

6.2.2 Minor (Underground) Drainage

The Village of Duchess has an extensive storm water collection system throughout a large portion of the

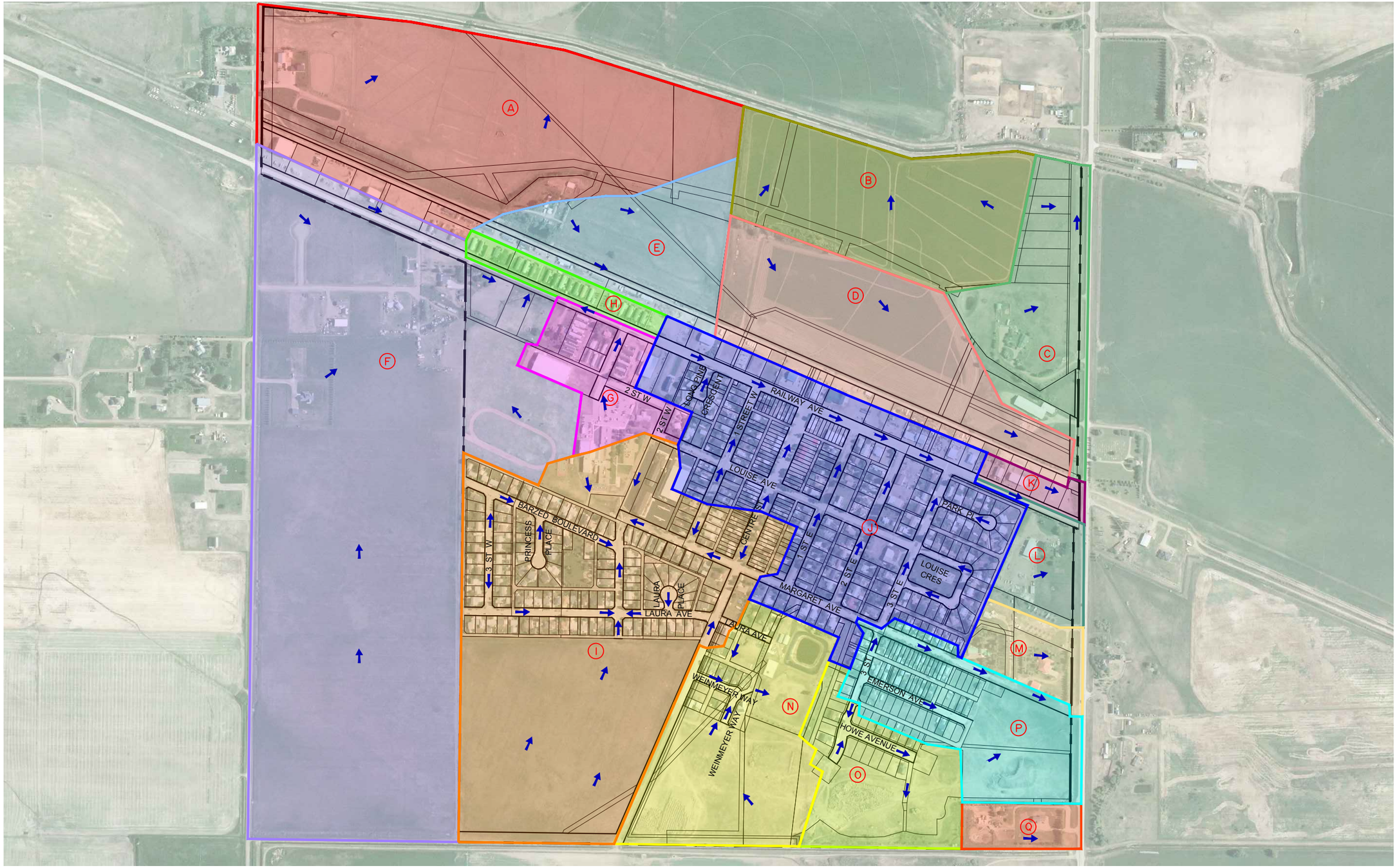
developed Village area. There are three separate storm water collection systems in the Village. One system is located between the school and the Duchess Recreation Center and drains to the north. Another system is located in the older part of the developed Village along Railway Avenue, 1st Street East, and 2nd Street East and outlets to the Highway 873 ditch. The third system is located in the new southeast area of the Village and drains Emerson Avenue and Howe Avenue. The storm water collection system pipes range in size from 300 mm to 750 mm. Video inspection of the mains was not completed as part of the scope of this project.

6.3 Storm Water Conveyance Analysis

6.3.1 Storm Water Management Principles

A number of guiding principles were applied to the storm water analysis of the study area, as follows:

- Storm water management is an integral part of land development. The general principle for storm water management is that runoff from a developed area cannot exceed the runoff that occurred prior to development. The benchmark is the runoff from a storm that occurs on average once in five years (1:5). The post development 1:5 year runoff rate cannot exceed the pre-development 1:5 year runoff rate. Any runoff in excess of this must be stored for later release at a controlled rate. Storage is typically required for runoff from all storms up to the 1:100 year design storm.
- In an urban setting, a storm water management system often incorporates both a minor system and a major system. The design standard for the minor system is for the underground storm pipes to carry the 1:5 year post development runoff. Catch basins divert runoff from frequent smaller storm events into the underground pipes and prevent it from ponding on the surface. For larger storms that exceed the capacity of the minor system, the major overland drainage system relies on surface grading to route the runoff from less frequent but larger (up to the 1:100 year) storms to a storm water management facility (SWMF). The outlet from the SWMF is designed to limit the release of storm water into the downstream system or receiving watercourse to no more than the 1:5 year pre-development runoff rate.
- As well as addressing storm water quantity, new developments must also address storm water quality. AEP's "Municipal Policies and Procedures Manual" (2001) requires a minimum of 85% removal of sediments with a particle size of 75 µm or greater.



LEGEND

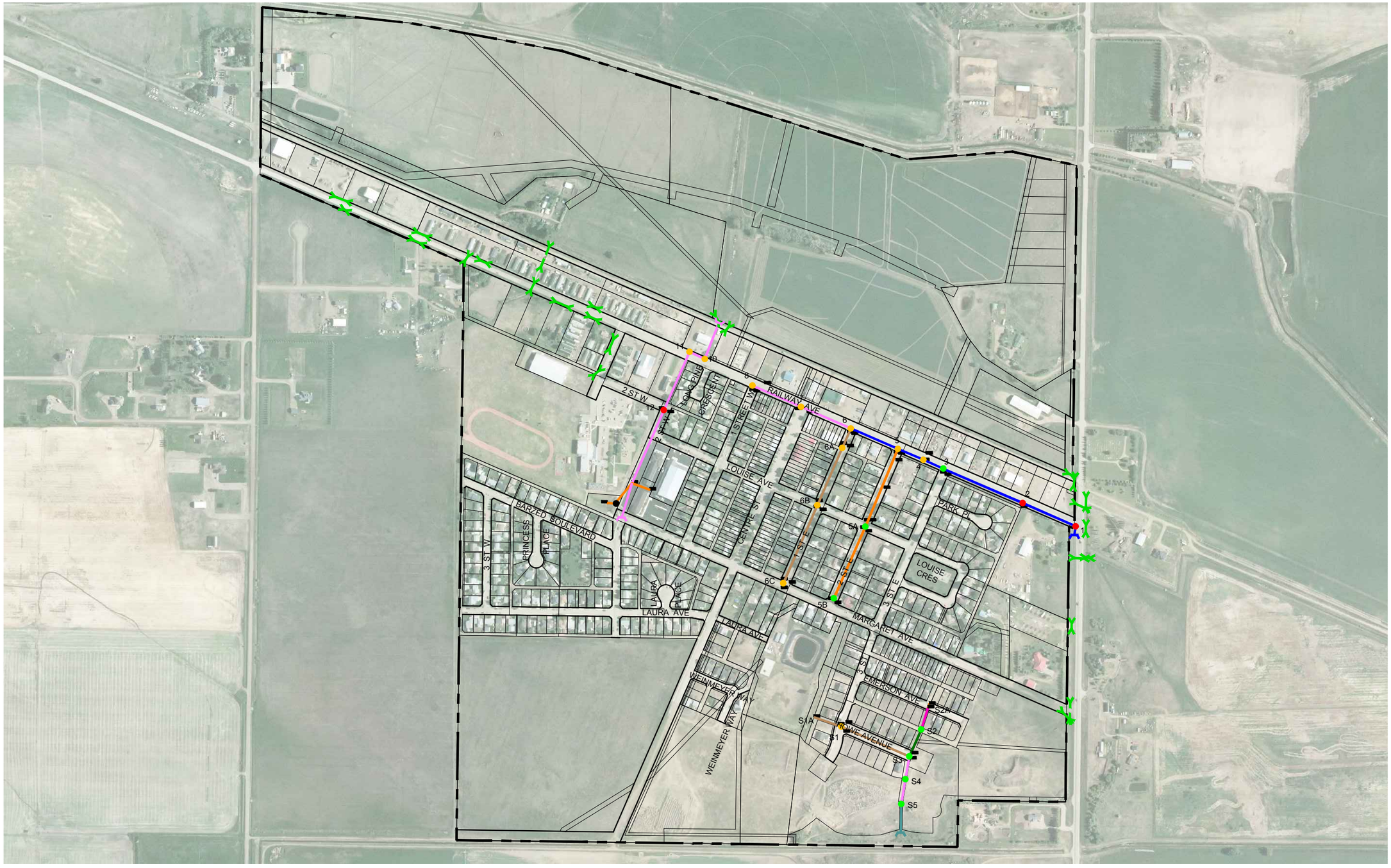
- VILLAGE BOUNDARY
- MAIN CATCHMENT AREA
- (A) CATCHMENT AREA
- DRAINAGE FLOW ARROWS

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
STORM WATER DRAINAGE PATTERN PLAN
EXISTING

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **6.1**



LEGEND

- VILLAGE BOUNDARY
- EXISTING STORM WATER MANHOLE - GOOD CONDITION
- EXISTING STORM WATER MANHOLE - FAIR CONDITION
- EXISTING STORM WATER MANHOLE - POOR CONDITION
- EXISTING STORM WATER CATCHBASIN
- EXISTING CULVERT
- 300mm EXISTING STORM WATER PIPELINE
- 375mm EXISTING STORM WATER PIPELINE
- 450mm EXISTING STORM WATER PIPELINE
- 600mm EXISTING STORM WATER PIPELINE
- 675mm EXISTING STORM WATER PIPELINE
- 750mm EXISTING STORM WATER PIPELINE
- UNKNOWN EXISTING STORM WATER PIPELINE

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
STORMWATER COLLECTION SYSTEM
EXISTING

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **6.2**

6.3.2 Design Storms

The City of Brooks intensity-duration-frequency (IDF) curve was available on the AEP website and was utilized to create a design storm, which was adopted for the present analysis. The following formula defines the intensity-duration-frequency (IDF) curves for various storms, with the coefficients varying according to the return period (frequency), the storm intensity, and the storm duration. Rainfall intensity is calculated as:

$$i = \frac{a}{(t+b)^c}$$

Where:

i is the rainfall intensity (mm/hour).

t is time (minutes).

a, b and ***c*** are the constants for the respective design storm return period.

The design storms used in this analysis are the 4-hour 1:5 year storm and the 24-hour 1:100 year storm. The coefficients for the City of Brooks design storms that were used in this study are presented in Table 6.1.

Table 6.1 – IDF Equation Coefficients

Return Period	*a*	*b*	*c*
1 in 5 Year	683.84	7.91	0.807
1 in 100 Year	1508.47	8.47	0.849

The 4-hour, 1:5 year design storm for the City of Brooks produces approximately 32 mm of precipitation. The 24 hour, 1:100 year design storm produces approximately 75 mm of precipitation.

6.3.3 Computer Modeling

A storm water analysis of the Village was undertaken using the hydrologic modeling program PCSWMM. The model was used to aid in determination of runoff volumes, peak flow rates, and to size SWMFs for storage of runoff.

Specific parameters used in the PCSWMM modeling for the pre-development and post-development conditions can be found in Appendix D.

6.4 Proposed Drainage Work

6.4.1 Major (Overland) Drainage

Presently in the developed areas of the Village, ditches and road systems are used to drain the storm water from major events. The majority of the land development in the Village has not included SWMFs for the major storm events. Only the most recent developments include SWMFs. For new developments, SWMFs should be considered to prevent flooding and comply with AEP Standards and Guidelines and the Water Act.

Site survey and the computer modeling results show that the existing SWMF located near the school is adequately sized for the 4 hour 1:5 year storm. The computer modeling results show that the SWMF does not have adequate capacity for the 24 hour 1:100 year storm. The SWMF should be expanded to prevent flooding and protect the homes near the SWMF. The estimated size of the pond expansion for a 1:100 year event is 6,000 m^3.

Future Residential Development is planned for the southeast corner of the study area within catchments N, O and P. Catchment N naturally drains from southwest to northeast with an existing SWMF at the northeast corner. As part of the next phase of development, the SWMF should be expanded. With a zero release rate, the estimated size of the pond for this area, including the existing pond, is approximately 8,300 m^3.

Catchment O naturally drains from northwest to southeast with an existing SWMF at the southeast corner. The post-development run-off would flow along the main roads to the SWMF at the southeast corner. The SWMF as shown on the preliminary drawings for this development is sufficiently sized for the planned phases of development. However, the preliminary drawings for the SWMF do not meet the current SWMF requirements as described in 6.3.1. AEP requirements for the SWMF should be reviewed prior to the next phase of development.

Catchment P naturally drains from west to east with a natural low spot at the east side of the planned development. The post-development run-off would flow along the main roads to the SWMF on the east side. With a zero release rate, the estimated size of the pond for this area is approximately 6,000 m^3.

The computer modeling results show that ponding occurs at the culvert crossing Highway 873 just south of Railway Avenue. The culvert is undersized for a 4 hour 1:5 year storm event at the current level of development. A SWMF or an upsized and/or a lowered culvert crossing should be considered to alleviate the ponding, however; there is limited space available within the Village boundary near the highway crossing to construct a SWMF. Therefore, an upsized culvert crossing should be considered. A SWMF may be required if the downstream landowners are not willing to accept increased flow rates with an upsized culvert. The minimum culvert size that should be considered is 1050 mm. With the current release rate that the culvert provides, the estimated volume of storage required for a 24 hour 1:100 year design storm is 19,000 m^3. Upgrades to this location should be done in consultation with Alberta Transportation and downstream landowners.

The computer modeling results show that ponding occurs at the culvert crossing Railway Avenue west of 2nd Street West. This area has a natural low area that should be checked to confirm there is sufficient storage for a 24 hour 1:100 year design storm. Utilizing a release rate equal to the capacity of the culvert yields a storage requirement of approximately 6,400 m^3.

Figure 6.3 show the proposed overland drainage improvements for the study area including the location of the existing and proposed SWMFs.

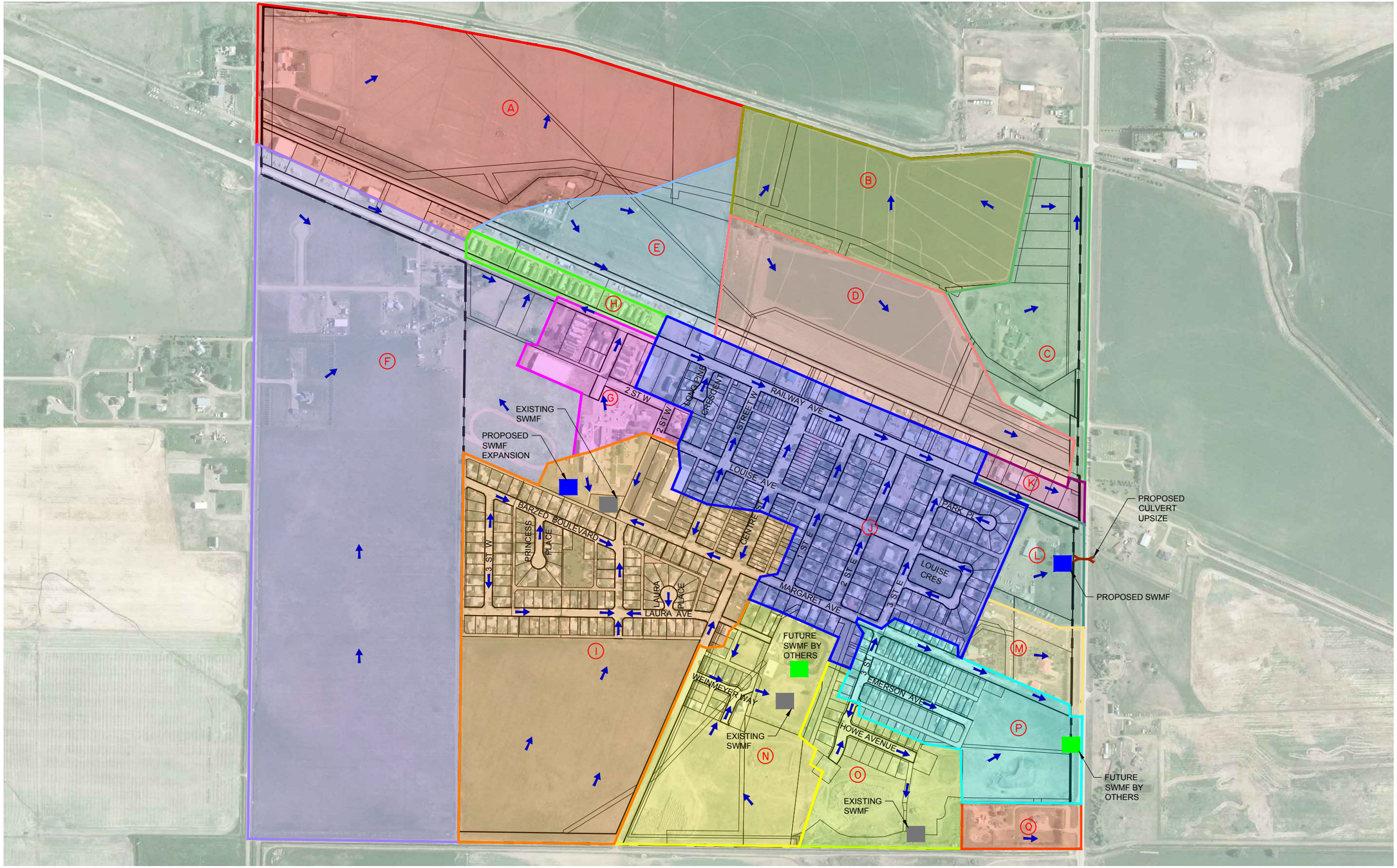
6.4.2 Minor (Underground) Drainage

The computer modeling results show that the storm water collection system in the older portion of the Village is insufficient to convey the 4 hour 1:5 year design storm.

The computer modeling results show that the storm water collection system functions relatively well. The model shows that there will be ponding in a few areas including the corners of Railway Avenue and 1st Street West and Railway Avenue and 2nd Street East, and on 2nd Street East between Railway Avenue and Louise Avenue. In the event of a minor 1:5 year storm, the computer model shows ponding for no longer than 1 hour in these locations. To eliminate the ponding in a minor storm event there would need to be major upgrades to the main along Railway Avenue, which collects all the storm water runoff.

The model also shows that there will be minor ponding at the east end of Emerson Avenue. In the event of a minor 1:5 year storm, the computer model shows ponding for no longer than 1 hour.

The site survey and the computer modeling results show that there will be ponding at the storm water collection system outlet at Railway Avenue and Highway 873. This is because the outlet is lower than the culvert that crosses Highway 873. To eliminate the ponding resulting from a storm event the culvert that crosses Highway 873 should be lowered and upsized as discussed in 6.4.1.



LEGEND

- VILLAGE BOUNDARY
- MAIN CATCHMENT AREA
- (A) CATCHMENT AREA
- DRAINAGE FLOW ARROWS
- EXISTING STORM WATER MANAGEMENT FACILITY
- PROPOSED STORM WATER MANAGEMENT FACILITY
- STORM WATER MANAGEMENT FACILITY BY OTHERS
- PROPOSED CULVERT

MPE Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
STORM WATER COLLECTION SYSTEM
PROPOSED

SCALE: 1:7500	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **6.3**

6.5 Cost Estimate

Preliminary cost estimates have been prepared for the storm drainage works outlined above. Table 6.2 presents the costs for the storm water improvements. Details of the estimates are included in Appendix D.

Table 6.2 – Proposed Storm Water System Upgrades

Infrastructure Improvement	Preliminary Cost
Margaret Avenue Storm Pond Expansion	$ 270,000
Highway 873 Storm Pond	$ 840,000
Highway 873 Culvert Upgrades	$ 90,000
Total	**$ 1,200,000**

6.6 Conclusions and Recommendations

The Following conclusions can be made:

- Currently the Village has storage for some major (overland) drainage. SWMFs will need to be constructed or expanded for the new developments and for some existing areas of the Village.
- The current minor (underground) system is generally adequate.

The Following Recommendations can be made:

- Design and construction of the proposed storm water management works should proceed in conjunction with the overall development of the Village of Duchess.
- Video inspections should be undertaken in order to assess the condition of the minor (underground) drainage system.
- The Village should continue routine maintenance operations including storm main flushing and manhole and catch basin cleaning.
- The Village should submit to AEP a Storm Water Master Plan in conjunction with a Water Act application for registration of all existing and proposed storm drainage works.

7.0 BUILDING INSPECTIONS

7.1 Village Owned Buildings

The Village has a number of public buildings and amenities including a Village Office/Shop, Equipment Shop, Treated Water Distribution Pump Station, Fire Hall, and Recreation Centre. The mechanical, electrical, and structural components of each of these buildings was given a rating based on the condition as shown in Figure 7.1. Details of the evaluation are found in the following sections.

7.1.1 Village Office/Shop

The mechanical systems are generally in acceptable condition.

- The roof drainage system consists of eaves troughs and downspouts, and is in good condition.
- Hand held fire extinguishers are located throughout the building.
- The drainage system in the shop is a trench drain with a grease trap.
- The water service is 25mm (1") copper to the office and 50mm (2") to the bulk water fill.
- The plumbing fixtures in the washroom, consisting of a sink and toilet, are in good condition.
- A gas fired tank water heater, in good condition, heats the domestic water.
- A forced air furnace with air conditioning heats the office area. The furnace and condensing unit appear to be in acceptable condition; however, they are past their expected life cycle and should be replaced within the next 5 years to avoid unexpected failure ($5,000).
- A radiant tube gas heater and two (2) forced air ceiling-hung gas-fired unit heaters heat the shop. The unit heaters are past their expected life cycles and should be replaced to avoid unexpected failure ($4,000).
- Electric heaters, in good condition, are located in the office entrance and the second floor boardroom to supplement heating.
- The shop is ventilated with a manually operated exhaust fan, in acceptable condition. Ceiling fans (2) are also located in the shop, in acceptable condition.

The electrical systems are generally in good condition.

- The main electrical service is 120/240V, single phase, 200A. The main panel is approximately 80% full, and in acceptable condition.

- Exterior lighting consists of incandescent and halogen lighting. As bulbs fail, they should be replaced with energy efficient LED lighting to save on energy costs.
- The interior lighting consists of a mixture of fluorescent and incandescent lighting. As incandescent bulbs fail, they should be replaced with energy efficient LED lighting to save on energy costs.

The building structure and finishes are generally in good condition.

- The building was constructed in 1965. The building consists of a main floor and a mezzanine.
- The building is an approximately 213 m², wood post and beam building with glulam posts and beams with dimensional wood infill. There are five columns covered in plywood that are in fair condition.
- New walls have been framed and painted in the office portion. Flooring is vinyl tile in poor condition and should be replaced ($10,000).
- The windows throughout are wood framed and painted. The paint is in poor condition.
- The roof is non-vented with no attic space, in good condition.
- The concrete floor has a sump drain, which is in good condition.
- The exterior walls are stucco with minor cracking throughout and should be repaired ($2,000).
- The downspouts are missing leaders or splash pads which help direct rain water away from the building ($500).
- The soffit is non-vented and constructed of plywood, which is in poor shape ($3,500).
- There is no evidence of sub-soil problems.
- The framing of the building is in good condition.
- The building is accessible by the street and two sides in the event of a fire or emergency response.

7.1.2 Equipment Shop (north of Office/Shop)

The mechanical systems are generally in good condition.

- The roof drainage system consists of eaves troughs and downspouts, which are in good condition.
- Hand held fire extinguishers are located throughout the building.
- A forced air ceiling-hung gas-fired unit heaters, in good condition, heat the shop.

The electrical systems are generally in good condition.

- The main electrical service is 120/240V, single phase, 100A. The main panel is approximately 40% full, and in good condition.
- The exterior lighting consists of LED lighting, in good condition.
- The interior lighting consists of incandescent lighting that should be replaced with energy efficient LED lighting to save on energy costs and to reduce replacement frequency as these fixtures are located in the high ceiling of the parking bay and are difficult to access.

The building structure is generally in good condition.

- The building is wood framed with wood trusses, steel-lined approximately 252 m².
- The building has three overhead doors, in good condition.
- The lean-to added to the east side of the building, approximately 25 m², is used for sand storage.
- The concrete slab on grade has some visible cracks. The cracks appear to be shrinkage related and do not show signs of settlement. There is a sump in the middle of the floor. The floor is graded towards the sump for drainage.

7.1.3 Treated Water Distribution Pump Station

The mechanical systems are generally in acceptable condition.

- The roof drainage system consists of eaves troughs and downspouts and is in good condition.
- Hand held fire extinguishers are located throughout the building.
- There are floor drains located throughout the building, which are in acceptable condition.
- The water service is 25mm (1”) from the distribution header.
- The plumbing fixtures consist of a sink and toilet, and are in good condition.
- A gas fired tank water heater, in good condition, heats the domestic water.
- A forced air furnace heats the office, washroom, and front overhead door area. The furnace appears to be in acceptable condition.
- A forced air ceiling-hung gas-fired unit heater (2 total) heats each pump area and filter tank area. The unit heaters are past their expected life cycles and should be replaced to avoid unexpected failure ($2,000), however, the heater in the filter tank area does not

need to be replaced as this area is no longer in use and does not require heat.

- The pump area and filter tank area are both ventilated with ceiling hung makeup air units and motorized intake and relief dampers. Both air units are in acceptable condition, however, the unit in the filter area does not operate, as this area is not in use. Consideration should be taken to salvage this unit if it can be used elsewhere in the Village.

The electrical systems are generally in good condition.

- The building electrical service consists of two (2) 120/240V, single phase, 100A panels. The panels are approximately 95% full, and in acceptable condition.
- The exterior lighting consists of incandescent and halogen lighting. Bulbs should be replaced as they fail with energy efficient LED lighting to save on energy costs.
- The interior lighting consists of incandescent lighting that should be replaced with energy efficient LED lighting to save on energy costs and to reduce replacement frequency as these fixtures are located in the high ceiling of the parking bay and are difficult to access.

The building structure is generally in good condition.

- The building consists of two rigid framed steel buildings with concrete floors. The buildings are used to house the pumps (“Pump Building”), and abandoned water treatment equipment (“Filter Building”). The buildings are conjoined, constructed at two different times.
- The pump building is 15m x 8.76m, Filter Building is 16.9m x 7m.
- The interior concrete slab is in good condition.
- The exterior concrete apron is graded towards the building, preventing the door from opening beyond 100°. There are signs of moisture near the main door.
- The exterior steel cladding, wall and roof structures are in good condition.
- The building envelope is in good condition. The steel lined inside faces of the exterior walls are in good condition.
- The steel roof is peaked away from the door and controls ice and snowfall from the roof.
- The doors and aluminum windows are in good condition. The door is a non-panic release, which may be a safety concern, and should be retrofitted with panic hardware ($500).

- The interior walls, ceiling, and floor are in good condition, with minor worn spots on the concrete floor. The millwork and washroom are in good condition.
- The site landscaping consists of concrete apron surrounding the building, surrounded by gravel and an asphalt apron. The road entrance is gravel. The site has signs of pooling because of poor surface drainage, though there are no signs of sub-soil problems. The site should be re-graded to improve surface drainage ($10,000)
- There is no designated parking for building access, though the layout is suitable for parking.

7.1.4 Fire Hall

The mechanical systems are generally in good condition.

- The roof drainage system consists of eaves troughs and downspouts and is in good condition.
- Hand held fire extinguishers are located throughout the building.
- The drainage system in vehicle bay is a trench drain with a grease trap.
- The water service is 100mm (4”), branching off to 25mm (1”) copper to the office and 100mm (4”) to the bulk water fill.
- The plumbing fixtures in the washroom, consisting of a sink, toilet and shower, are in good condition.
- A gas fired tank water heater, in good condition, heats the domestic water.
- A forced air furnace, in good condition, heats the office area. A forced air ceiling-hung gas-fired unit heaters, in good condition, heats the recreation area above the office.
- Radiant tube gas heaters, in good condition, heats the vehicle bay.
- The vehicle bay is ventilated with a manually operated exhaust fan, as well as manually operated ceiling fans, all in good condition.

The electrical systems are generally in good condition.

- The main electrical service is 120/240V, single phase, 100A. Main panel is approximately 95% full, and in acceptable condition.
- The exterior lighting consists of LED fixtures, in good condition.
- The interior lighting consists of fluorescent lighting throughout, in good condition.
- The building has sufficient exit and emergency lighting fixtures, all in good condition.

The building structure and finishes are generally in good condition.

- The Fire Hall was built in the early 2000s. The building is a 26m x 14.8m, prefabricated rigid steel building with steel cladding inside and out. All cladding is in good condition.
- The building is constructed of both combustible and non-combustible materials with no fire separations in place.
- The building includes a wood construction mezzanine, containing a gym, office, and lunch area.
- The concrete floor has some cracks consistent with shrinkage. There are no signs of settlement and the floors are considered to be in good condition.
- The site landscaping consists of well-graded gravel, which provides sufficient drainage with no evidence of sub-soil problems. The signage provides clear vehicular and pedestrian access points, though the parking lot is small.
- The floor structure, beams, wall structures, and roof of the exterior of the building are in good condition.
- The building envelope, including the steel cladding, fascia, gutters, doors, and windows are in good condition.
- None of the exit doors in the Fire Hall have panic escape latches. There is adequate access to exits in the event of an evacuation.
- The interior of the fire hall, including the doors and hardware, millwork, washrooms materials, etc. are in good condition.
- The interior steel wall and ceiling cladding and concrete floor are in good condition with no indication of settling.

7.1.5 Recreation Centre

The mechanical systems are generally in good condition.

- The roof drainage system consists of eaves troughs and downspouts and is in good condition.
- Hand held fire extinguishers are located throughout the building.
- The water service is 25mm (1”) copper, in good condition.
- The plumbing fixtures in the public washrooms, consisting of sinks, toilets and urinals, are in good condition.
- A gas fired tank water heater, in good condition, heats the domestic water.

- Gas unit heaters, in good condition, heat the lobby and arena. Electric heaters, in good condition, heat the mechanical areas.
- The building is ventilated with 3 natural gas fired air-handling units, mounted on ground level on the exterior. All units are in good condition.

The electrical systems are generally in good condition.

- The main electrical service is 120/208V, 3 phase, 225A. Main panel is approximately 40% full, and in good condition.
- The exterior lighting consists of LED fixtures and is in good condition.
- The interior lighting consists of fluorescent and LED lighting and is good condition.
- The building has sufficient exit and emergency lighting fixtures, and is equipped with a fire alarm system with horn/strobes, door pull stations, and sufficient heat and smoke detectors. All emergency systems are in good condition.

The building structure and finishes are generally in good condition.

- The Recreation Centre was built in 2014. The facility is in like new condition with a rubberized track and infield used for sports and recreation.
- Structure of the building is in good condition. There are no signs of building envelope failure.

7.2 Agricultural Society Owned Buildings

The Duchess Agricultural Society also has a number of buildings in and around the Village of Duchess including a Curling Rink/Library, Community Hall, Hockey Arena, and Golf Clubhouse and Shop. The mechanical, electrical, and structural components of each of these buildings was given a rating based on the condition as shown in Figure 7.1. Details of the evaluation are found in the following sections.

7.2.1 Curling Rink/Library

The mechanical systems are generally in acceptable condition.

- The roof drainage system consists of eaves troughs and downspouts and is in good condition.
- Hand held fire extinguishers are located throughout the building.
- The water service is 25mm (1”) copper, meter located in the kitchen, in acceptable condition.

- The plumbing fixtures in the public washrooms, consisting of sinks, toilets and urinals, are in acceptable condition.
- A gas fired tank water heater, in good condition, heats the domestic water.
- A forced air furnace, in acceptable condition, heats the lounge and kitchen area.
- A forced air furnace heats the library. The furnace is operational, but it is past its expected life cycle and should be replaced within the next 5 years to avoid unexpected failure ($5,000)
- The kitchen exhaust system is equipped with a fire suppression system and is interlocked with a dedicated makeup air unit. The kitchen ventilation is in good condition.
- Forced-air gas-fired unit heaters, in good condition, heats the curling arena.
- The curling arena is ventilated with a manually operated exhaust fan, in good condition.
- The ice plant compressors, pumps, and condenser are past their expected life cycle and are in marginal condition. The ice plant is currently operational. However, it should be replaced to reduce maintenance costs and provide higher efficiency ($700,000).

The electrical systems are generally in acceptable condition.

- The main electrical service is 120/208V, 3 phase, 200A. Main panel is approximately 95% full, and in acceptable condition.
- The exterior lighting consists of a mix of incandescent, halogen, and LED fixtures. Lenses on halogen and incandescent fixtures are weathered and yellowing, and should be replaced with energy efficient LED fixtures.
- The interior lighting consists of fluorescent lighting throughout, in good condition.
- The building has sufficient exit and emergency lighting fixtures, and is equipped with a fire alarm system with bells, door pull stations, and sufficient heat and smoke detectors. All emergency systems are in acceptable condition.

The building structure and finishes are generally in good condition.

- The Curling Rink is a large building of wood construction. The interior and exterior finishes are vinyl siding.
- The building is 37 years old and utilizes a sand bed for the curling ice, surrounded by a concrete curb.
- The site location and surrounding area is well manicured and graded for adequate

drainage. The asphalt is in good condition, with no signs of sub-soil problem. The site accessories are in good condition and there is no concern for the site safety. Three sides are open for fire vehicle access, while signage for pedestrian access points, bus lanes, and adequate parking are clear and concise. The asphalt parking lot provides surface drainage and the layout and condition of the sidewalks, ramps, and curbs are in excellent condition.

- The interior floor structure and beams are in acceptable condition, lying flat and even.
- The wall structure and columns coverings are in in good shape with no signs of bending, cracking or settling.
- The roof is steel cladded and in good condition. There is no presence of an ice break above the entry doors.
- The exterior vinyl siding is in good condition.
- The downspouts have no leaders or splash pads.
- Most of the steel doors and frames have panic hardware and are in acceptable condition. The exit doors do not have panic hardware but are in good condition.
- The windows and window accessories are free of cracks, rusting, or deterioration. The overall building envelope is in good condition.
- The interior walls are clean, and the floors have no signs of cracks or indications of differential settlement.
- The vinyl flooring is in acceptable condition; however, it should be replaced in the next 5-10 years ($12,000).
- The ceiling is stippled and in good condition.

7.2.2 Community Hall

The mechanical systems are generally in good condition.

- The roof drainage system consists of eaves troughs and downspouts and is in good condition.
- Hand held fire extinguishers are located throughout the building.
- The water service is 25mm (1”) copper, in acceptable condition.
- The plumbing fixtures in the public washrooms, consisting of sinks, toilets and urinals, are in good condition. In the north “drama room” there is a poorly maintained washroom consisting of a sink and toilet. These fixtures are in poor condition and should

be replaced if this washroom is to be maintained ($2,000).

- A gas fired tank water heater, in good condition, heats the domestic water.
- Five (5) gas-fired furnaces all located in the main mechanical room, heat the building. The furnaces include air conditioning coils. All furnaces are in good condition.

The electrical systems are generally in acceptable condition.

- The main electrical service is 120/240V, single phase, 200A. Main panel is approximately 95% full, and in acceptable condition.
- The exterior lighting consists of a mix of incandescent, halogen, and LED fixtures. As fixtures fail, they should be replaced with energy efficient LED fixtures.
- The interior lighting consists of incandescent and fluorescent fixtures, in acceptable condition. As they fail, fixtures should be replaced with energy efficient LED fixtures.
- The building has sufficient exit and emergency lighting fixtures, and is equipped with a fire alarm system with bells, door pull stations, and sufficient heat and smoke detectors. All emergency systems are in acceptable condition.

The building structure and architectural finishes are generally in acceptable condition.

- The single story, wood constructed community hall consists of three conjoined buildings, which have been added on over the years.
- The main hall room is 15x30m, the kitchen 15x13m, and an addition used for extra storage and occupancy is 7.2x30m.
- The asphalt surrounding the building provides a large parking lot with adequate surface drainage.
- There are no controls for ice and snow falling from the roof and there are no leaders or splash pads on the downspouts.
- Some minor surface cracking is visible on sidewalks, but not an indicator of significant sub-soil settlement.
- The building exterior is vinyl sided and in good condition.
- The floor structure and beams are slab on grade, and covered in vinyl plank flooring in good condition.
- The walls are finished gyprock in good condition. There are some minor cracks in the gyprock walls throughout the building. The inside faces of the exterior walls show evidence of minor cracking ($5,000).

- Overall, the building envelope is in good condition as there are no signs of heavy condensation on the doors or windows.
- The interior is updated as the floors, doors and windows were recently replaced, though some cracking in doorways are visible and is common in similar buildings. The doors and window hardware are in good condition.
- The main hall has tile ceiling, while the other two rooms have stippled gyprock.
- The building materials are combustible and the building is non-sprinklered.
- The building has barrier-free access.

7.2.3 Hockey Arena

The mechanical systems are generally in good condition.

- The roof drainage system consists of eaves troughs and downspouts and is in good condition.
- Hand held fire extinguishers are located throughout the building. Some cabinets are missing fire extinguishers; these cabinets should contain extinguishers to maintain coverage ($1,000).
- A fire hose cabinet is located in the front mechanical room and is in good condition.
- The water service is 50mm (2”) copper, in acceptable condition.
- The plumbing fixtures in the public washrooms, consisting of sinks, toilets and urinals, are in acceptable condition. Each change room contains one toilet, sink, and shower. All change room plumbing fixtures are in good condition.
- A gas fired tank water heater, which includes a separate hot water storage tank, heats the domestic water. Another gas-fired tank domestic water heater is located in the Zamboni room for Zamboni operation. Heaters and tank are all in good condition.
- The kitchen exhaust system is equipped with a fire suppression system and is interlocked with a dedicated makeup air unit. Kitchen ventilation is in good condition.
- A gas-fired furnace, located in the main mechanical room, heats the change rooms. Furnace is in acceptable condition.
- Gas-fired radiant heaters, all in good condition, heat the arena.
- Gas-fired forced-air unit heaters, all in good condition, heat the maintenance and ice-plant areas
- Ventilation is supplied by wall-mounted exhaust fans, with two in the arena, two in the

ice plant, and one for the change rooms. All exhaust fans are in acceptable condition.

- Ice plant compressors, pumps, and condenser appear to be in acceptable condition.

The electrical systems are generally in acceptable condition.

- The building service electrical panel is 120/240V, single phase, 125A. Panel is approximately 60% full, and in acceptable condition.
- The exterior lighting consists of LED fixtures, in good condition.
- The interior lighting consists of fluorescent fixtures, in good condition.
- Building has sufficient exit and emergency lighting fixtures, and is equipped with a fire alarm system with bells, door pull stations, and sufficient heat and smoke detectors. All emergency systems are in acceptable condition.

The building structure and finishes are generally in good condition.

- The building is rigid steel framing with steel cladding.
- The splash pads under several of the downspouts are graded towards the building, and should be re-graded to direct rain and melt water away from the building foundation ($1,000).
- The exterior cladding is in good condition; however, some panels are showing denting and damage. The damage does not compromise the integrity of the building, but should be considered for repair for aesthetics.
- The exposed walls inside the service area of the building show exposed insulation that has slight damage. This should be repaired or replaced as part of regular building maintenance.
- The exposed concrete flooring is in good condition. There are minor cracks, which are consistent with concrete floors.
- The large long span open web steel trusses that span the building are in good condition, with some minor surface rusting on some of the members. The trusses should have the rust removed and then painted with a zinc rich paint to ensure longevity ($5,000).
- The columns are open web trusses constructed from square hollow structural steel.
- The lobby area of the Arena has stands for spectating as well as a foyer and kitchen/canteen. The flooring is vinyl tile in fair condition. The walls have modern coverings and are in good condition. The ceiling has a steel liner.

- The doors and hardware throughout the building are in good condition.

7.2.4 Golf Clubhouse and Shop

The mechanical systems are generally in acceptable condition.

- The roof drainage system consists of eaves troughs and downspouts and is in good condition.
- Hand held fire extinguishers are located throughout the building.
- The water service is 25mm (1") copper, in acceptable condition.
- The plumbing fixtures in washrooms consist of sinks, toilets and urinals, and are in good condition.
- A domestic style gas fired tank water heater, in good condition, heats the domestic water.
- The kitchen exhaust system is equipped with a fire suppression system and is in good condition.
- A gas-fired radiant tube heater, in acceptable condition, heats the shop building.
- A gas-fired forced-air furnace, in acceptable condition, heats the clubhouse.

The electrical systems are generally in acceptable condition.

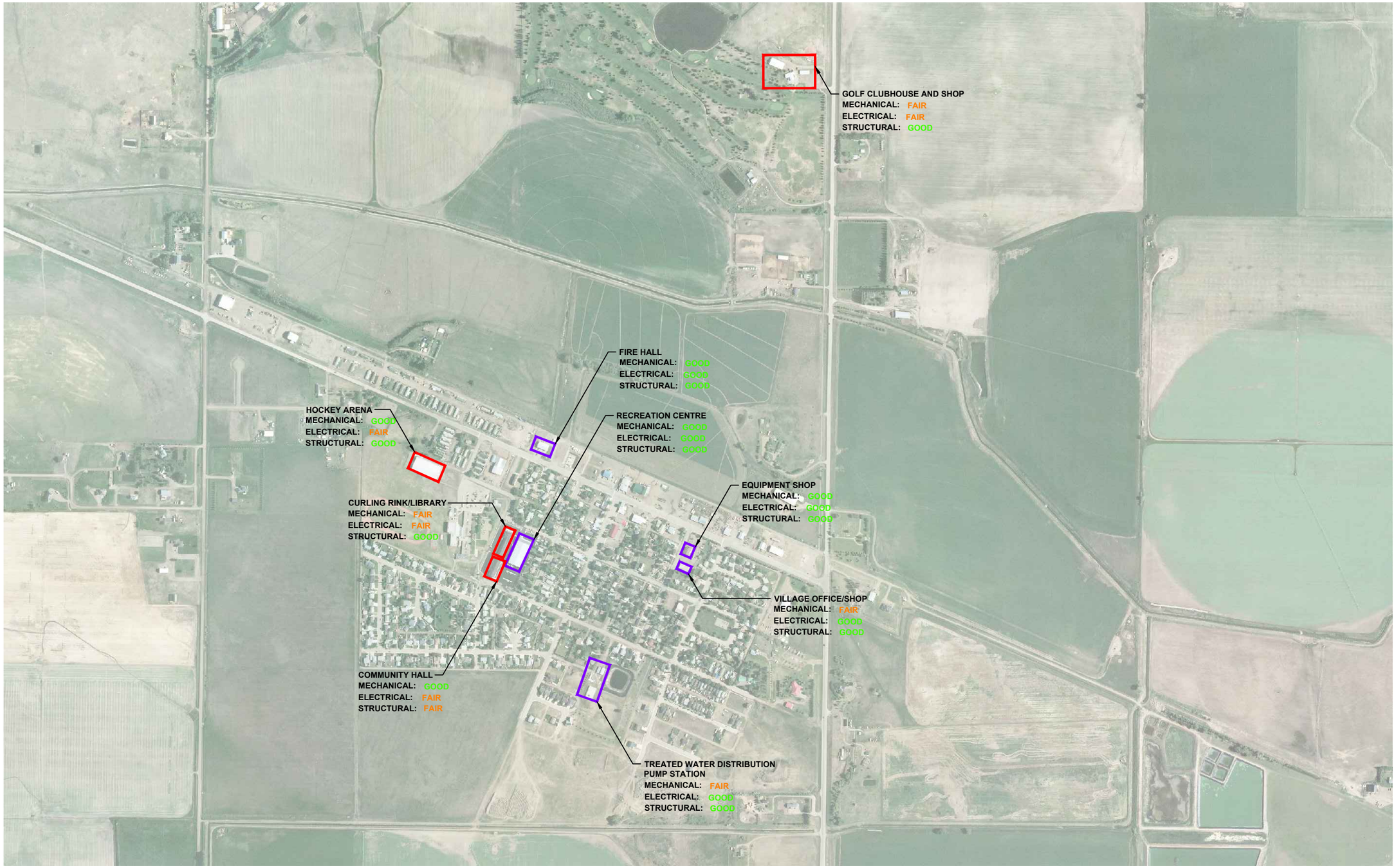
- The shop electrical service is 120/240V, single phase, 100A. Panel is approximately 90% full, and in acceptable condition.
- The clubhouse main electrical service is 120/240V, single phase, 100A. Panel is approximately 95% full, and in acceptable condition.
- The exterior lighting consists of a mix of incandescent and halogen fixtures. As lighting fixtures fail, they should be replaced with energy efficient LED fixtures.
- The interior lighting consists of incandescent and compact fluorescent fixtures, in acceptable condition. As lighting fixtures fail, they should be replaced with energy efficient LED bulbs.

The structures of the maintenance shop and clubhouse are generally in good condition.

- The maintenance shop consists of two small buildings. Both are approximately 131 m^2 and separated by a shared wall.
- The concrete floors of the maintenance shops are in good condition.
- The walls in the shop are unfinished gyproc. The second building is a cold storage unit

with exposed framing. Some cracks are visible in the gyproc joints in the ceiling and should be repaired ($1,500).

- The clubhouse is single floor, wood framed, built in 1992. The building is vinyl sided with a shingled roof. It has an approximated area of 3000 ft2.
- There are no visible cracks in the foundation.
- The doors and windows are in satisfactory condition.
- The interior consists of a combination of floor tile and carpet, and finished gyproc walls.
- The kitchen floor is vinyl tile and in good condition.
- The cabinets in the kitchen are in acceptable condition. The counters are worn and should be refinished in 5 years at the latest ($2,500).
- The asphalt and landscaped area surrounding the clubhouse provides adequate drainage.



LEGEND

VILLAGE OWNED BUILDING

AGRICULTURAL SOCIETY OWNED BUILDING

Engineering Ltd.

VILLAGE OF DUCHESS

INFRASTRUCTURE MASTER PLAN
BUILDING CONDITION ASSESSMENT

SCALE: 1:10 000	DATE: OCTOBER 2018	JOB: 1447-001-01	FIGURE: **7.1**

7.3 Cost Summary

7.3.1 Village Owned Buildings

A summary of the cost of the proposed building upgrades are presented in Table 7.1.

Table 7.1 – Proposed Village Owned Building Upgrades

Building	Description of Upgrades	Order of Magnitude Cost
7.2 – Village Office/Shop	Replace office heater	$ 5,000
	Replace shop heaters	$ 4,000
	Replace office flooring	$ 10,000
	Repair stucco	$ 2,000
	Downspout leaders or splash pads	$ 500
	Replace soffit	$ 3,500
7.4 – Treated Water Distribution Pump Station	Replace pump area unit heater	$ 2,000
	Install door panic hardware	$ 500
	Site re-grading	$10,000
Total		**$ 37,500**

7.3.2 Agricultural Society Owned Buildings

A summary of the cost of the proposed building upgrades are presented in Table 7.2. The costs for the proposed upgrades to Agricultural Society Owned Buildings are not included in further sections of the report as they are not attributable to the Village.

Table 7.2 – Proposed Agricultural Society Owned Building Upgrades

Building	Description of Upgrades	Order of Magnitude Cost
7.6 – Curling Rink/Library	Replace library furnace	$ 5,000
	Replace ice plant	$700,000
	Replace flooring	$12,000
7.8 – Community Hall	Replace drama room plumbing fixtures	$ 2,000
	Repair wall cracking	$ 5,000
7.9 – Hockey Arena	Replace missing fire extinguishers	$ 1,000
	Regrade splash pads away from building	$ 1,000
	Remove rust and paint trusses	$ 5,000
7.10 – Golf Clubhouse and Shop	Repair cracks in gyproc in shop	$ 1,500
	Re-finish kitchen counters	$ 2,500
Total		**$ 735,000**

8.0 COST ANALYSIS

The Village of Duchess, in undertaking this Infrastructure Master Plan, has developed the background and framework for maintaining and expanding the basic infrastructure needed to support a growing community. The relevant information on each of the major infrastructure systems is presented in their respective sections within this report.

Upgrades and expansions have been identified for the various systems, and cost estimates have been developed in association with the proposed works. The cost estimates were prepared for each improvement independently of others. However, projects could be completed in conjunction with others to use funds more efficiently and avoid duplication of cost on items such as roadwork.

Table 8.1 summarizes all of the infrastructure work noted in the various sections of this plan along with the estimated costs and suggested timeframe for completion.

The Capital Plan should be an evolving plan to address infrastructure items, both those included here and others that may arise. Therefore, the Capital Plan presented here may represent priorities as they exist this year, but next year some items may shift either ahead or back in the plan. The value in laying out projects in this capital plan is that the Village can use the plan to position itself to best advantage in pursuing Provincial and Federal funding, in seeking debentures, in assigning off-site levies, and in judging appropriate levels of taxation.

Table 8.1 - Village of Duchess - Infrastructure Capital Plan

		Project Costs, Based on Year 2018 Dollars						
Proposed Project Year	**Infrastructure Projects**	**Concrete and Road Works**	**Water System Upgrades**	**Sanitary System Upgrades**	**Storm Water Improvements**	**Public Buildings**	**PROJECT TOTAL**	**PER YEAR**
2019	3rd Street East - Short Term	$154,000.00					$154,000.00	
	Long Pine Court West - Short Term	$54,000.00					$54,000.00	
	Louise Avenue - Short Term	$82,000.00					$82,000.00	
	Laura Avenue West - Short Term	$194,000.00					$194,000.00	
	Inflow/Infiltration Study			$40,000.00			$40,000.00	
	Sanitary Main Condition Assessment			$180,000.00			$180,000.00	
	Highway 873 Culvert Upgrades				$90,000.00		$90,000.00	
	Village Offfice/Shop Building Upgrades					$25,000.00	$25,000.00	**$819,000.00**
2020	2nd Street West - Short Term	$82,000.00					$82,000.00	
	Margaret Avenue West - Short Term	$60,000.00					$60,000.00	
	Barzed Avenue West - Short Term	$86,000.00					$86,000.00	
	Railway Avenue East - Short Term	$678,000.00					$678,000.00	
	Railway Avenue East Upsize		$350,000.00				$350,000.00	
	Railway Avenue MH 36 to 1R			$230,000.00			$230,000.00	
	Distribution Pump Station Building Upgrades					$12,500.00	$13,000.00	**$1,499,000.00**
2021	Margaret Avenue East - Short Term	$131,000.00					$131,000.00	
	Railway Avenue West -Short Term	$583,000.00					$583,000.00	
	Railway Avenue West Upsize		$690,000.00				$690,000.00	**$1,404,000.00**
2022	Park Place East - Short Term	$45,000.00					$45,000.00	
	Princess Place West - Short Term	$37,000.00					$37,000.00	
	Centre Street - Short Term	$327,000.00					$327,000.00	
	Louise Crescent East - Short Term	$122,000.00					$122,000.00	
	Proposed Hydrants		$110,000.00				$110,000.00	**$641,000.00**
2023	3rd Street West - Short Term	$86,000.00					$86,000.00	
	Margaret Avenue Storm Pond Expansion				$270,000.00		$270,000.00	**$356,000.00**
2024	Highway 873 Storm Pond				$840,000.00		$840,000.00	**$840,000.00**
2025	3rd Street East - Medium Term	$110,000.00					$110,000.00	
	2nd Street East - Medium Term	$7,000.00					$7,000.00	**$117,000.00**
2026	Howe Avenue East - Medium Term	$58,000.00					$58,000.00	
	Emerson Avenue East - Medium Term	$70,000.00					$70,000.00	
	Weinmeyer Way East - Medium Term	$3,000.00					$3,000.00	**$131,000.00**
2027	Margaret Avenue - Medium Term	$44,000.00					$44,000.00	
	Centre Street - Medium Term	$62,000.00					$62,000.00	
	1 st Street East - Medium Term	$12,000.00					$12,000.00	
	Park Place East - Medium Term	$15,000.00					$15,000.00	**$133,000.00**
2028	Laura Place West - Medium Term	$7,000.00					$7,000.00	
	2nd Street West - Medium Term	$21,000.00					$21,000.00	
	Laura Avenue West - Medium Term	$21,000.00					$21,000.00	
	3rd Street West - Medium Term	$8,000.00					$8,000.00	
	Princess Place West - Medium Term	$6,000.00					$6,000.00	
	Barzed Avenue West - Medium Term	$51,000.00					$51,000.00	
	Long Pine Court West - Medium Term	$4,000.00					$4,000.00	**$118,000.00**
2029	2nd Street West - Medium Term	$39,000.00					$39,000.00	
	Louise Avenue - Medium Term	$119,000.00					$119,000.00	**$158,000.00**
2030	Louise Crescent East - Medium Term	$43,000.00					$43,000.00	
	Long Pine Crescent Looping		$100,000.00				$100,000.00	**$143,000.00**
2031	Railway Avenue East - Medium Term	$157,000.00					$157,000.00	**$157,000.00**
2032	Centre Street - Long Term	$164,000.00					$164,000.00	**$164,000.00**
2033	2nd Street East - Long Term	$113,000.00					$113,000.00	
	2nd Street East Upsize		$90,000.00				$90,000.00	**$203,000.00**
2034	Park Place East - Long Term	$4,000.00					$4,000.00	
	1 Street East - Long Term	$118,000.00					$118,000.00	**$122,000.00**
2035	Magaret Avenue West - Long Term	$140,000.00					$140,000.00	**$140,000.00**
2036	Weinmeyer Way East - Long Term	$62,000.00					$62,000.00	
	Laura Place West - Long Term	$18,000.00					$18,000.00	
	Laura Avenue West - Long Term	$15,000.00					$15,000.00	
	3rd Street West - Long Term	$2,000.00					$2,000.00	
	Princess Place West - Long Term	$5,000.00					$5,000.00	
	Barzed Avenue West - Long Term	$8,000.00					$8,000.00	**$110,000.00**
2037	1st Street West - Long Term	$127,000.00					$127,000.00	
	Long Pine Court West - Long Term	$2,000.00					$2,000.00	**$129,000.00**
2038	Louise Avenue - Long Term	$90,000.00					$90,000.00	
	Railway Avenue - Long Term	$13,000.00					$13,000.00	**$103,000.00**
	TOTAL COSTS:	**$4,459,000.00**	**$1,340,000.00**	**$450,000.00**	**$1,200,000.00**	**$38,000.00**	**$7,487,000.00**	**$7,487,000.00**

8.1 Funding

Government grants and funding support are available to communities like Duchess to undertake infrastructure projects, which, if secured, would enable these projects to become more feasible. Available funding programs that apply include the Federal Gas Tax, Basic Municipal Transportation Grant (BMTG), Investing in Canada Plan, and Clean Water and Wastewater Fund (CWWF).

9.0 REFERENCES

Alberta Environment and Parks, “Municipal Policies and Procedures Manual,” Environmental Sciences Division, Municipal Program Development Branch, Edmonton, Alberta, April 2001.

Alberta Environment and Parks, “Standards and Guidelines for Municipal Waterworks, Wastewater and Strom Drainage Systems,” Drinking Water Branch, Environmental Policy Branch, Environmental Assurance Division, Edmonton, Alberta, April 2012.

City of Lethbridge, “Design Standards 2016 Edition”, Lethbridge, Alberta, 2016.

Appendix A – Road Network Evaluation & Cost Estimates

Village of Duchess

Infrastructure Master Plan

Road Component Evaluations

	Road Description	Side of Road	Curb & Gutter							Concrete Swale								Separate Sidewalk												Monolithic Sidewalk												Roads						
			Type	Total Length	Cracking	Spalling	Displace	Replace	Overall	Location	Total Length	width	Area	Cracking	Spalling	Displace	Overall	Total Length	Area	# Section	Section Length	Section Width	Section Area	Cracking	Spalling	Trip Hazard	Replace	Percent Good	Overall	Type	Total Length	Area	# Section	Section Length	Section Width	Section Area	Cracking	Spalling	Trip Hazard	Replace	Overall	Type	Width	Length	Area	Rehabilitation Treatment	Overall Rating	Rating
				(m)	(#)	(m)	(m)	(m)	Rating		(m)	(m)	(m^2)	L/M/H	L/M/H	Y/N	Rating	(m)	(m^2)		(m)	(m)	(m^2)	Section	Section	Section	(m^2)	%	Rating		(m)	(m^2)		(m)	(m)	(m^2)	Section	Section	Section	(m^2)	Rating		(m)	(m)	(m^2)		/100	
10	3rd Street East - End to Howe Ave East	W																											Roll	80	96.0	53	1.5	1	2				0	Good	A	8.3	60.3	501	Edge Mill and Overlay 50mm	80.4	Good
		E	Stan	70.0				0	Good																																						
20	3rd Street East - Howe Ave East to Emerson Ave East	W																											Roll	105	126.0	70	1.5	1	2	1			2	Good	A	8.3	105.7	877	Edge Mill and Overlay 50mm	76.8	Good
		E	Roll	105.0	3			9	Good																																						
30	3rd Street East - Emerson Ave East to Margaret Ave East	W	Roll	100.0	1			3	Good	N	15	1	15.0	M	L		Fair	100.0	120.0	67	1.50	1.20	1.8	1			2	99%	Good													A	10.8	102.5	1107	Edge Mill and Overlay 50mm	77.7	Good
		E	Roll	90.0	1	2		9	Fair																																						
40	3rd Street East - Margaret Ave East to Louise Cres East	W	Roll	90.0	11		2	39	Poor																																	A	10.8	100.4	1084	Edge Mill and Overlay 50mm	71.7	Good
		E																											Roll	95	114.0	63	1.5	1	2	12			22	Fair								
50	3rd Street East - Louise Cres East to Louise Cres East	W	Roll	70.0	1		1	6	Good																																	A	10.8	71.7	775	Edge Mill and Overlay 50mm	43.5	Poor
		E																											Roll	65	78.0	43	1.5	1	2	2			4	Good								
60	3rd Street East - Louise Cres East to Park Place East	W	95	95.0		1	1	6	Good																																	A	10.8	100.2	1083	Edge Mill and Overlay 50mm	71.1	Good
		E																											Roll	90	108.0	60	1.5	1	2	17		1	32	Poor								
70	3rd Street East - Park Place East to Railway Ave East	W	Stan	65.0	1		1	6	Good																																	A	10.8	71.5	772	Edge Mill and Overlay 50mm	59.1	Fair
		E																											Roll	60	72.0	19	3.2	1	4	7		1	31	Poor								
80	Howe Avenue East - 3rd St East to Cul de Sac	N	Roll	145.0	3			9	Good																																	A	10.3	141.6	1459	Edge Mill and Overlay 50mm	83.5	Good
		S																											Roll	145	174.0	97	1.5	1	2	4			7	Good								
90	Emerson Avenue East - 3rd St East to End	N	Roll	210.0				0	Good																																	A	8.0	217.8	1743	Edge Mill and Overlay 50mm	78.2	Good
		S	Roll	210.0		1		3	Good																																						
100	Weinmeyer Way East - Centre St to End	N/E																											Roll	170	204.0	113	1.5	1	2	11			20	Good	A	9.3	151.6	1410	Edge Mill and Overlay 50mm	89.2	Good
		S/W	Roll	145.0	5	1		18	Fair																																						
110	Centre Street - End to Weinmeyer Way East	W	Roll	65.0				0	Good																																	A	12.3	49.0	603	Edge Mill and Overlay 50mm	99.4	Good
		E																											Roll	55	66.0	37	1.5	1	2				0	Good								
120	Centre Street - Weinmeyer Way East to Laura Ave West	W	Roll	120.0	1			3	Good																																	A	12.3	115.9	1426	Edge Mill and Overlay 50mm	100.0	Good
		E																											Roll	110	132.0	73	1.5	1	2	2			4	Good								
130	Centre Street - Laura Ave West to Margaret Ave East	W	Roll	100.0				0	Good	N	12	1	12.3	M			Fair																											A	12.3	113.4	1395	Edge Mill and Overlay 50mm	87.4	Good
		E	Roll	105.0				0	Good																																						
140	Centre Street - Margaret Ave East to Louise Ave East	W								S	22	2	32.3	L	L		Fair	160.0	192.0	80	2.00	1.20	2.4	3			7	96%	Good													A	12.0	174.3	2091	Full Mill and Overlay 50mm	47.5	Poor
		E																160.0	192.0	80	2.00	1.20	2.4	2		5	17	91%	Good																				
150	Centre Street - Louise Ave East to Railway Ave East	W																											Stan	160.0	480.0	89	1.8	3.0	5.4	24	8	4	194	Poor	A	24.0	170.3	4087	Full Mill and Overlay 50mm	30.9	Poor
		E																											Stan	160	448.0	89	1.8	3	5	15	10	9	171	Poor								
160	Park Place East - 3rd St East to Cul de Sac	N								W	16	2	23.4		L		Fair													Roll	125	150.0	83	1.5	1	2	5	1		11	Good	A	9.3	120.8	1123	Edge Mill and Overlay 50mm	62.3	Fair
		S																											Roll	125	150.0	83	1.5	1	2	21	1		40	Fair								
170	2nd Street East - Margaret Ave East to Louise Ave East	W																165.0	198.0	110	1.50	1.20	1.8	5	5	8	32	84%	Fair													A	8.0	171.5	1372	Edge Mill and Overlay 50mm	90.7	Good
		E																105.0	126.0	70	1.50	1.20	1.8	2		1	5	96%	Good																				
180	2nd Street East - Louise Ave East to Railway Ave East	W																160	192.0	107	1.50	1.20	1.8	4	3		13	93%	Good													A	8.0	169.8	1359	Edge Mill and Overlay 50mm	100.0	Good
190	1st Street East - Margaret Ave East to Louise Ave East	W																140.0	168.0	93	1.50	1.20	1.8	6	1	6	23	86%	Fair													A	8.3	171.9	1427	Edge Mill and Overlay 50mm	89.4	Good
		E																155.0	186.0	103	1.50	1.20	1.8	1		4	9	95%	Good																				
200	1st Street East - Louise Ave East to Railway Ave East	W																110.0	132.0	69	1.60	1.20	1.9	11	3	2	31	77%	Fair													A	8.3	170.1	1412	Edge Mill and Overlay 50mm	90.0	Good
		E																110.0	132.0	69	1.60	1.20	1.9	2		4	12	91%	Good																				
210	Laura Place West - Laura Ave West to Cul de Sac	W	Roll	60.0	2			6	Fair	S	21	1	21.4	M			Fair																											A	9.3	48.2	449	Edge Mill and Overlay 50mm	100.0	Good
		E	Roll	60.0	3		1	12	Fair																																						
220	2nd Street West - Alley to Laura Ave West	W																											Roll	45.0	54.0	30	1.5	1.2	1.8	4	1	2	13	Fair	A	9.3	47.0	437	Edge Mill and Overlay 50mm	41.3	Poor
		E																											Roll	45.0	54.0	30	1.5	1	2	7		1	14	Fair								
230	2nd Street West - Laura Ave West to Barzed Ave West	W																											Roll	120.0	144.0	80	1.5	1.2	1.8	12	1	1	25	Fair	A	9.3	131.0	1218	Edge Mill and Overlay 50mm	69.7	Fair
		E																											Roll	125.0	150.0	83	1.5	1.2	1.8	10			18	Fair								
240	2nd Street West - Barzed Ave West to Margaret Ave West	W																											Roll	50	60.0	33	1.5	1	2				0	Good	A	9.3	38.3	357	Edge Mill and Overlay 50mm	55.5	Fair
		E																											Roll	45	54.0	30	1.5	1	2	2		1	5	Poor								
250	Margaret Avenue West - 2nd St West to 1st St West	N	Roll	130.0	1	1		6	Good																																	A	10.3	146.8	1512	Edge Mill and Overlay 50mm	55.1	Fair
		S																											Roll	130	195.0	87	1.5	2	2	4			9	Good								
260	Margaret Avenue West - 1st St West to Centre St	N	Roll	95.0	1	1		6	Good																																	A	10.3	106.9	1101	Edge Mill and Overlay 50mm	82.0	Good
		S																											Roll	100	120.0	67	1.5	1	2	2			4	Good								
270	Margaret Avenue East - Centre St to 1st St East	N																																							A	10.3	105.5	1086	Edge Mill and Overlay 50mm	100.0	Good
		S																											Roll	100.0	150.0	67	1.5	2	2				0	Good								
280	Margaret Avenue East - 1st St East to 2nd St East	N																																							A	10.3	95.3	982	Edge Mill and Overlay 50mm	100.0	Good
		S																											Roll	100.0	150.0	67	1.5	1.5	2				0	Good								
290	Margaret Avenue East - 2nd St East to 3rd St East	N																																							A	10.3	100.7	1037	Edge Mill and Overlay 50mm	100.0	Good
		S																											Roll	95.0	142.5	63	1.5	1.5	2.3				0	Good								
300	Margaret Avenue East - 3rd St East to Start of Gravel	N																											Roll	225	270.0	132	1.7	1	2	6		1	14	Good	A	10.3	239.9	2471	Full Mill and Overlay 50mm	57.4	Fair
		S	Roll	225.0	5			15	Good									225.0	270.0	132	1.70	1.20	2.0				0	100%	Good																				
310	Laura Avenue West - Range Rd 144A to 3rd St West	N	Roll	45.0	1			3	Good																																	A	9.3	44.0	409	Edge Mill and Overlay 50mm	47.6	Poor
		S																											Roll	50	60.0	33	1.5	1	2		1		2	Good								
320	Laura Avenue West - 3rd St West to 2nd St West	N	Roll	90.0	5			15	Fair	E	18	2	26.7				Good													Roll	15	18.0	10	1.5	1	2	10		3	23	Poor	A	9.3	256.0	2381	Edge Mill and Overlay 50mm	65.8	Fair
		S																											Roll	240	288.0	160	1.5	1	2	8	8	8	43	Fair								
330	Laura Avenue West - 2nd St West to Laura Place West	N								W	14	2	21.6	L			Good													Roll	85.0	102.0	57	1.5	1.2	1.8	3			5	Good	A	9.3	97.0	902	Edge Mill and Overlay 50mm	57.5	Fair
		S																											Roll	90.0	108.0	60	1.5	1.2	2	5	1	1	13	Fair								
340	Laura Avenue West - Laura Place West to Centre St	N	Roll	80.0	3			9	Fair																																	A	9.3	92.6	861	Full Mill and Overlay 50mm	56.4	Fair
		S																											Roll	85.0	102.0	57	1.5	1.2	2	1		2	5	Good								
350	3rd Street West - Laura Ave West to Barzed Ave West	W								N	16	2	23.3	L			Fair													Roll	225.0	270.0	150	1.5	1.2	1.8	2		1	5	Good	A	9.3	232.1	2159	Edge Mill and Overlay 50mm	56.6	Fair
		E	Roll	220.0	3	5	1	27	Fair																																						
360	Princess Place West - Cul de Sac to Barzed Ave West	W	Roll	110.0	5	3		24	Fair	N	19	2	28.5		L		Good																									A	9.3	99.1	922	Edge Mill and Overlay 50mm	63.5	Fair
		E	Roll	110.0	4	1		15	Fair																																						
370	Barzed Avenue West - Range Rd 144A to 3rd St West	N																											Roll	50	60.0	33	1.5	1	2				0	Good	A	9.3	52.6	489	Edge Mill and Overlay 50mm	57.3	Fair
		S	Roll	45.0	4			12	Fair																																						
380	Barzed Avenue West - 3rd St West to Princess Place West	N																											Roll	95	114.0	63	1.5	1	2			3	5	Good	A	9.3	107.9	1004	Edge Mill and Overlay 50mm	72.8	Good
		S	Roll	90.0	6	3		27	Poor																																						
390	Barzed Avenue West - Princess Place West to 2nd St West	N								E	20	2	30.2				Good													Roll	160.0	192.0	107	1.5	1.2	1.8	9	4	1	25	Fair	A	9.3	163.6	1522	Edge Mill and Overlay 50mm	52.1	Fair
		S																											Roll	155.0	186.0	103	1.5	1	2	22	5	8	63	Poor								
400	1st Street West - Margaret Avenue West to Louise Avenue West	W	Roll	165.0				0	Good	S	17	2	26.1				Good	165.0	198.0	110	1.50	1.20	1.8	3	3	1	13	94%	Good													A	8.3	171.6	1424	Edge Mill and Overlay 50mm	93.9	Good
		E	Roll	165.0				0	Good									165.0	198.0	110	1.50	1.20	1.8	5		2	13	94%	Good																				
410	1st Street West - Louise Avenue West to Railway Avenue West	W	Roll	160.0				0	Good									160.0	192.0	100	1.60	1.20	1.9	1		2	6	97%	Good													A	8.3	170.1	1412	Edge Mill and Overlay 50mm	96.3	Good
		E	Roll	160.0	1			3	Good									160.0	192.0	80	2.00	1.20	2.4	5		1	14	93%	Good																				

Village of Duchess

Infrastructure Master Plan

Road Component Evaluations

	Road Description	Side of Road	Curb & Gutter							Concrete Swale								Separate Sidewalk												Monolithic Sidewalk											Roads						
			Type	Total Length	Cracking	Spalling	Displace	Replace	Overall	Location	Total Length	width	Area	Cracking	Spalling	Displace	Overall	Total Length	Area	# Section	Section Length	Section Width	Section Area	Cracking	Spalling	Trip Hazard	Replace	Percent Good	Overall	Type	Total Length	Area	# Section	Section Length	Section Width	Section Area	Cracking	Spalling	Trip Hazard	Replace	Overall	Type	Width	Length	Area	Rehabilitation Treatment	Overall Rating	Rating
				(m)	(#)	(m)	(m)	(m)	Rating		(m)	(m)	(m^2)	L/M/H	L/M/H	Y/N	Rating	(m)	(m^2)		(m)	(m)	(m^2)	Section	Section	Section	(m^2)	%	Rating		(m)	(m^2)		(m)	(m)	(m^2)	Section	Section	Section	(m^2)	Rating		(m)	(m)	(m^2)		/100	
420	Long Pine Court West - Cul de Sac to Railway Ave West	W																												Roll	75	75.0	47	1.6	1	2	2			3	Good	A	10.3	65.9	679	Full Mill and Overlay + LBR	13.9	Poor
		E																											Roll	75	75.0	47	1.6	1	2	6		1	11	Fair							
430	2nd Street West - Railway Ave West to Louise Ave West																																								A	9.3	103.4	961	Edge Mill and Overlay 50mm	85.5	Good
440	Louise Avenue West - 2nd St West to 1st St West	N								E	21	1	21.0				Good	125.0	150.0	83	1.50	1.20	1.8	8	8	2	32	78%	Fair													A	8.3	334.0	2773	Edge Mill and Overlay 50mm	79.3	Good
		S																																											
450	Louise Avenue West - 1st St West to Centre St	N								E	21	1	21.0				Good	90.0	108.0	60	1.50	1.20	1.8	2		2	7	93%	Good													A	8.3	104.8	870	Edge Mill and Overlay 50mm	47.1	Poor
		S																90.0	108.0	60	1.50	1.20	1.8				0	100%	Good																		
460	Louise Avenue East - Centre St to 1st St East	N																90.0	108.0	60	1.50	1.20	1.8	4		5	16	85%	Fair													A	9.0	107.5	967	Edge Mill and Overlay 50mm	91.0	Good
		S																90.0	108.0	60	1.50	1.20	1.8			1	2	98%	Good																		
470	Louise Avenue East - 1st St East to 2nd St East	N																90.0	108.0	60	1.50	1.20	1.8	8	5		23	78%	Fair													A	9.0	99.1	892	Edge Mill and Overlay 50mm	96.2	Good
		S																90.0	108.0	60	1.50	1.20	1.8	3			5	95%	Good																		
480	Louise Avenue East - 2nd St East to 3rd St East	N								E	16	2	24.0	L			Good	20.0	20.0	20	1.00	1.00	1.0	20			20	0%	Poor													A	9.0	98.5	887	Full Mill and Overlay 50mm	32.7	Poor
		S																																										
490	Louise Crescent East - 3rd St East to 3rd St East	Outside								N	14	2	20.4	L			Fair													Roll	310	372.0	207	1.5	1	2	41	5	4	90	Fair	A	10.3	298.9	3079	Edge Mill and Overlay 50mm	62.6	Fair
		Inside	Stan	260.0	16	8		72	Fair	S	15	2	22.2		L		Fair																														
500	Railway Avenue West - Range Road 145 to Brianne Blvd																																								A	8.5	341.0	2898	Edge Mill and Overlay 50mm	95.4	Good
510	Railway Avenue West - Brianne Blvd to Modular Home Park Entrance																																								A	8.5	134.0	1139	Edge Mill and Overlay 50mm	78.9	Good
520	Railway Avenue West - Modular Home Park Entrance to Brianne Blvd																																								A	8.5	234.5	1993	Edge Mill and Overlay 50mm	70.7	Good
530	Railway Avenue West - Brianne Blvd to 2nd St West	N	Stan	55.0		2		6	Fair																																A	8.5	62.3	529	Full Mill and Overlay 75mm	55.0	Fair
540	Railway Avenue West - 2nd St West to Long Pine Court West	N	Stan	190.0				0	Good																																A	14.3	187.7	2684	Full Mill and Overlay + LBR	44.5	Poor
		S	Stan	90.0		1	1	6	Good																					Stan	85	170.0	28	3.0	2	6	5			30	Fair							
550	Railway Avenue West - Long Pine Court West to 1st St West	N	Stan	90.0		4		12	Fair																																A	14.3	99.0	1416	Full Mill and Overlay + LBR	39.9	Poor
		S																											Stan	80	80.0	17	4.6	1	5	4			18	Fair							
560	Railway Avenue West - 1st St West to Centre St	N	Stan	105.0	3	5	1	27	Fair																																A	14.3	102.6	1467	Full Mill and Overlay 75mm	35.7	Poor
		S																											Stan	85	85.0	27	3.1	1	3	4	3		22	Fair							
570	Railway Avenue East - Centre St to 1st St East	N	Stan	105.0		4		12	Fair																																A	14.3	104.4	1493	Full Mill and Overlay + LBR	37.4	Poor
		S																											Stan	85.0	85.0	27	3.1	1	3	8	4		37	Poor							
580	Railway Avenue East - 1st St East to 2nd St East	N	Stan	100.0		1	3	12	Fair																																A	14.3	99.0	1416	Full Mill and Overlay + LBR	38.5	Poor
		S																											Stan	90.0	90.0	29	3.1	1.0	3	6	2		25	Fair							
590	Railway Avenue East - 2nd St East to 3rd St East	N	Stan	100.0	1	2		9	Good																																A	14.3	103.3	1478	Arterial Reconstruction	34.1	Poor
		S																											Stan	90.0	153.0	26	3.4	1.7	5.8	1	1		12	Good							
600	Railway Avenue East - 3rd St East to Range Road 144	N	Stan	255.0	3	2	1	18	Good																																A	14.3	272.6	3899	Full Mill and Overlay + LBR	42.7	Poor
		S	Stan	265.0	2	2	1	15	Good																																					

Village of Duchess - Infrastructure Master Plan
Roads

Short Term Cost Estimates

3rd Street East

40.0	3rd Street East - Margaret Ave East to Louise Cres East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,084	m^2	$ 30.00	$ 32,600.00
2	Remove and Replace Concrete Curb & Gutter	39	m^2	$ 110.00	$ 4,300.00
				SUBTOTAL	$ 36,900.00
CONTINGENCY (15%)					$ 5,600.00
GEOTECHNICAL (2.5%)					$ 1,100.00
ENGINEERING (12%)					$ 5,100.00
				TOTAL	**$ 49,000.00**

50.0	3rd Street East - Louise Cres East to Louise Cres East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	775	m^2	$ 30.00	$ 23,300.00
				SUBTOTAL	$ 23,300.00
CONTINGENCY (15%)					$ 3,500.00
GEOTECHNICAL (2.5%)					$ 700.00
ENGINEERING (12%)					$ 3,300.00
				TOTAL	**$ 31,000.00**

60.0	3rd Street East - Louise Cres East to Park Place East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,083	m^2	$ 30.00	$ 32,500.00
2	Remove and Replace Monolithic Sidewalk	32	m^2	$ 210.00	$ 6,900.00
				SUBTOTAL	$ 32,500.00
CONTINGENCY (15%)					$ 4,900.00
GEOTECHNICAL (2.5%)					$ 1,000.00
ENGINEERING (12%)					$ 4,500.00
				TOTAL	**$ 43,000.00**

70.0	3rd Street East - Park Place East to Railway Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	772	m^2	$ 30.00	$ 23,200.00
2	Remove and Replace Monolithic Sidewalk	31	m^2	$ 210.00	$ 6,500.00
				SUBTOTAL	$ 23,200.00
CONTINGENCY (15%)					$ 3,500.00
GEOTECHNICAL (2.5%)					$ 700.00
ENGINEERING (12%)					$ 3,300.00
				TOTAL	**$ 31,000.00**

3rd Street East Total **$ 154,000.00**

Short Term Cost Estimates

Centre Street

140.0	Centre Street - Margaret Ave East to Louise Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay 50mm	2,091	m^2	$ 40.00	$ 83,700.00
				SUBTOTAL	$ 83,700.00
CONTINGENCY (15%)					$ 12,600.00
GEOTECHNICAL (2.5%)					$ 2,500.00
ENGINEERING (12%)					$ 11,600.00
				TOTAL	**$ 111,000.00**

150.0	Centre Street - Louise Ave East to Railway Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay 50mm	4,087	m^2	$ 40.00	$ 163,500.00
2	Remove and Replace Monolithic Sidewalk	366	m^2	$ 210.00	$ 76,900.00
				SUBTOTAL	$ 163,500.00
CONTINGENCY (15%)					$ 24,600.00
GEOTECHNICAL (2.5%)					$ 4,800.00
ENGINEERING (12%)					$ 22,600.00
				TOTAL	**$ 216,000.00**

Centre Street Total **$ 327,000.00**

Park Place East

160.0	Park Place East - 3rd St East to Cul de Sac	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,123	m^2	$ 30.00	$ 33,800.00
				SUBTOTAL	$ 33,800.00
CONTINGENCY (15%)					$ 5,100.00
GEOTECHNICAL (2.5%)					$ 1,000.00
ENGINEERING (12%)					$ 4,700.00
				TOTAL	**$ 45,000.00**

Park Place East Total **$ 45,000.00**

2nd Street West

220.0	2nd Street West - Alley to Laura Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	437	m^2	$ 30.00	$ 13,200.00
				SUBTOTAL	$ 13,200.00
CONTINGENCY (15%)					$ 2,000.00
GEOTECHNICAL (2.5%)					$ 400.00
ENGINEERING (12%)					$ 1,900.00
				TOTAL	**$ 18,000.00**

230.0	2nd Street West - Laura Ave West to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,218	m^2	$ 30.00	$ 36,600.00
				SUBTOTAL	$ 36,600.00
CONTINGENCY (15%)					$ 5,500.00
GEOTECHNICAL (2.5%)					$ 1,100.00
ENGINEERING (12%)					$ 5,100.00
				TOTAL	**$ 49,000.00**

240.0	2nd Street West - Barzed Ave West to Margaret Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	357	m^2	$ 30.00	$ 10,700.00
2	Remove and Replace Monolithic Sidewalk	5	m^2	$ 210.00	$ 1,200.00
				SUBTOTAL	$ 10,700.00
CONTINGENCY (15%)					$ 1,700.00
GEOTECHNICAL (2.5%)					$ 400.00
ENGINEERING (12%)					$ 1,500.00
				TOTAL	**$ 15,000.00**

2nd Street West Total **$ 82,000.00**

Margaret Avenue

250.0	Margaret Avenue West - 2nd St West to 1st St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,512	m^2	$ 30.00	$ 45,400.00
				SUBTOTAL	$ 45,400.00
CONTINGENCY (15%)					$ 6,900.00
GEOTECHNICAL (2.5%)					$ 1,400.00
ENGINEERING (12%)					$ 6,300.00
				TOTAL	**$ 60,000.00**

300.0	Margaret Avenue East - 3rd St East to Start of Gravel	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay 50mm	2,471	m^2	$ 40.00	$ 98,900.00
				SUBTOTAL	$ 98,900.00
CONTINGENCY (15%)					$ 14,900.00
GEOTECHNICAL (2.5%)					$ 2,900.00
ENGINEERING (12%)					$ 13,700.00
				TOTAL	**$ 131,000.00**

Margaret Avenue Total **$ 191,000.00**

Short Term Cost Estimates

Laura Avenue West

310.0	Laura Avenue West - Range Rd 144A to 3rd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	409	m^2	$ 30.00	$ 12,300.00
				SUBTOTAL	$ 12,300.00
CONTINGENCY (15%)					$ 1,900.00
GEOTECHNICAL (2.5%)					$ 400.00
ENGINEERING (12%)					$ 1,800.00
				TOTAL	**$ 17,000.00**

320.0	Laura Avenue West - 3rd St West to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	2,381	m^2	$ 30.00	$ 71,500.00
2	Remove and Replace Monolithic Sidewalk	23	m^2	$ 210.00	$ 5,000.00
				SUBTOTAL	$ 71,500.00
CONTINGENCY (15%)					$ 10,800.00
GEOTECHNICAL (2.5%)					$ 2,100.00
ENGINEERING (12%)					$ 9,900.00
				TOTAL	**$ 95,000.00**

330.0	Laura Avenue West - 2nd St West to Laura Place West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	902	m^2	$ 30.00	$ 27,100.00
				SUBTOTAL	$ 27,100.00
CONTINGENCY (15%)					$ 4,100.00
GEOTECHNICAL (2.5%)					$ 800.00
ENGINEERING (12%)					$ 3,800.00
				TOTAL	**$ 36,000.00**

340.0	Laura Avenue West - Laura Place West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay 50mm	861	m^2	$ 40.00	$ 34,500.00
				SUBTOTAL	$ 34,500.00
CONTINGENCY (15%)					$ 5,200.00
GEOTECHNICAL (2.5%)					$ 1,000.00
ENGINEERING (12%)					$ 4,800.00
				TOTAL	**$ 46,000.00**

Laura Avenue West Total **$ 194,000.00**

Short Term Cost Estimates

3rd Street West

350.0	3rd Street West - Laura Ave West to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	2,159	m^2	$ 30.00	$ 64,800.00
				SUBTOTAL	$ 64,800.00
CONTINGENCY (15%)					$ 9,800.00
GEOTECHNICAL (2.5%)					$ 1,900.00
ENGINEERING (12%)					$ 9,000.00
				TOTAL	**$ 86,000.00**

3rd Street West Total **$ 86,000.00**

Princess Place West

360.0	Princess Place West - Cul de Sac to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	922	m^2	$ 30.00	$ 27,700.00
				SUBTOTAL	$ 27,700.00
CONTINGENCY (15%)					$ 4,200.00
GEOTECHNICAL (2.5%)					$ 800.00
ENGINEERING (12%)					$ 3,900.00
				TOTAL	**$ 37,000.00**

Princess Place West Total **$ 37,000.00**

Barzed Avenue West

370.0	Barzed Avenue West - Range Rd 144A to 3rd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	489	m^2	$ 30.00	$ 14,700.00
				SUBTOTAL	$ 14,700.00
CONTINGENCY (15%)					$ 2,300.00
GEOTECHNICAL (2.5%)					$ 500.00
ENGINEERING (12%)					$ 2,100.00
				TOTAL	**$ 20,000.00**

380.0	Barzed Avenue West - 3rd St West to Princess Place West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	27	m^2	$ 110.00	$ 3,000.00
				SUBTOTAL	$ 3,000.00
CONTINGENCY (15%)					$ 500.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 500.00
				TOTAL	**$ 5,000.00**

Short Term Cost Estimates

390.0	Barzed Avenue West - Princess Place West to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,522	m^2	$ 30.00	$ 45,700.00
2	Remove and Replace Monolithic Sidewalk	63	m^2	$ 210.00	$ 13,300.00
				SUBTOTAL	$ 45,700.00
CONTINGENCY (15%)					$ 6,900.00
GEOTECHNICAL (2.5%)					$ 1,400.00
ENGINEERING (12%)					$ 6,400.00
				TOTAL	**$ 61,000.00**

Barzed Avenue West Total **$ 86,000.00**

Long Pine Court West

420.0	Long Pine Court West - Cul de Sac to Railway Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay + LBR	679	m^2	$ 60.00	$ 40,800.00
				SUBTOTAL	$ 40,800.00
CONTINGENCY (15%)					$ 6,200.00
GEOTECHNICAL (2.5%)					$ 1,200.00
ENGINEERING (12%)					$ 5,700.00
				TOTAL	**$ 54,000.00**

Long Pine Court West Total **$ 54,000.00**

Louise Avenue

450.0	Louise Avenue West - 1st St West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	870	m^2	$ 30.00	$ 26,100.00
				SUBTOTAL	$ 26,100.00
CONTINGENCY (15%)					$ 4,000.00
GEOTECHNICAL (2.5%)					$ 800.00
ENGINEERING (12%)					$ 3,700.00
				TOTAL	**$ 35,000.00**

Short Term Cost Estimates

480.0	Louise Avenue East - 2nd St East to 3rd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay 50mm	887	m^2	$ 40.00	$ 35,500.00
2	Remove and Replace Separate Sidewalk	20	m^2	$ 150.00	$ 3,000.00
				SUBTOTAL	$ 35,500.00
CONTINGENCY (15%)					$ 5,400.00
GEOTECHNICAL (2.5%)					$ 1,100.00
ENGINEERING (12%)					$ 5,000.00
				TOTAL	**$ 47,000.00**

Louise Avenue Total **$ 82,000.00**

Louise Crescent East

490.0	Louise Crescent East - 3rd St East to 3rd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	3,079	m^2	$ 30.00	$ 92,400.00
				SUBTOTAL	$ 92,400.00
CONTINGENCY (15%)					$ 13,900.00
GEOTECHNICAL (2.5%)					$ 2,700.00
ENGINEERING (12%)					$ 12,800.00
				TOTAL	**$ 122,000.00**

Louise Crescent East Total **$ 122,000.00**

Railway Avenue

510.0	Railway Avenue West - Brianne Blvd to Modular Home Park Entrance	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,139	m^2	$ 30.00	$ 34,200.00
				SUBTOTAL	$ 34,200.00
CONTINGENCY (15%)					$ 5,200.00
GEOTECHNICAL (2.5%)					$ 1,000.00
ENGINEERING (12%)					$ 4,800.00
				TOTAL	**$ 46,000.00**

520.0	Railway Avenue West - Modular Home Park Entrance to Brianne Blvd	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,993	m^2	$ 30.00	$ 59,800.00
				SUBTOTAL	$ 59,800.00
CONTINGENCY (15%)					$ 9,000.00
GEOTECHNICAL (2.5%)					$ 1,800.00
ENGINEERING (12%)					$ 8,300.00
				TOTAL	**$ 79,000.00**

Short Term Cost Estimates

530.0	Railway Avenue West - Brianne Blvd to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay 75mm	529	m^2	$ 50.00	$ 26,500.00
				SUBTOTAL	$ 26,500.00
CONTINGENCY (15%)					$ 4,000.00
GEOTECHNICAL (2.5%)					$ 800.00
ENGINEERING (12%)					$ 3,700.00
				TOTAL	**$ 35,000.00**

540.0	Railway Avenue West - 2nd St West to Long Pine Court West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay + LBR	2,684	m^2	$ 60.00	$ 161,100.00
				SUBTOTAL	$ 161,100.00
CONTINGENCY (15%)					$ 24,200.00
GEOTECHNICAL (2.5%)					$ 4,700.00
ENGINEERING (12%)					$ 22,300.00
				TOTAL	**$ 213,000.00**

550.0	Railway Avenue West - Long Pine Court West to 1st St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay + LBR	1,416	m^2	$ 60.00	$ 85,000.00
				SUBTOTAL	$ 85,000.00
CONTINGENCY (15%)					$ 12,800.00
GEOTECHNICAL (2.5%)					$ 2,500.00
ENGINEERING (12%)					$ 11,800.00
				TOTAL	**$ 113,000.00**

560.0	Railway Avenue West - 1st St West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay 75mm	1,467	m^2	$ 50.00	$ 73,400.00
				SUBTOTAL	$ 73,400.00
CONTINGENCY (15%)					$ 11,100.00
GEOTECHNICAL (2.5%)					$ 2,200.00
ENGINEERING (12%)					$ 10,200.00
				TOTAL	**$ 97,000.00**

570.0	Railway Avenue East - Centre St to 1st St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay + LBR	1,493	m^2	$ 60.00	$ 89,600.00
				SUBTOTAL	$ 89,600.00
CONTINGENCY (15%)					$ 13,500.00
GEOTECHNICAL (2.5%)					$ 2,600.00
ENGINEERING (12%)					$ 12,400.00
				TOTAL	**$ 119,000.00**

Short Term Cost Estimates

580.0	Railway Avenue East - 1st St East to 2nd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay + LBR	1,416	m^2	$ 60.00	$ 85,000.00
				SUBTOTAL	$ 85,000.00
CONTINGENCY (15%)					$ 12,800.00
GEOTECHNICAL (2.5%)					$ 2,500.00
ENGINEERING (12%)					$ 11,800.00
				TOTAL	**$ 113,000.00**

590.0	Railway Avenue East - 2nd St East to 3rd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Arterial Reconstruction	1,478	m^2	$ 70.00	$ 103,500.00
				SUBTOTAL	$ 103,500.00
CONTINGENCY (15%)					$ 15,600.00
GEOTECHNICAL (2.5%)					$ 3,000.00
ENGINEERING (12%)					$ 14,300.00
				TOTAL	**$ 137,000.00**

600.0	Railway Avenue East - 3rd St East to Range Road 144	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Full Mill and Overlay + LBR	3,899	m^2	$ 60.00	$ 234,000.00
				SUBTOTAL	$ 234,000.00
CONTINGENCY (15%)					$ 35,100.00
GEOTECHNICAL (2.5%)					$ 6,800.00
ENGINEERING (12%)					$ 32,300.00
				TOTAL	**$ 309,000.00**

Railway Avenue Total	**$**	**1,261,000.00**
Total Short	**$**	**2,721,000.00**

3rd Street East

10.0	3rd Street East - End to Howe Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	501	m^2	$ 30.00	$ 15,100.00
				SUBTOTAL	$ 15,100.00
CONTINGENCY (15%)					$ 2,300.00
GEOTECHNICAL (2.5%)					$ 500.00
ENGINEERING (12%)					$ 2,100.00
				TOTAL	**$ 20,000.00**

20.0	3rd Street East - Howe Ave East to Emerson Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	877	m^2	$ 30.00	$ 26,400.00
				SUBTOTAL	$ 26,400.00
CONTINGENCY (15%)					$ 4,000.00
GEOTECHNICAL (2.5%)					$ 800.00
ENGINEERING (12%)					$ 3,700.00
				TOTAL	**$ 35,000.00**

30.0	3rd Street East - Emerson Ave East to Margaret Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,107	m^2	$ 30.00	$ 33,300.00
2	Remove and Replace Concrete Curb & Gutter	9	m^2	$ 110.00	$ 1,000.00
3	Remove and Replace Concrete Swale	15	m^2	$ 120.00	$ 1,800.00
				SUBTOTAL	$ 36,100.00
CONTINGENCY (15%)					$ 5,500.00
GEOTECHNICAL (2.5%)					$ 1,100.00
ENGINEERING (12%)					$ 5,000.00
				TOTAL	**$ 48,000.00**

40.0	3rd Street East - Margaret Ave East to Louise Cres East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	22	m^2	$ 210.00	$ 4,600.00
				SUBTOTAL	$ 4,600.00
CONTINGENCY (15%)					$ 700.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 700.00
				TOTAL	**$ 7,000.00**

3rd Street East Total **$ 110,000.00**

Medium Term Cost Estimates

Howe Avenue East

80.0	Howe Avenue East - 3rd St East to Cul de Sac	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,459	m^2	$ 30.00	$ 43,800.00
				SUBTOTAL	$ 43,800.00
CONTINGENCY (15%)					$ 6,600.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 6,100.00
				TOTAL	**$ 58,000.00**

Howe Avenue East Total **$ 58,000.00**

Emerson Avenue East

90.0	Emerson Avenue East - 3rd St East to End	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,743	m^2	$ 30.00	$ 52,300.00
				SUBTOTAL	$ 52,300.00
CONTINGENCY (15%)					$ 7,900.00
GEOTECHNICAL (2.5%)					$ 1,600.00
ENGINEERING (12%)					$ 7,300.00
				TOTAL	**$ 70,000.00**

Emerson Avenue East Total **$ 70,000.00**

Weinmeyer Way East

100.0	Weinmeyer Way East - Centre St to End	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	18	m^2	$ 110.00	$ 2,000.00
				SUBTOTAL	$ 2,000.00
CONTINGENCY (15%)					$ 300.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 300.00
				TOTAL	**$ 3,000.00**

Weinmeyer Way East Total **$ 3,000.00**

Medium Term Cost Estimates

Centre Street

130.0	Centre Street - Laura Ave West to Margaret Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,395	m^2	$ 30.00	$ 41,900.00
				SUBTOTAL	$ 41,900.00
CONTINGENCY (15%)					$ 6,300.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 5,800.00
				TOTAL	**$ 56,000.00**

140.0	Centre Street - Margaret Ave East to Louise Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	32	m^2	$ 120.00	$ 3,900.00
				SUBTOTAL	$ 3,900.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 6,000.00**

Centre Street Total **$ 62,000.00**

Park Place East

160.0	Park Place East - 3rd St East to Cul de Sac	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	23	m^2	$ 120.00	$ 2,900.00
2	Remove and Replace Monolithic Sidewalk	40	m^2	$ 210.00	$ 8,400.00
				SUBTOTAL	$ 11,300.00
CONTINGENCY (15%)					$ 1,700.00
GEOTECHNICAL (2.5%)					$ 400.00
ENGINEERING (12%)					$ 1,600.00
				TOTAL	**$ 15,000.00**

Park Place East Total **$ 15,000.00**

Medium Term Cost Estimates

2nd Street East

170.0	2nd Street East - Margaret Ave East to Louise Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Separate Sidewalk	32	m^2	$ 150.00	$ 4,900.00
				SUBTOTAL	$ 4,900.00
CONTINGENCY (15%)					$ 800.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 700.00
				TOTAL	**$ 7,000.00**

2nd Street East Total **$ 7,000.00**

1 Street East

190.0	1st Street East - Margaret Ave East to Louise Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Separate Sidewalk	23	m^2	$ 150.00	$ 3,600.00
				SUBTOTAL	$ 3,600.00
CONTINGENCY (15%)					$ 600.00
					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 5,000.00**

200.0	1st Street East - Louise Ave East to Railway Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Separate Sidewalk	31	m^2	$ 150.00	$ 4,700.00
				SUBTOTAL	$ 4,700.00
CONTINGENCY (15%)					$ 800.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 700.00
				TOTAL	**$ 7,000.00**

1 Street East Total **$ 12,000.00**

Laura Place West

210.0	Laura Place West - Laura Ave West to Cul de Sac	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	18	m^2	$ 110.00	$ 2,000.00
2	Remove and Replace Concrete Swale	21	m^2	$ 120.00	$ 2,600.00
				SUBTOTAL	$ 4,600.00
CONTINGENCY (15%)					$ 700.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 700.00
				TOTAL	**$ 7,000.00**

Laura Place West Total **$ 7,000.00**

2nd Street West

220.0	2nd Street West - Alley to Laura Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	27	m^2	$ 210.00	$ 5,700.00
				SUBTOTAL	$ 5,700.00
CONTINGENCY (15%)					$ 900.00
					$ 200.00
ENGINEERING (12%)					$ 800.00
				TOTAL	**$ 8,000.00**

230.0	2nd Street West - Laura Ave West to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	43	m^2	$ 210.00	$ 9,100.00
				SUBTOTAL	$ 9,100.00
CONTINGENCY (15%)					$ 1,400.00
GEOTECHNICAL (2.5%)					$ 300.00
ENGINEERING (12%)					$ 1,300.00
				TOTAL	**$ 13,000.00**

2nd Street West Total **$ 21,000.00**

Margaret Avenue

260.0	Margaret Avenue West - 1st St West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,101	m^2	$ 30.00	$ 33,100.00
				SUBTOTAL	$ 33,100.00
CONTINGENCY (15%)					$ 5,000.00
GEOTECHNICAL (2.5%)					$ 1,000.00
ENGINEERING (12%)					$ 4,600.00
				TOTAL	**$ 44,000.00**

Margaret Avenue Total **$ 44,000.00**

Laura Avenue West

320.0	Laura Avenue West - 3rd St West to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	15	m^2	$ 110.00	$ 1,700.00
2	Remove and Replace Monolithic Sidewalk	43	m^2	$ 210.00	$ 9,100.00
				SUBTOTAL	$ 10,800.00
CONTINGENCY (15%)					$ 1,700.00
GEOTECHNICAL (2.5%)					$ 400.00
ENGINEERING (12%)					$ 1,500.00
				TOTAL	**$ 15,000.00**

330.0	Laura Avenue West - 2nd St West to Laura Place West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	13	m^2	$ 210.00	$ 2,700.00
				SUBTOTAL	$ 2,700.00
CONTINGENCY (15%)					$ 500.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 4,000.00**

340.0	Laura Avenue West - Laura Place West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	9	m^2	$ 110.00	$ 1,000.00
				SUBTOTAL	$ 1,000.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

Laura Avenue West Total **$ 21,000.00**

3rd Street West

350.0	3rd Street West - Laura Ave West to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	27	m^2	$ 110.00	$ 3,000.00
1	Remove and Replace Concrete Swale	23	m^2	$ 120.00	$ 2,800.00
				SUBTOTAL	$ 5,800.00
CONTINGENCY (15%)					$ 900.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 900.00
				TOTAL	**$ 8,000.00**

3rd Street West Total **$ 8,000.00**

Princess Place West

360.0	Princess Place West - Cul de Sac to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	39	m^2	$ 110.00	$ 4,300.00
				SUBTOTAL	$ 4,300.00
CONTINGENCY (15%)					$ 700.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 6,000.00**

Princess Place West Total **$ 6,000.00**

Barzed Avenue West

370.0	Barzed Avenue West - Range Rd 144A to 3rd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	12	m^2	$ 110.00	$ 1,400.00
				SUBTOTAL	$ 1,400.00
CONTINGENCY (15%)					$ 300.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 300.00
				TOTAL	**$ 3,000.00**

380.0	Barzed Avenue West - 3rd St West to Princess Place West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,004	m^2	$ 30.00	$ 30,200.00
				SUBTOTAL	$ 30,200.00
CONTINGENCY (15%)					$ 4,600.00
GEOTECHNICAL (2.5%)					$ 900.00
ENGINEERING (12%)					$ 4,200.00
				TOTAL	**$ 40,000.00**

390.0	Barzed Avenue West - Princess Place West to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	25	m^2	$ 210.00	$ 5,300.00
				SUBTOTAL	$ 5,300.00
CONTINGENCY (15%)					$ 800.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 800.00
				TOTAL	**$ 8,000.00**

Barzed Avenue West Total **$ 51,000.00**

Long Pine Court West

420.0	Long Pine Court West - Cul de Sac to Railway Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	11	m^2	$ 210.00	$ 2,400.00
				SUBTOTAL	$ 2,400.00
CONTINGENCY (15%)					$ 400.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 4,000.00**

Long Pine Court West Total **$ 4,000.00**

2nd Street West

430.0	2nd Street West - Railway Ave West to Louise Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	961	m^2	$ 30.00	$ 28,900.00
				SUBTOTAL	$ 28,900.00
CONTINGENCY (15%)					$ 4,400.00
GEOTECHNICAL (2.5%)					$ 900.00
ENGINEERING (12%)					$ 4,000.00
				TOTAL	**$ 39,000.00**

2nd Street West Total **$ 39,000.00**

Louise Avenue

440.0	Louise Avenue West - 2nd St West to 1st St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	2,773	m^2	$ 30.00	$ 83,200.00
2	Remove and Replace Separate Sidewalk	32	m^2	$ 150.00	$ 4,900.00
				SUBTOTAL	$ 83,200.00
CONTINGENCY (15%)					$ 12,500.00
GEOTECHNICAL (2.5%)					$ 2,400.00
ENGINEERING (12%)					$ 11,500.00
				TOTAL	**$ 110,000.00**

460.0	Louise Avenue East - Centre St to 1st St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Separate Sidewalk	16	m^2	$ 150.00	$ 2,500.00
				SUBTOTAL	$ 2,500.00
CONTINGENCY (15%)					$ 400.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 4,000.00**

470.0	Louise Avenue East - 1st St East to 2nd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Separate Sidewalk	23	m^2	$ 150.00	$ 3,600.00
				SUBTOTAL	$ 3,600.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 5,000.00**

490.0	Louise Crescent East - 3rd St East to 3rd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	72	m^2	$ 110.00	$ 8,000.00
2	Remove and Replace Concrete Swale	43	m^2	$ 120.00	$ 5,200.00
3	Remove and Replace Monolithic Sidewalk	90	m^2	$ 210.00	$ 18,900.00
				SUBTOTAL	$ 32,100.00
CONTINGENCY (15%)					$ 4,900.00
GEOTECHNICAL (2.5%)					$ 1,000.00
ENGINEERING (12%)					$ 4,500.00
				TOTAL	**$ 43,000.00**

Louise Avenue Total **$ 162,000.00**

Railway Avenue

500.0	Railway Avenue West - Range Road 145 to Brianne Blvd	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	2,898	m^2	$ 30.00	$ 87,000.00
				SUBTOTAL	$ 87,000.00
CONTINGENCY (15%)					$ 13,100.00
GEOTECHNICAL (2.5%)					$ 2,600.00
ENGINEERING (12%)					$ 12,100.00
				TOTAL	**$ 115,000.00**

530.0	Railway Avenue West - Brianne Blvd to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	6	m^2	$ 110.00	$ 700.00
				SUBTOTAL	$ 700.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

540.0	Railway Avenue West - 2nd St West to Long Pine Court West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	30	m^2	$ 210.00	$ 6,300.00
				SUBTOTAL	$ 6,300.00
CONTINGENCY (15%)					$ 1,000.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 900.00
				TOTAL	**$ 9,000.00**

Medium Term Cost Estimates

550.0	Railway Avenue West - Long Pine Court West to 1st St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	12	m^2	$ 110.00	$ 1,400.00
2	Remove and Replace Monolithic Sidewalk	18	m^2	$ 210.00	$ 3,900.00
				SUBTOTAL	$ 5,300.00
CONTINGENCY (15%)					$ 800.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 800.00
				TOTAL	**$ 8,000.00**

560.0	Railway Avenue West - 1st St West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	27	m^2	$ 110.00	$ 3,000.00
2	Remove and Replace Monolithic Sidewalk	22	m^2	$ 210.00	$ 4,600.00
				SUBTOTAL	$ 7,600.00
CONTINGENCY (15%)					$ 1,200.00
GEOTECHNICAL (2.5%)					$ 300.00
ENGINEERING (12%)					$ 1,100.00
				TOTAL	**$ 11,000.00**

570.0	Railway Avenue East - Centre St to 1st St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	12	m^2	$ 110.00	$ 1,400.00
				SUBTOTAL	$ 1,400.00
CONTINGENCY (15%)					$ 300.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 300.00
				TOTAL	**$ 3,000.00**

580.0	Railway Avenue East - 1st St East to 2nd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	12	m^2	$ 110.00	$ 1,400.00
2	Remove and Replace Monolithic Sidewalk	25	m^2	$ 210.00	$ 5,300.00
				SUBTOTAL	$ 6,700.00
CONTINGENCY (15%)					$ 1,100.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 1,000.00
				TOTAL	**$ 9,000.00**

Railway Avenue Total	**$**	**157,000.00**
Total Med	**$**	**857,000.00**

Long Term Cost Estimates

3rd Street East

10.0	3rd Street East - End to Howe Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	0	m^2	$ 110.00	$ -
2	Remove and Replace Monolithic Sidewalk	0	m^2	$ 210.00	$ -
				SUBTOTAL	$ -
CONTINGENCY (15%)					$ -
GEOTECHNICAL (2.5%)					$ -
ENGINEERING (12%)					$ -
				TOTAL	**$ -**

20.0	3rd Street East - Howe Ave East to Emerson Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	9	m^2	$ 110.00	$ 1,000.00
2	Remove and Replace Monolithic Sidewalk	2	m^2	$ 210.00	$ 400.00
				SUBTOTAL	$ 1,400.00
CONTINGENCY (15%)					$ 300.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 300.00
				TOTAL	**$ 3,000.00**

30.0	3rd Street East - Emerson Ave East to Margaret Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	3	m^2	$ 110.00	$ 400.00
2	Remove and Replace Separate Sidewalk	2	m^2	$ 150.00	$ 300.00
				SUBTOTAL	$ 700.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

50.0	3rd Street East - Louise Cres East to Louise Cres East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	6	m^2	$ 110.00	$ 700.00
2	Remove and Replace Monolithic Sidewalk	4	m^2	$ 210.00	$ 800.00
				SUBTOTAL	$ 1,500.00
CONTINGENCY (15%)					$ 300.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 300.00
				TOTAL	**$ 3,000.00**

60.0	3rd Street East - Louise Cres East to Park Place East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	6	m^2	$ 110.00	$ 700.00
				SUBTOTAL	$ 700.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

70.0	3rd Street East - Park Place East to Railway Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	6	m^2	$ 110.00	$ 700.00
				SUBTOTAL	$ 700.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

3rd Street East Total **$ 12,000.00**

Howe Avenue East

80.0	Howe Avenue East - 3rd St East to Cul de Sac	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	9	m^2	$ 110.00	$ 1,000.00
2	Remove and Replace Monolithic Sidewalk	7	m^2	$ 210.00	$ 1,600.00
				SUBTOTAL	$ 2,600.00
CONTINGENCY (15%)					$ 400.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 4,000.00**

Howe Avenue East **$ 4,000.00**

Emerson Avenue East

90.0	Emerson Avenue East - 3rd St East to End	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	3	m^2	$ 110.00	$ 400.00
				SUBTOTAL	$ 400.00
CONTINGENCY (15%)					$ 100.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 100.00
				TOTAL	**$ 1,000.00**

Emerson Avenue East **$ 1,000.00**

Long Term Cost Estimates

Weinmeyer Way East

100.0	Weinmeyer Way East - Centre St to End	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,410	m^2	$ 30.00	$ 42,400.00
2	Remove and Replace Monolithic Sidewalk	20	m^2	$ 210.00	$ 4,200.00
				SUBTOTAL	$ 46,600.00
CONTINGENCY (15%)					$ 7,000.00
GEOTECHNICAL (2.5%)					$ 1,400.00
ENGINEERING (12%)					$ 6,500.00
				TOTAL	**$ 62,000.00**

Weinmeyer Way East Total **$ 62,000.00**

Center Street

110.0	Centre Street - End to Weinmeyer Way East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	603	m^2	$ 30.00	$ 18,100.00
2	Remove and Replace Concrete Curb & Gutter	0	m^2	$ 110.00	$ -
3	Remove and Replace Monolithic Sidewalk	0	m^2	$ 210.00	$ -
				SUBTOTAL	$ 18,100.00
CONTINGENCY (15%)					$ 2,800.00
GEOTECHNICAL (2.5%)					$ 600.00
ENGINEERING (12%)					$ 2,600.00
				TOTAL	**$ 25,000.00**

120.0	Centre Street - Weinmeyer Way East to Laura Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,426	m^2	$ 30.00	$ 42,800.00
2	Remove and Replace Concrete Curb & Gutter	3	m^2	$ 110.00	$ 400.00
3	Remove and Replace Monolithic Sidewalk	4	m^2	$ 210.00	$ 800.00
				SUBTOTAL	$ 44,000.00
CONTINGENCY (15%)					$ 6,600.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 6,100.00
				TOTAL	**$ 58,000.00**

Long Term Cost Estimates

130.0	Centre Street - Laura Ave West to Margaret Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,412	m^2	$ 30.00	$ 42,400.00
2	Remove and Replace Concrete Curb & Gutter	0	m^2	$ 110.00	$ -
3	Remove and Replace Concrete Swale	12	m^2	$ 120.00	$ 1,500.00
				SUBTOTAL	$ 43,900.00
CONTINGENCY (15%)					$ 6,600.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 6,100.00
				TOTAL	**$ 58,000.00**

140.0	Centre Street - Margaret Ave East to Louise Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	449	m^2	$ 30.00	$ 13,500.00
2	Remove and Replace Separate Sidewalk	24	m^2	$ 150.00	$ 3,600.00
				SUBTOTAL	$ 17,100.00
CONTINGENCY (15%)					$ 2,600.00
GEOTECHNICAL (2.5%)					$ 500.00
ENGINEERING (12%)					$ 2,400.00
				TOTAL	**$ 23,000.00**

Center Street Total **$ 164,000.00**

Park Place East

160.0	Park Place East - 3rd St East to Cul de Sac	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	11	m^2	$ 210.00	$ 2,300.00
				SUBTOTAL	$ 2,300.00
CONTINGENCY (15%)					$ 400.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 4,000.00**

Park Place East Total **$ 4,000.00**

2nd Street East

170.0	2nd Street East - Margaret Ave East to Louise Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,372	m^2	$ 30.00	$ 41,200.00
2	Remove and Replace Separate Sidewalk	5	m^2	$ 150.00	$ 900.00
				SUBTOTAL	$ 42,100.00
CONTINGENCY (15%)					$ 6,400.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 5,900.00
				TOTAL	**$ 56,000.00**

180.0	2nd Street East - Louise Ave East to Railway Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,359	m^2	$ 30.00	$ 40,800.00
2	Remove and Replace Separate Sidewalk	13	m^2	$ 150.00	$ 1,900.00
				SUBTOTAL	$ 42,700.00
CONTINGENCY (15%)					$ 6,500.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 6,000.00
				TOTAL	**$ 57,000.00**

2nd Street East Total **$ 113,000.00**

1st Street East

190.0	1st Street East - Margaret Ave East to Louise Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,427	m^2	$ 30.00	$ 42,900.00
2	Remove and Replace Separate Sidewalk	9	m^2	$ 150.00	$ 1,400.00
				SUBTOTAL	$ 44,300.00
CONTINGENCY (15%)					$ 6,700.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 6,200.00
				TOTAL	**$ 59,000.00**

Long Term Cost Estimates

200.0	1st Street East - Louise Ave East to Railway Ave East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,412	m^2	$ 30.00	$ 42,400.00
2	Remove and Replace Separate Sidewalk	12	m^2	$ 150.00	$ 1,800.00
				SUBTOTAL	$ 44,200.00
CONTINGENCY (15%)					$ 6,700.00
GEOTECHNICAL (2.5%)					$ 1,300.00
ENGINEERING (12%)					$ 6,200.00
				TOTAL	**$ 59,000.00**

1st Street East Total **$ 118,000.00**

Laura Place West

210.0	Laura Place West - Laura Ave West to Cul de Sac	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	449	m^2	$ 30.00	$ 13,500.00
				SUBTOTAL	$ 13,500.00
CONTINGENCY (15%)					$ 2,100.00
GEOTECHNICAL (2.5%)					$ 400.00
ENGINEERING (12%)					$ 1,900.00
				TOTAL	**$ 18,000.00**

Laura Place West Total **$ 18,000.00**

2nd Street West

240.0	2nd Street West - Barzed Ave West to Margaret Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	0	m^2	$ 210.00	$ -
				SUBTOTAL	$ -
CONTINGENCY (15%)					$ -
GEOTECHNICAL (2.5%)					$ -
ENGINEERING (12%)					$ -
				TOTAL	**$ -**

2nd Street West Total **$ -**

Long Term Cost Estimates

Margaret Avenue

250.0	Margaret Avenue West - 2nd St West to 1st St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	6	m^2	$ 110.00	$ 700.00
2	Remove and Replace Monolithic Sidewalk	9	m^2	$ 210.00	$ 1,900.00
				SUBTOTAL	$ 2,600.00
CONTINGENCY (15%)					$ 400.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 4,000.00**

260.0	Margaret Avenue West - 1st St West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	6	m^2	$ 110.00	$ 700.00
2	Remove and Replace Monolithic Sidewalk	4	m^2	$ 210.00	$ 800.00
				SUBTOTAL	$ 1,500.00
CONTINGENCY (15%)					$ 300.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 300.00
				TOTAL	**$ 3,000.00**

270.0	Margaret Avenue East - Centre St to 1st St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,086	m^2	$ 30.00	$ 32,600.00
2	Remove and Replace Monolithic Sidewalk	0	m^2	$ 210.00	$ -
				SUBTOTAL	$ 32,600.00
CONTINGENCY (15%)					$ 4,900.00
GEOTECHNICAL (2.5%)					$ 1,000.00
ENGINEERING (12%)					$ 4,500.00
				TOTAL	**$ 43,000.00**

280.0	Margaret Avenue East - 1st St East to 2nd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	982	m^2	$ 30.00	$ 29,500.00
2	Remove and Replace Monolithic Sidewalk	0	m^2	$ 210.00	$ -
				SUBTOTAL	$ 29,500.00
CONTINGENCY (15%)					$ 4,500.00
GEOTECHNICAL (2.5%)					$ 900.00
ENGINEERING (12%)					$ 4,100.00
				TOTAL	**$ 39,000.00**

Long Term Cost Estimates

290.0	Margaret Avenue East - 2nd St East to 3rd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,037	m^2	$ 30.00	$ 31,200.00
2	Remove and Replace Monolithic Sidewalk	0	m^2	$ 210.00	$ -
				SUBTOTAL	$ 31,200.00
CONTINGENCY (15%)					$ 4,700.00
GEOTECHNICAL (2.5%)					$ 900.00
ENGINEERING (12%)					$ 4,400.00
				TOTAL	**$ 42,000.00**

300.0	Margaret Avenue East - 3rd St East to Start of Gravel	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	15	m^2	$ 110.00	$ 1,700.00
2	Remove and Replace Separate Sidewalk	0	m^2	$ 150.00	$ -
3	Remove and Replace Monolithic Sidewalk	14	m^2	$ 210.00	$ 3,000.00
				SUBTOTAL	$ 4,700.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 9,000.00**

Margaret Avenue Total **$ 140,000.00**

Laura Avenue West

310.0	Laura Avenue West - Range Rd 144A to 3rd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	3	m^2	$ 110.00	$ 400.00
2	Remove and Replace Monolithic Sidewalk	2	m^2	$ 210.00	$ 400.00
				SUBTOTAL	$ 800.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

320.0	Laura Avenue West - 3rd St West to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	27	m^2	$ 120.00	$ 3,300.00
				SUBTOTAL	$ 3,300.00
CONTINGENCY (15%)					$ 500.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 500.00
				TOTAL	**$ 5,000.00**

Long Term Cost Estimates

330.0	Laura Avenue West - 2nd St West to Laura Place West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	22	m^2	$ 120.00	$ 2,600.00
2	Remove and Replace Monolithic Sidewalk	5	m^2	$ 210.00	$ 1,200.00
				SUBTOTAL	$ 3,800.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 6,000.00**

340.0	Laura Avenue West - Laura Place West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	5	m^2	$ 210.00	$ 1,200.00
				SUBTOTAL	$ 1,200.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

Laura Avenue West Total **$ 15,000.00**

3rd Street West

350.0	3rd Street West - Laura Ave West to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	5	m^2	$ 210.00	$ 1,200.00
				SUBTOTAL	$ 1,200.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

3rd Street West Total **$ 2,000.00**

Princess Place West

360.0	Princess Place West - Cul de Sac to Barzed Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	29	m^2	$ 120.00	$ 3,500.00
				SUBTOTAL	$ 3,500.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 500.00
				TOTAL	**$ 5,000.00**

Princess Place West Total **$ 5,000.00**

Long Term Cost Estimates

Barzed Avenue West

370.0	Barzed Avenue West - Range Rd 144A to 3rd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	0	m^2	$ 210.00	$ -
				SUBTOTAL	$ -
CONTINGENCY (15%)					$ -
GEOTECHNICAL (2.5%)					$ -
ENGINEERING (12%)					$ -
				TOTAL	**$ -**

380.0	Barzed Avenue West - 3rd St West to Princess Place West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	5	m^2	$ 210.00	$ 1,200.00
				SUBTOTAL	$ 1,200.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

390.0	Barzed Avenue West - Princess Place West to 2nd St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	30	m^2	$ 120.00	$ 3,700.00
				SUBTOTAL	$ 3,700.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 6,000.00**

Barzed Avenue West Total **$ 8,000.00**

Long Term Cost Estimates

1st Street West

400.0	1st Street West - Margaret Avenue West to Louise Avenue West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,424	m^2	$ 30.00	$ 42,800.00
2	Remove and Replace Concrete Curb & Gutter	0	m^2	$ 110.00	$ -
3	Remove and Replace Concrete Swale	26	m^2	$ 120.00	$ 3,200.00
4	Remove and Replace Separate Sidewalk	25	m^2	$ 150.00	$ 3,800.00
				SUBTOTAL	$ 49,800.00
CONTINGENCY (15%)					$ 7,500.00
GEOTECHNICAL (2.5%)					$ 1,500.00
ENGINEERING (12%)					$ 6,900.00
				TOTAL	**$ 66,000.00**

410.0	1st Street West - Louise Avenue West to Railway Avenue West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	1,412	m^2	$ 30.00	$ 42,400.00
2	Remove and Replace Concrete Curb & Gutter	3	m^2	$ 110.00	$ 400.00
4	Remove and Replace Separate Sidewalk	20	m^2	$ 150.00	$ 3,100.00
				SUBTOTAL	$ 45,900.00
CONTINGENCY (15%)					$ 6,900.00
GEOTECHNICAL (2.5%)					$ 1,400.00
ENGINEERING (12%)					$ 6,400.00
				TOTAL	**$ 61,000.00**

1st Street West Total **$ 127,000.00**

Long Pine Court West

420.0	Long Pine Court West - Cul de Sac to Railway Ave West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Monolithic Sidewalk	3	m^2	$ 210.00	$ 700.00
				SUBTOTAL	$ 700.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

Long Pine Court West Total **$ 2,000.00**

Long Term Cost Estimates

Louise Avenue

440.0	Louise Avenue West - 2nd St West to 1st St West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	21	m^2	$ 120.00	$ 2,600.00
				SUBTOTAL	$ 2,600.00
CONTINGENCY (15%)					$ 400.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 400.00
				TOTAL	**$ 4,000.00**

450.0	Louise Avenue West - 1st St West to Centre St	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	21	m^2	$ 120.00	$ 2,600.00
2	Remove and Replace Separate Sidewalk	7	m^2	$ 150.00	$ 1,100.00
				SUBTOTAL	$ 3,700.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 6,000.00**

460.0	Louise Avenue East - Centre St to 1st St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	967	m^2	$ 30.00	$ 29,100.00
2	Remove and Replace Separate Sidewalk	2	m^2	$ 150.00	$ 300.00
				SUBTOTAL	$ 29,400.00
CONTINGENCY (15%)					$ 4,500.00
GEOTECHNICAL (2.5%)					$ 900.00
ENGINEERING (12%)					$ 4,100.00
				TOTAL	**$ 39,000.00**

470.0	Louise Avenue East - 1st St East to 2nd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Edge Mill and Overlay 50mm	892	m^2	$ 30.00	$ 26,800.00
2	Remove and Replace Separate Sidewalk	5	m^2	$ 150.00	$ 900.00
				SUBTOTAL	$ 27,700.00
CONTINGENCY (15%)					$ 4,200.00
GEOTECHNICAL (2.5%)					$ 800.00
ENGINEERING (12%)					$ 3,900.00
				TOTAL	**$ 37,000.00**

Long Term Cost Estimates

480.0	Louise Avenue East - 2nd St East to 3rd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	24	m^2	$ 120.00	$ 2,900.00
				SUBTOTAL	$ 2,900.00
CONTINGENCY (15%)					$ 500.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 500.00
				TOTAL	**$ 4,000.00**

Louise Avenue Total **$ 90,000.00**

Railway Avenue

540.0	Railway Avenue West - 2nd St West to Long Pine Court West	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	6	m^2	$ 110.00	$ 700.00
				SUBTOTAL	$ 700.00
CONTINGENCY (15%)					$ 200.00
GEOTECHNICAL (2.5%)					$ 100.00
ENGINEERING (12%)					$ 200.00
				TOTAL	**$ 2,000.00**

590.0	Railway Avenue East - 2nd St East to 3rd St East	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Curb & Gutter	9	m2	$ 110.00	$ 1,000.00
2	Remove and Replace Monolithic Sidewalk	12	m^2	$ 210.00	$ 2,500.00
				SUBTOTAL	$ 3,500.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 500.00
				TOTAL	**$ 5,000.00**

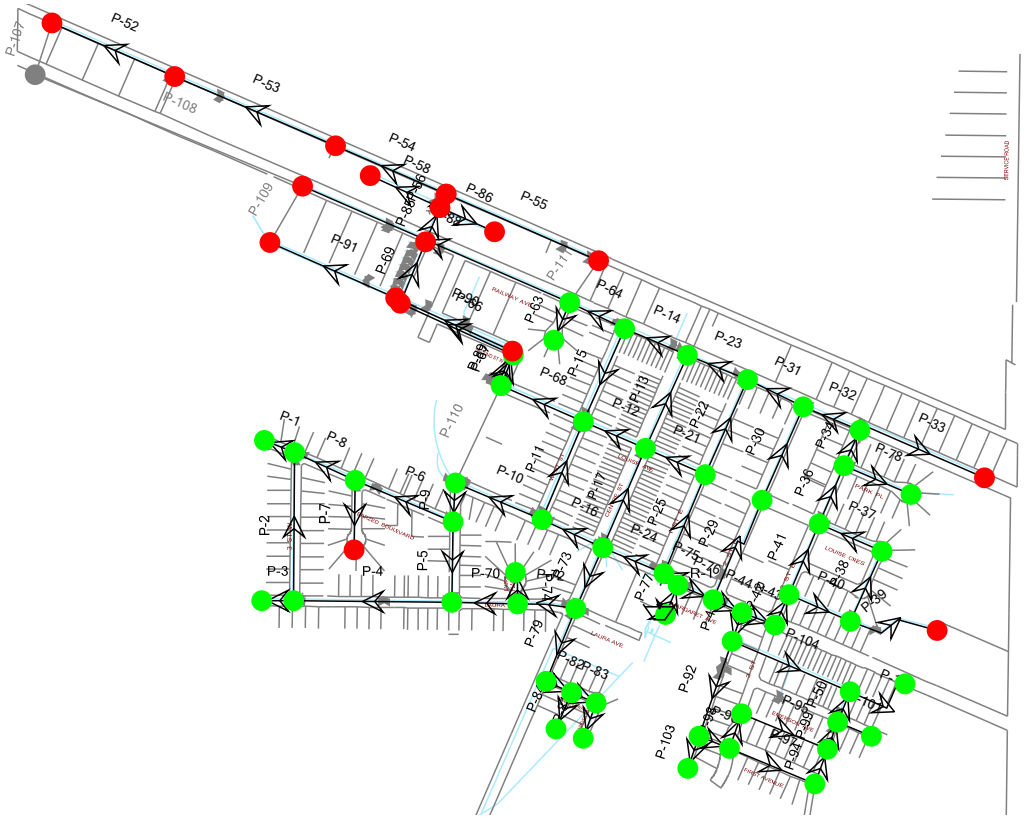
600.0	Railway Avenue East - 3rd St East to Range Road 144	QUANTITY	UNIT	UNIT PRICE	COST
General Items					
1	Remove and Replace Concrete Swale	33	m^2	$ 120.00	$ 4,000.00
				SUBTOTAL	$ 4,000.00
CONTINGENCY (15%)					$ 600.00
GEOTECHNICAL (2.5%)					$ 200.00
ENGINEERING (12%)					$ 600.00
				TOTAL	**$ 6,000.00**

Railway Avenue Total **$ 13,000.00**

Total Long **$ 898,000.00**

Appendix B – Water System Analysis & Cost Estimates

Scenario: 2018 FF



FlexTable: Pipe Table

ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C
32	P-1	52	33	34	149.0	AC	130.0
34	P-2	237	34	50	149.0	AC	130.0
36	P-3	51	50	49	149.0	AC	130.0
38	P-4	253	50	51	149.0	AC	130.0
40	P-5	128	51	37	149.0	AC	130.0
42	P-6	170	37	35	149.0	AC	130.0
44	P-7	111	35	36	149.0	AC	130.0
45	P-8	107	35	34	149.0	AC	130.0
47	P-9	62	37	38	149.0	AC	130.0
49	P-10	150	38	39	149.0	AC	130.0
51	P-11	170	39	27	149.0	AC	130.0
53	P-12	108	27	28	149.0	AC	130.0
55	P-13	163	28	14	149.0	AC	130.0
57	P-14	109	14	13	149.0	AC	130.0
58	P-15	162	13	27	149.0	AC	130.0
60	P-16	107	40	39	149.0	AC	130.0
61	P-17	173	40	28	149.0	AC	130.0
67	P-21	104	28	29	149.0	AC	130.0
69	P-22	166	29	15	149.0	AC	130.0
70	P-23	104	15	14	149.0	AC	130.0
72	P-24	106	40	41	149.0	AC	130.0
73	P-25	171	41	29	149.0	AC	130.0
80	P-29	188	43	30	149.0	AC	130.0
81	P-30	163	30	16	149.0	AC	130.0
82	P-31	99	16	15	149.0	AC	130.0
84	P-32	98	16	17	149.0	AC	130.0
86	P-33	223	17	18	50.0	AC	130.0
88	P-34	62	17	19	149.0	AC	130.0
92	P-36	101	19	31	149.0	AC	130.0
94	P-37	110	31	32	149.0	AC	130.0
96	P-38	123	32	47	149.0	AC	130.0
98	P-39	151	47	48	100.0	AC	130.0
100	P-40	107	47	46	149.0	AC	130.0
101	P-41	123	46	31	149.0	AC	130.0
103	P-42	53	46	45	149.0	AC	130.0
105	P-43	56	45	44	149.0	AC	130.0
106	P-44	51	44	43	200.0	AC	130.0
108	P-45	48	44	55	200.0	AC	130.0
118	P-50	53	56	58	149.0	AC	130.0
123	P-52	214	1	2	200.0	PVC	130.0
125	P-53	280	2	3	200.0	PVC	130.0
127	P-54	193	3	4	200.0	PVC	130.0
129	P-55	266	4	5	155.0	PVC	130.0
131	P-56	24	4	7	155.0	PVC	130.0
135	P-58	123	7	6	100.0	PVC	130.0
145	P-63	65	11	12	149.0	AC	130.0
146	P-64	97	11	13	149.0	AC	130.0
151	P-66	199	23	25	149.0	AC	130.0
153	P-67	53	25	26	149.0	AC	130.0
154	P-68	143	26	27	149.0	AC	130.0
155	P-69	106	10	23	149.0	AC	130.0
157	P-70	105	51	53	149.0	AC	130.0
161	P-72	93	53	54	149.0	AC	130.0
162	P-73	106	54	40	149.0	AC	130.0
164	P-74	51	53	52	149.0	AC	130.0
166	P-75	36	41	42	200.0	AC	130.0

FlexTable: Pipe Table

ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C
167	P-76	61	42	43	200.0	AC	130.0
169	P-77	51	42	WTP	200.0	AC	130.0
171	P-78	116	19	20	149.0	AC	130.0
173	P-79	126	54	60	250.0	PVC	130.0
177	P-81	60	62	64	200.0	PVC	130.0
179	P-82	44	60	61	200.0	PVC	130.0
180	P-83	43	61	62	200.0	PVC	130.0
182	P-84	63	61	63	155.0	PVC	130.0
183	P-85	59	7	10	155.0	PVC	130.0
185	P-86	95	7	8	100.0	PVC	130.0
187	P-87	11	R-1	WTP	200.0	AC	130.0
188	P-88	465	11	9	50.0	Ductile Iron	50.0
190	P-89	62	26	24	75.0	HDPE	130.0
192	P-90	205	24	22	75.0	HDPE	130.0
194	P-91	219	22	21	75.0	HDPE	130.0
196	P-92	161	55	67	200.0	PVC	130.0
200	P-94	59	69	66	200.0	Ductile Iron	130.0
202	P-95	148	66	65	152.4	Ductile Iron	130.0
204	P-96	52	67	68	200.0	PVC	130.0
205	P-97	148	68	69	200.0	PVC	130.0
206	P-98	58	65	68	152.4	Ductile Iron	130.0
207	P-99	46	66	58	200.0	Ductile Iron	130.0
211	P-101	58	58	59	200.0	Ductile Iron	130.0
213	P-102	123	56	57	200.0	PVC	130.0
215	P-103	54	67	70	200.0	PVC	130.0
216	P-104	205	55	56	200.0	PVC	130.0
252	P-107	87	1	J-83	152.4	Ductile Iron	130.0
253	P-108	463	J-83	9	152.4	Ductile Iron	130.0
255	P-109	104	21	9	152.4	Ductile Iron	130.0
259	P-110	171	38	26	152.4	Ductile Iron	130.0
260	P-111	81	11	5	152.4	Ductile Iron	130.0

FlexTable: Junction Table

ID	Label	Elevation (m)	Demand (L/min)	Pressure (psi)	Fire Flow (Available) (L/min)	Satisfies Fire Flow Constraints?
30	33	757.08	6.922	66.2	4,254.115	True
31	34	757.20	48.454	66.0	4,715.567	True
33	50	757.57	72.681	65.5	4,714.082	True
35	49	757.63	3.461	65.4	4,248.012	True
37	51	756.36	69.220	67.3	6,234.312	True
39	37	755.63	38.071	68.3	6,251.324	True
41	35	756.68	34.610	66.8	4,915.142	True
43	36	757.61	31.149	65.5	3,938.130	False
46	38	756.45	13.844	67.2	6,580.553	True
48	39	756.32	88.005	67.4	8,777.725	True
50	27	756.68	55.376	66.9	8,764.851	True
52	28	757.26	41.532	66.1	9,690.536	True
54	14	755.46	98.204	68.7	8,705.654	True
56	13	754.84	27.688	69.5	6,825.368	True
59	40	756.79	38.071	66.8	10,337.668	True
66	29	756.69	44.993	67.1	10,833.670	True
68	15	755.43	24.227	68.8	10,477.767	True
71	41	756.83	27.688	67.2	14,999.999	True
74	43	757.32	27.688	66.5	14,999.999	True
76	16	754.95	34.440	69.6	10,622.683	True
79	30	756.08	17.305	68.1	8,916.697	True
83	17	755.00	36.086	69.5	8,698.072	True
85	18	754.21	24.057	70.2	279.434	False
87	19	755.08	34.610	69.4	8,300.797	True
91	31	755.51	20.805	68.8	8,514.078	True
93	32	756.01	24.227	68.1	7,155.591	True
95	47	756.56	44.993	67.4	7,144.023	True
97	48	755.45	3.461	68.9	2,129.937	False
99	46	756.15	31.149	68.0	8,971.755	True
102	45	757.34	3.461	66.3	9,986.293	True
104	44	757.52	3.461	66.2	13,692.385	True
107	55	757.67	38.071	65.9	11,646.980	True
113	56	756.84	69.220	67.1	9,652.743	True
117	58	756.69	3.461	67.3	9,333.129	True
121	1	757.03	72.172	66.0	2,338.863	False
122	2	756.03	27.518	67.5	2,421.515	False
124	3	755.14	20.766	68.7	2,544.128	False
126	4	755.20	13.844	68.7	2,640.873	False
128	5	754.16	0.000	70.1	2,395.158	False
130	7	755.20	20.766	68.7	2,685.650	False
134	6	755.35	13.844	68.4	1,778.592	False
138	10	755.28	20.766	68.6	2,810.902	False
140	9	756.07	34.610	56.8	41.016	False
142	11	755.40	80.910	68.7	4,634.056	True
144	12	756.20	17.305	67.6	4,611.938	True
148	23	756.67	9.800	66.6	3,153.275	False
150	25	756.67	0.000	66.8	4,292.392	True
152	26	757.15	13.261	66.1	4,842.356	True
156	53	756.71	31.149	66.8	6,373.349	True
160	54	757.03	13.844	66.4	7,095.597	True
163	52	757.43	20.766	65.8	5,370.749	True
165	42	757.04	6.922	66.9	14,999.999	True
168	WTP	758.05	0.000	65.9	14,999.999	True
170	20	755.49	34.610	68.8	5,333.966	True
172	60	757.23	6.922	66.1	6,768.972	True
174	62	756.45	10.383	67.2	6,280.129	True

FlexTable: Junction Table

ID	Label	Elevation (m)	Demand (L/min)	Pressure (psi)	Fire Flow (Available) (L/min)	Satisfies Fire Flow Constraints?
176	64	756.75	3.461	66.8	5,969.438	True
178	61	756.78	10.383	66.7	6,475.633	True
181	63	757.25	3.461	66.1	5,433.043	True
184	8	755.18	10.383	68.7	1,917.459	False
189	24	756.73	0.000	66.7	1,516.626	False
191	22	756.52	27.688	66.9	720.573	False
193	21	756.09	3.461	67.5	533.843	False
195	67	757.94	6.922	65.6	9,692.888	True
197	69	757.24	10.383	66.5	9,179.781	True
199	66	757.38	0.000	66.3	9,286.489	True
201	65	758.03	6.922	65.4	8,189.397	True
203	68	757.53	3.461	66.1	9,512.141	True
210	59	756.77	0.000	67.2	8,486.360	True
212	57	756.00	10.383	68.3	8,060.571	True
214	70	757.66	3.461	65.9	8,823.764	True
250	J-83	0.00	(N/A)	(N/A)	(N/A)	False

Village of Duchess - Infrastructure Master Plan
Water Distribution System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

	Long Pine Crescent Looping	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 10,000.00	$ 10,000.00
2	Connect to Existing Water Distribution System	2	ea	$ 7,500.00	$ 15,000.00
3	Supply and Install 200 mm DR-18 C-900 Class PVC Water Pipe and Fittings, Complete	100	m	$ 250.00	$ 25,000.00
4	Supply and Install 200 mm Water Main Isolation Valves, Complete	2	ea	$ 3,000.00	$ 6,000.00
5	Grass Restoration - Topsoil and Seed	1,500	m^2	$ 6.00	$ 9,000.00
6	Asphalt Road Restoration - Truck Route	150	m^2	$ 70.00	$ 10,500.00
				SUBTOTAL	$ 76,000.00
CONTINGENCY (15%)					$ 11,000.00
MATERIAL TESTING (2.5%)					$ 2,000.00
ENGINEERING (12%)					$ 11,000.00
				TOTAL	**$ 100,000.00**

	2nd Street East Upsize	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 8,000.00	$ 8,000.00
2	Connect to Existing Water Distribution System	2	ea	$ 7,500.00	$ 15,000.00
3	Supply and Install 150 mm DR-18 C-900 Class PVC Water Pipe and Fittings, Complete	115	m	$ 225.00	$ 25,875.00
4	Supply and Install 150 mm Water Main Isolation Valves, Complete	2	ea	$ 2,500.00	$ 5,000.00
5	Asphalt Road Restoration - Local Road	150	m^2	$ 60.00	$ 9,000.00
				SUBTOTAL	$ 63,000.00
CONTINGENCY (15%)					$ 9,000.00
MATERIAL TESTING (2.5%)					$ 2,000.00
ENGINEERING (12%)					$ 9,000.00
				TOTAL	**$ 90,000.00**

	Railway Avenue East Upsize	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 34,000.00	$ 34,000.00
2	Connect to Existing Water Distribution System	2	ea	$ 7,500.00	$ 15,000.00
3	Supply and Install 150 mm DR-18 C-900 Class PVC Water Pipe and Fittings, Complete	225	m	$ 225.00	$ 50,625.00
4	Supply and Install 150 mm Water Main Isolation Valves, Complete	2	ea	$ 2,500.00	$ 5,000.00
5	Asphalt Road Restoration - Truck Route	2,250	m^2	$ 70.00	$ 157,500.00
				SUBTOTAL	$ 262,000.00
CONTINGENCY (15%)					$ 39,000.00
MATERIAL TESTING (2.5%)					$ 8,000.00
ENGINEERING (12%)					$ 37,000.00
				TOTAL	**$ 350,000.00**

	Railway Avenue West Upsize	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 68,000.00	$ 68,000.00
2	Connect to Existing Water Distribution System	2	ea	$ 7,500.00	$ 15,000.00
3	Supply and Install 150 mm DR-18 C-900 Class PVC Water Pipe and Fittings, Complete	465	m	$ 225.00	$ 104,625.00
4	Supply and Install 150 mm Water Main Isolation Valves, Complete	2	ea	$ 2,500.00	$ 5,000.00
5	Asphalt Road Restoration - Truck Route	4,650	m^2	$ 70.00	$ 325,500.00
				SUBTOTAL	$ 518,000.00
CONTINGENCY (15%)					$ 78,000.00
MATERIAL TESTING (2.5%)					$ 15,000.00
ENGINEERING (12%)					$ 73,000.00
				TOTAL	**$ 690,000.00**

Village of Duchess - Infrastructure Master Plan
Water Distribution System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Proposed Hydrants		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 10,000.00	$ 10,000.00
2	Supply and Install Hydrant, Complete	5	ea	$ 9,000.00	$ 45,000.00
3	Grass Restoration - Topsoil and Sod	200	m^2	$ 10.00	$ 2,000.00
4	Asphalt Road Restoration - Local Road	300	m^2	$ 60.00	$ 18,000.00
5	Sidewalk Restoration	30	m^2	$ 150.00	$ 4,500.00
				SUBTOTAL	$ 80,000.00
CONTINGENCY (15%)					$ 12,000.00
MATERIAL TESTING (2.5%)					$ 2,000.00
ENGINEERING (12%)					$ 11,000.00
				TOTAL	**$ 110,000.00**

Appendix C – Sanitary System Analysis & Cost Estimates

Scenario: 2018 Peak+WWF

FlexTable: Conduit Table

Current Time: 0.000 hours

ID	Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Length (Scaled) (m)	Slope (Calculated) (%)	Diameter (mm)	Material	Manning's n
30	CO-1	S MH 1B	754.27	S MH 2B	753.96	81.3	0.38	201.2	PVC	0.013
32	CO-2	S MH 2B	753.94	S MH 3B	753.48	120.4	0.38	201.2	PVC	0.013
34	CO-3	S MH 3B	753.46	S MH 4B	753.01	120.8	0.37	201.2	PVC	0.013
36	CO-4	S MH 4B	752.98	S MH 5B	752.54	121.1	0.37	201.2	PVC	0.013
38	CO-5	S MH 5B	752.51	S MH 6B	751.97	116.7	0.46	201.2	PVC	0.013
40	CO-6	S MH 6B	751.94	S MH 7B	751.55	120.8	0.32	201.2	PVC	0.013
42	CO-7	S MH 8B	752.01	S MH 7B	751.55	132.9	0.34	201.2	PVC	0.013
44	CO-8	S MH 9B	752.48	S MH 8B	752.04	120.7	0.37	201.2	PVC	0.013
77	CO-23	S MH 9A	754.59	S MH 9	753.99	135.2	0.44	201.2	PVC	0.013
79	CO-24	S MH 9	753.91	S MH 8	753.73	58.4	0.31	201.2	PVC	0.013
81	CO-25	S MH 8A	754.27	S MH 8	753.74	129.3	0.41	201.2	PVC	0.013
83	CO-26	S MH 8	753.70	S MH 7	753.48	47.2	0.47	201.2	PVC	0.013
85	CO-27	S MH 7A	753.81	S MH 7	753.49	73.0	0.44	201.2	PVC	0.013
87	CO-28	S MH 7	753.45	S MH 2	753.29	46.8	0.34	201.2	PVC	0.013
89	CO-29	S MH 2	753.24	S MH 1	753.14	13.4	0.75	201.2	PVC	0.013
91	CO-30	S MH 1	753.09	S MH 18A	752.86	104.0	0.22	201.2	PVC	0.013
93	CO-31	S MH 18A	752.85	S MH 18	752.63	54.7	0.40	201.2	PVC	0.013
95	CO-32	S MH 19	753.51	S MH 18	752.81	108.2	0.65	201.2	PVC	0.013
97	CO-33	CLEAN OUT	753.88	S MH 19	753.69	47.4	0.40	201.2	PVC	0.013
99	CO-34	S MH 1A	753.39	S MH 1	753.14	59.4	0.42	201.2	PVC	0.013
101	CO-35	S MH 3	753.65	S MH 2	753.27	100.7	0.38	201.2	PVC	0.013
104	CO-36	S MH 58	754.37	S MH 57	753.75	93.7	0.66	201.2	PVC	0.013
106	CO-37	S MH 57	753.70	S MH 50	753.37	74.0	0.45	201.2	PVC	0.013
108	CO-38	S MH 50	753.36	S MH 49	753.02	96.2	0.35	201.2	PVC	0.013
110	CO-39	S MH 51	753.49	S MH 49	752.90	128.1	0.46	201.2	PVC	0.013
112	CO-40	S MH 59	753.87	S MH 51	753.55	97.6	0.33	201.2	PVC	0.013
114	CO-41	S MH 60	754.17	S MH 59	753.91	38.3	0.68	201.2	PVC	0.013
116	CO-42	S MH 63	754.14	S MH 59	753.89	46.1	0.54	201.2	PVC	0.013
118	CO-43	S MH 63	751.96	S MH 62	751.61	73.6	0.48	201.2	PVC	0.013
120	CO-44	S MH 62	751.54	S MH 61	751.18	85.5	0.42	201.2	PVC	0.013
122	CO-45	S MH 49	752.71	S MH 49A	752.41	9.9	3.02	201.2	PVC	0.013
124	CO-46	S MH 49A	752.41	S MH 61B	752.05	67.2	0.54	201.2	PVC	0.013
129	CO-48	S MH 39	753.89	S MH 38	753.35	79.7	0.68	201.2	PVC	0.013
131	CO-49	S MH 41	754.04	S MH 39	753.91	18.4	0.71	201.2	PVC	0.013
133	CO-50	S MH 40	754.25	S MH 41	754.04	61.9	0.34	201.2	PVC	0.013
137	CO-52	S MH 43	752.93	S MH 36	752.52	95.8	0.43	201.2	PVC	0.013
139	CO-53	S MH 44	753.27	S MH 43	752.99	69.7	0.40	201.2	PVC	0.013
141	CO-54	S MH 45	753.20	S MH 43	752.97	64.5	0.36	201.2	PVC	0.013
143	CO-55	S MH 45A	753.31	S MH 45	753.22	20.7	0.43	201.2	PVC	0.013
145	CO-56	S MH 45B	753.66	S MH 45A	753.31	99.2	0.35	201.2	PVC	0.013
147	CO-57	S MH 45C	754.06	S MH 45B	753.70	94.4	0.38	201.2	PVC	0.013
149	CO-58	S MH 45D	754.41	S MH 45C	754.07	86.6	0.39	201.2	PVC	0.013
153	CO-59	S MH 14B	751.44	S MH 13B	751.11	83.1	0.40	201.2	PVC	0.013
163	CO-64	S MH 14	751.22	S MH 13	750.78	74.0	0.59	201.2	PVC	0.013
165	CO-65	S MH 15	752.55	S MH 14	751.40	113.1	1.02	201.2	PVC	0.013
167	CO-66	S MH 16	751.59	S MH 14	751.23	100.8	0.36	201.2	PVC	0.013
169	CO-67	S MH 17	752.02	S MH 16	751.59	108.2	0.40	201.2	PVC	0.013
170	CO-68	S MH 18	752.57	S MH 17	752.08	123.2	0.40	201.2	PVC	0.013
173	CO-69	S MH 6	755.10	S MH 5	754.65	109.9	0.41	201.2	PVC	0.013
175	CO-70	S MH 5	754.63	S MH 4	754.10	100.6	0.53	201.2	PVC	0.013
177	CO-71	CLEAN OUT	754.23	S MH 4	754.09	35.5	0.39	201.2	PVC	0.013

FlexTable: Conduit Table

Current Time: 0.000 hours

ID	Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Length (Scaled) (m)	Slope (Calculated) (%)	Diameter (mm)	Material	Manning's n
178	CO-72	S MH 4	754.01	S MH 3	753.69	96.9	0.33	201.2	PVC	0.013
181	CO-73	S MH 64C	753.49	S MH 64B	753.24	47.3	0.51	201.2	PVC	0.013
183	CO-74	S MH 64B	753.22	S MH 64A	752.98	47.9	0.52	201.2	PVC	0.013
185	CO-75	S MH 64A	752.93	S MH 64	752.35	121.0	0.48	201.2	PVC	0.013
186	CO-76	S MH 64	752.21	S MH 63	752.02	47.3	0.38	201.2	PVC	0.013
188	CO-77	S MH 52	753.92	S MH 51	753.55	103.5	0.36	201.2	PVC	0.013
190	CO-78	S MH 53	754.19	S MH 52	753.93	80.7	0.32	201.2	PVC	0.013
192	CO-79	S MH 54	754.54	S MH 53	754.23	69.7	0.44	201.2	PVC	0.013
194	CO-80	S MH 55	755.14	S MH 54	754.56	113.5	0.51	201.2	PVC	0.013
196	CO-81	S MH 55	755.12	S MH 56	754.18	120.1	0.78	201.2	PVC	0.013
197	CO-82	S MH 56	754.12	S MH 57	753.72	105.6	0.38	201.2	PVC	0.013
205	CO-86	S MH 25	751.56	S MH 22	751.15	99.8	0.41	201.2	PVC	0.013
207	CO-87	S MH 26	753.44	S MH 25	751.60	110.1	1.67	201.2	PVC	0.013
209	CO-88	S MH 27	753.89	S MH 26	753.48	109.2	0.38	201.2	PVC	0.013
211	CO-89	S MH 28	754.29	S MH 27	753.91	109.9	0.35	201.2	PVC	0.013
213	CO-90	S MH 29	754.39	S MH 28	754.41	13.4	-0.15	201.2	PVC	0.013
215	CO-91	S MH 30	754.55	S MH 29	754.41	29.2	0.48	201.2	PVC	0.013
217	CO-92	S MH 31	755.01	S MH 30	754.67	70.1	0.48	201.2	PVC	0.013
219	CO-93	S MH 23	752.99	S MH 22	751.15	122.4	1.50	201.2	PVC	0.013
221	CO-94	S MH 24	754.08	S MH 23	753.00	121.9	0.89	201.2	PVC	0.013
223	CO-95	S MH 24A	754.51	S MH 24	754.09	50.3	0.84	201.2	PVC	0.013
225	CO-96	S MH 36	752.49	S MH 37	752.03	89.7	0.51	201.2	PVC	0.013
227	CO-97	S MH 37	752.01	S MH 32	751.99	15.3	0.13	201.2	PVC	0.013
229	CO-98	S MH 33	753.02	S MH 32	752.44	110.3	0.53	201.2	PVC	0.013
231	CO-99	S MH 34	753.91	S MH 33	753.37	109.4	0.49	201.2	PVC	0.013
233	CO-100	S MH 35	754.47	S MH 34	753.91	107.0	0.52	201.2	PVC	0.013
234	CO-101	S MH 32	751.99	S MH 25	751.57	105.1	0.40	201.2	PVC	0.013
236	CO-102	S MH 1R	752.14	S MH 37	752.01	50.7	0.26	201.2	PVC	0.013
238	CO-103	S MH 48	752.87	S MH 49	752.71	30.3	0.53	201.2	PVC	0.013
240	CO-104	S MH 47	752.98	S MH 48	752.87	32.4	0.34	201.2	PVC	0.013
242	CO-105	S MH 46	754.29	S MH 47	753.14	92.0	1.25	201.2	PVC	0.013
245	CO-107	S MH 7B	751.51	S MH 11B	751.40	26.5	0.43	201.2	PVC	0.013
246	CO-108	S MH 11B	751.37	S MH 13B	751.11	67.7	0.38	201.2	PVC	0.013
248	CO-109	S MH 10B	751.93	S MH 11B	751.37	124.4	0.45	201.2	PVC	0.013
250	CO-110	S MH 12B	751.93	S MH 11B	751.37	100.3	0.56	201.2	PVC	0.013
252	CO-111	S MH 61B	752.00	W-2	751.97	5.3	0.56	201.2	PVC	0.013
253	CO-112	S MH 61	751.13	W-2	751.06	16.1	0.44	201.2	PVC	0.013
302	CO-129	S MH 13B	751.11	W-1	751.00	2.7	4.08	201.2	<None>	0.013
48	CO-10	S MH 2R	751.53	S MH 3R	751.13	149.8	0.27	251.5	PVC	0.013
50	CO-11	S MH 3R	751.11	S MH 4R	750.68	150.1	0.29	251.5	PVC	0.013
52	CO-12	S MH 4R	750.66	S MH 5R	750.27	149.7	0.26	251.5	PVC	0.013
54	CO-13	S MH 5R	750.24	S MH 6R	749.89	131.2	0.27	251.5	PVC	0.013
60	CO-16	S MH 8L	749.15	S MH 7L	748.91	122.4	0.20	251.5	PVC	0.013
70	CO-20	S MH 5L	748.32	S MH 4L	748.00	121.0	0.27	251.5	PVC	0.013
72	CO-21	S MH 4L	747.97	S MH 3L	747.62	120.7	0.29	251.5	PVC	0.013
74	CO-22	S MH 3L	747.61	S MH 2L	747.03	125.3	0.46	251.5	PVC	0.013
157	CO-61	S MH 11	750.15	S MH 10	749.74	95.8	0.43	251.5	PVC	0.013
159	CO-62	S MH 12	750.41	S MH 11	750.16	97.0	0.26	251.5	PVC	0.013
161	CO-63	S MH 13	750.68	S MH 12	750.41	98.6	0.27	251.5	PVC	0.013
199	CO-83	S MH 20	750.96	S MH 13	750.68	59.4	0.47	251.5	PVC	0.013
201	CO-84	S MH 21	750.96	S MH 20	750.97	5.0	-0.20	251.5	PVC	0.013
203	CO-85	S MH 22	751.14	S MH 21	751.03	39.9	0.28	251.5	PVC	0.013

FlexTable: Conduit Table

Current Time: 0.000 hours

ID	Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Length (Scaled) (m)	Slope (Calculated) (%)	Diameter (mm)	Material	Manning's n
243	CO-106	S MH 1R	751.80	S MH 2R	751.56	29.6	0.84	251.5	PVC	0.010
259	CO-113	S MH 7L	748.91	S MH 6L	748.54	121.8	0.30	251.5	PVC	0.013
260	CO-114	S MH 6L	748.54	S MH 5L	748.32	121.8	0.18	251.5	PVC	0.013
262	CO-115	S MH 6R	749.83	S MH 9L	749.62	39.0	0.53	251.5	PVC	0.013
263	CO-116	S MH 7R	749.62	S MH 9L	749.63	2.3	-0.53	251.5	PVC	0.013
264	CO-117	S MH 9L	749.62	S MH 8L	749.15	135.0	0.35	251.5	PVC	0.013
279	CO-124	S MH 10	749.67	S MH 7R	749.62	40.6	0.12	251.5	PVC	0.013
292	CO-127	S MH 2L	746.99	S MH 1L	746.94	35.6	0.14	251.5	PVC	0.013
294	CO-128	S MH 1L	746.94	O-1	746.75	36.2	0.52	251.5	PVC	0.013
127	CO-47	S MH 42	753.96	S MH 38	753.28	152.2	0.45	299.4	PVC	0.013
135	CO-51	S MH 38	753.27	S MH 36	752.56	170.5	0.42	299.4	PVC	0.013
290	CO-126	S MH 14R	747.39	O-2	746.92	35.9	1.31	299.4	PVC	0.013
266	CO-118	S MH 7R	749.84	S MH 8R	749.51	150.0	0.22	366.4	PVC	0.013
268	CO-119	S MH 8R	749.48	S MH 9R	749.05	149.9	0.29	366.4	PVC	0.013
270	CO-120	S MH 9R	749.00	S MH 10R	748.62	151.2	0.25	366.4	PVC	0.013
272	CO-121	S MH 10R	748.61	S MH 11R	748.29	150.0	0.21	366.4	PVC	0.013
274	CO-122	S MH 11R	748.26	S MH 12R	747.89	148.8	0.25	366.4	PVC	0.013
276	CO-123	S MH 12R	747.86	S MH 13R	747.57	114.9	0.25	366.4	PVC	0.013
288	CO-125	S MH 13R	747.51	S MH 14R	747.42	36.2	0.25	366.4	PVC	0.013

FlexTable: Manhole Table

Current Time: 0.000 hours

ID	Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Flow (Total In) (L/s)	Flow (Total Out) (L/s)
96	CLEAN OUT	755.82	755.82	753.88	0.217	0.217
176	CLEAN OUT	757.50	757.50	754.23	0.217	0.217
88	S MH 1	756.72	756.72	753.09	4.831	4.827
98	S MH 1A	756.44	756.44	753.39	0.217	0.217
28	S MH 1B	757.03	757.03	754.27	1.264	1.253
291	S MH 1L	749.92	749.92	746.94	29.075	29.075
235	S MH 1R	755.03	755.03	751.80	0.566	0.566
86	S MH 2	756.91	756.91	753.24	4.234	4.234
29	S MH 2B	756.62	756.62	753.94	1.433	1.423
73	S MH 2L	749.03	749.03	746.99	28.858	28.858
45	S MH 2R	754.61	754.61	751.53	0.783	0.783
100	S MH 3	757.35	757.35	753.65	1.642	1.642
31	S MH 3B	756.00	756.00	753.46	2.122	2.117
71	S MH 3L	749.62	749.62	747.61	28.640	28.640
47	S MH 3R	754.35	754.35	751.11	1.000	1.000
174	S MH 4	757.66	757.66	754.01	1.146	1.146
33	S MH 4B	755.86	755.86	752.98	2.392	2.445
69	S MH 4L	750.00	750.00	747.97	28.423	28.423
49	S MH 4R	753.85	753.85	750.66	1.218	1.218
172	S MH 5	757.90	757.90	754.63	0.514	0.514
35	S MH 5B	755.80	755.80	752.51	2.166	2.197
67	S MH 5L	751.19	751.19	748.32	28.206	28.206
51	S MH 5R	753.68	753.68	750.24	1.435	1.435
171	S MH 6	757.82	757.82	755.10	0.217	0.217
37	S MH 6B	755.46	755.46	751.94	2.929	2.933
63	S MH 6L	751.27	751.27	748.54	27.989	27.989
53	S MH 6R	753.33	753.33	749.83	1.652	1.652
82	S MH 7	756.75	756.75	753.45	1.581	1.581
84	S MH 7A	756.66	756.66	753.81	0.217	0.217
39	S MH 7B	755.19	755.19	751.51	3.183	2.740
59	S MH 7L	751.80	751.80	748.91	27.772	27.772
55	S MH 7R	753.91	753.91	749.62	25.469	25.469
78	S MH 8	757.50	757.50	753.70	1.113	1.107
80	S MH 8A	758.23	758.23	754.27	0.217	0.217
41	S MH 8B	754.93	754.93	752.01	0.434	0.434
57	S MH 8L	753.03	753.03	749.15	27.555	27.555
265	S MH 8R	752.59	752.59	749.48	0.434	0.217
75	S MH 9	757.37	757.37	753.91	0.474	0.479
76	S MH 9A	757.78	757.78	754.59	0.217	0.217
43	S MH 9B	754.86	754.86	752.48	0.217	0.217
261	S MH 9L	753.88	753.88	749.62	27.338	27.338
267	S MH 9R	751.65	751.65	749.00	0.651	0.434
154	S MH 10	753.72	753.72	749.67	25.252	25.252
247	S MH 10B	754.58	754.58	751.93	0.574	0.574
269	S MH 10R	751.66	751.66	748.61	0.869	0.651
156	S MH 11	754.30	754.30	750.15	25.034	25.034
244	S MH 11B	755.39	755.39	751.37	4.265	4.265
271	S MH 11R	749.85	749.85	748.26	1.086	0.869
158	S MH 12	754.95	754.95	750.41	24.468	24.468
249	S MH 12B	756.07	756.07	751.93	0.217	0.217
273	S MH 12R	749.45	749.45	747.86	1.303	1.086
160	S MH 13	755.04	755.04	750.68	23.902	23.902
152	S MH 13B	755.99	755.99	751.11	5.096	5.096
275	S MH 13R	749.03	749.03	747.51	1.520	1.303

FlexTable: Manhole Table

Current Time: 0.000 hours

ID	Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Flow (Total In) (L/s)	Flow (Total Out) (L/s)
162	S MH 14	755.15	755.15	751.22	8.829	8.829
151	S MH 14B	756.21	756.21	751.44	0.217	0.219
287	S MH 14R	749.80	749.80	747.39	1.737	1.520
164	S MH 15	755.65	755.65	752.55	0.336	0.336
166	S MH 16	755.58	755.58	751.59	7.640	7.640
168	S MH 17	756.11	756.11	752.02	6.984	6.984
92	S MH 18	756.56	756.56	752.57	6.490	6.489
90	S MH 18A	756.53	756.53	752.85	5.083	5.083
94	S MH 19	756.19	756.19	753.51	0.593	0.593
198	S MH 20	754.93	754.93	750.96	14.602	14.602
200	S MH 21	755.00	755.00	750.96	14.385	14.385
202	S MH 22	755.21	755.21	751.14	13.818	13.818
218	S MH 23	755.87	755.87	752.99	1.088	1.088
220	S MH 24	756.64	756.64	754.08	0.633	0.633
222	S MH 24A	756.88	756.88	754.51	0.217	0.217
204	S MH 25	755.54	755.54	751.56	12.195	12.195
206	S MH 26	756.18	756.18	753.44	2.256	2.256
208	S MH 27	756.86	756.86	753.89	1.721	1.721
210	S MH 28	756.74	756.74	754.29	1.107	1.107
212	S MH 29	756.91	756.91	754.39	0.850	0.850
214	S MH 30	757.06	757.06	754.55	0.554	0.553
216	S MH 31	757.39	757.39	755.01	0.217	0.217
226	S MH 32	755.43	755.43	751.99	8.720	8.720
228	S MH 33	756.43	756.43	753.02	1.604	1.604
230	S MH 34	757.50	757.50	753.91	0.950	0.950
232	S MH 35	756.78	756.78	754.47	0.297	0.297
134	S MH 36	755.00	755.00	752.49	6.364	6.364
224	S MH 37	755.22	755.22	752.01	6.700	6.700
126	S MH 38	756.72	756.72	753.27	2.912	2.557
128	S MH 39	757.16	757.16	753.89	2.112	2.050
132	S MH 40	757.18	757.18	754.25	1.487	1.448
130	S MH 41	757.24	757.24	754.04	1.421	1.329
125	S MH 42	756.48	756.48	753.96	0.297	0.297
136	S MH 43	755.44	755.44	752.93	3.867	2.994
138	S MH 44	756.24	756.24	753.27	0.297	0.297
140	S MH 45	755.61	755.61	753.20	2.242	2.242
142	S MH 45A	755.98	755.98	753.31	2.025	2.025
144	S MH 45B	756.80	756.80	753.66	1.528	1.528
146	S MH 45C	756.93	756.93	754.06	1.112	1.112
148	S MH 45D	756.61	756.61	754.41	0.217	0.217
241	S MH 46	756.14	756.14	754.29	0.217	0.217
239	S MH 47	756.23	756.23	752.98	0.714	0.714
237	S MH 48	755.57	755.57	752.87	0.975	0.993
107	S MH 49	755.77	755.77	752.71	7.523	7.467
121	S MH 49A	755.78	755.78	752.41	7.684	7.684
105	S MH 50	756.23	756.23	753.36	2.475	2.475
109	S MH 51	756.49	756.49	753.49	3.288	3.288
187	S MH 52	756.78	756.78	753.92	2.060	1.565
189	S MH 53	757.21	757.21	754.19	1.446	1.070
191	S MH 54	757.60	757.60	754.54	1.387	0.703
193	S MH 55	758.00	758.00	755.12	0.217	0.218
195	S MH 56	757.33	757.33	754.12	0.950	0.950
103	S MH 57	756.64	756.64	753.70	2.099	2.099
102	S MH 58	757.51	757.51	754.37	0.376	0.376

FlexTable: Manhole Table

Current Time: 0.000 hours

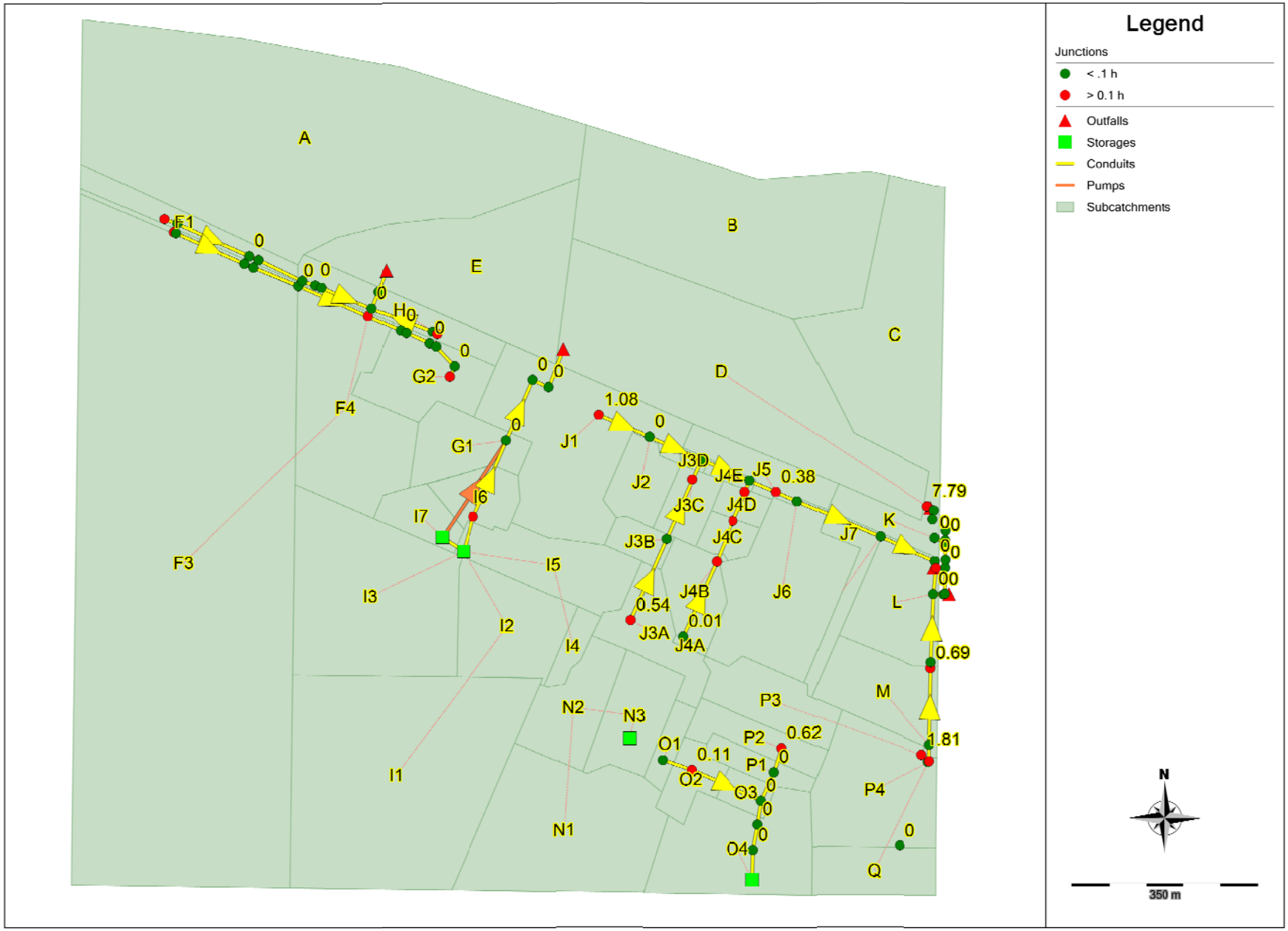
ID	Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Flow (Total In) (L/s)	Flow (Total Out) (L/s)
111	S MH 59	756.83	756.83	753.87	0.831	0.831
113	S MH 60	757.42	757.42	754.17	0.376	0.376
119	S MH 61	756.28	756.28	751.13	2.473	2.473
123	S MH 61B	756.20	756.20	752.00	8.100	8.100
117	S MH 62	756.61	756.61	751.54	2.161	2.068
115	S MH 63	756.97	756.97	751.96	1.681	1.681
184	S MH 64	757.21	757.21	752.21	1.305	1.305
182	S MH 64A	757.30	757.30	752.93	1.009	1.009
180	S MH 64B	756.80	756.80	753.22	0.712	0.713
179	S MH 64C	756.45	756.45	753.49	0.336	0.336

Village of Duchess - Infrastructure Master Plan
Sanitary Collection System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

	Railway Avenue MH 36 to 1R	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 22,000.00	$ 22,000.00
2	Bypass Pumping	1	L.S.	$ 5,000.00	$ 5,000.00
3	Connect to Existing Sanitary Collection System	2	ea	$ 7,500.00	$ 15,000.00
4	Supply and install type 1 standard precast manhole, complete	6	v.m.	$ 2,000.00	$ 12,000.00
5	Supply and install 250 mm SDR35 PVC Sanitary Sewer Pipe, complete	175	m	$ 275.00	$ 48,125.00
6	Tie-in existing residential sanitary service lines	1	ea	$ 1,500.00	$ 1,500.00
7	Gravel Road Restoration	500		$ 40.00	$ 20,000.00
8	Asphalt Road Restoration - Truck Route	650	m^2	$ 70.00	$ 45,500.00
				SUBTOTAL	$ 169,000.00
CONTINGENCY (15%)					$ 25,000.00
MATERIAL TESTING (2.5%)					$ 5,000.00
ENGINEERING (12%)					$ 24,000.00
				TOTAL	**$ 230,000.00**
	Inflow/Infiltration Study	**QUANTITY**	**UNIT**	**UNIT PRICE**	**COST**
1	Flow Monitoring	1	L.S.	$ 10,000.00	$ 10,000.00
2	Report	1	L.S.	$ 20,000.00	$ 20,000.00
				SUBTOTAL	$ 30,000.00
CONTINGENCY (15%)					$ 5,000.00
				TOTAL	**$ 40,000.00**
	Sanitary Main Condition Assessment	**QUANTITY**	**UNIT**	**UNIT PRICE**	**COST**
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 20,000.00	$ 20,000.00
2	Flushing/CCTV Inspection	10,450	m	$ 10.00	$ 104,500.00
3	Assessment Report	1	L.S.	$ 30,000.00	$ 30,000.00
				SUBTOTAL	$ 155,000.00
CONTINGENCY (15%)					$ 23,000.00
				TOTAL	**$ 180,000.00**

Appendix D – Storm Water System Analysis & Cost Estimates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B
C
D
E
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F2
F3
F4
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G2
H0
I1
I2
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I4
I5
I6
I7
J1
J2
J3A
J3B
J3C
J3D
J4A
J4B
J4C
J4D
J4E
J5
J6
J7
K
L
M
N1
N2
N3
O1
O2
O3
O4
P1
P2
P3
P4
Q
1.08
0.38
7.79
0.54
0.01
0.69
0.62
0.11
1.81
Legend
Junctions
< .1 h
> 0.1 h
Outfalls
Storages
Conduits
Pumps
Subcatchments
N
350 m

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)

****
Element Count
****
Number of rain gages 3
Number of subcatchments ... 48
Number of nodes 78
Number of links 71
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Chicago_24h_1in100	Chicago_24h_1in100	INTENSITY	5 min.
Chicago_4h_1in2	Chicago_4h_1in2	INTENSITY	5 min.
Chicago_4h_1in5	Chicago_4h_1in5	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A	27.68	887.00	14.01	0.8000	Chicago_24h_1in100	A
B	13.49	546.00	11.30	0.5000	Chicago_24h_1in100	B
C	9.24	480.00	10.00	0.3000	Chicago_24h_1in100	C
D	15.02	410.00	16.83	0.1000	Chicago_24h_1in100	J36
E	8.75	275.00	15.25	0.3000	Chicago_24h_1in100	E
F1	1.59	37.00	53.74	0.4000	Chicago_24h_1in100	J3
F2	0.45	10.00	55.00	0.4000	Chicago_24h_1in100	J8
F3	50.11	375.00	12.39	0.2500	Chicago_24h_1in100	F4
F4	6.76	150.00	10.00	0.3500	Chicago_24h_1in100	J18
G1	2.22	170.00	64.00	0.2000	Chicago_24h_1in100	STMH12
G2	2.90	190.00	43.93	1.0000	Chicago_24h_1in100	J29
H	2.10	400.00	38.00	0.4000	Chicago_24h_1in100	J27
I1	15.54	246.67	10.00	0.3000	Chicago_24h_1in100	I2
I2	3.75	125.00	38.00	0.4000	Chicago_24h_1in100	SCHOOL_CSP
I3	9.07	174.42	36.92	0.5000	Chicago_24h_1in100	SCHOOL_CSP
I4	0.65	40.00	38.00	0.4000	Chicago_24h_1in100	I5
I5	3.35	100.30	49.13	0.4000	Chicago_24h_1in100	SCHOOL_CSP
I6	1.45	45.00	77.00	1.0000	Chicago_24h_1in100	STMH13
I7	1.21	65.00	48.38	0.6000	Chicago_24h_1in100	SU1
J1	7.60	210.00	61.65	0.8000	Chicago_24h_1in100	STMH8
J2	1.51	105.00	50.77	1.0000	Chicago_24h_1in100	STMH7
J3A	2.25	85.00	38.00	0.8000	Chicago_24h_1in100	STMH6C
J3B	0.75	70.00	38.00	0.7000	Chicago_24h_1in100	STMH6B
J3C	1.14	95.00	38.00	0.9000	Chicago_24h_1in100	STMH6A
J3D	0.15	28.00	80.00	0.6000	Chicago_24h_1in100	STMH6
J4A	0.09	10.00	38.00	0.6000	Chicago_24h_1in100	STMH5B
J4B	1.80	115.00	38.00	0.5000	Chicago_24h_1in100	STMH5A
J4C	0.72	100.00	46.50	0.8000	Chicago_24h_1in100	STCB5B
J4D	0.60	100.00	72.00	0.4000	Chicago_24h_1in100	STCB5A
J4E	0.26	23.00	80.00	0.3000	Chicago_24h_1in100	STMH5
J5	1.68	48.00	78.01	0.2000	Chicago_24h_1in100	STMH4
J6	5.95	180.00	35.32	0.5000	Chicago_24h_1in100	STMH3

J7	1.10	45.00	38.00	0.7000	Chicago_24h_1in100	STMH2
K	1.24	45.00	72.00	0.6000	Chicago_24h_1in100	J40
L	3.34	200.00	41.10	1.0000	Chicago_24h_1in100	J46
M	3.06	130.00	27.08	2.0000	Chicago_24h_1in100	J55
N1	8.01	275.00	10.00	0.2500	Chicago_24h_1in100	N2
N2	2.64	35.00	38.00	1.0000	Chicago_24h_1in100	N3
N3	2.50	110.00	44.98	0.4000	Chicago_24h_1in100	SU2
O1	0.69	40.00	24.00	0.3000	Chicago_24h_1in100	STMHS1A
O2	1.14	50.00	38.00	0.5000	Chicago_24h_1in100	STMHS1
O3	0.64	63.00	38.00	0.5000	Chicago_24h_1in100	STMHS3
O4	5.02	275.00	10.00	1.2000	Chicago_24h_1in100	SU3
P1	0.89	40.00	38.00	0.5000	Chicago_24h_1in100	STMHS2
P2	1.54	55.00	38.00	0.7000	Chicago_24h_1in100	STMHS2A
P3	2.42	100.00	38.00	0.8000	Chicago_24h_1in100	J52
P4	4.91	205.00	10.00	1.0000	Chicago_24h_1in100	J53
Q	2.08	90.00	20.00	1.7000	Chicago_24h_1in100	J53

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Node Summary
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Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J10	JUNCTION	755.54	0.46	0.0	
J11	JUNCTION	755.41	0.46	0.0	
J12	JUNCTION	755.18	0.60	0.0	
J13	JUNCTION	755.22	0.60	0.0	
J14	JUNCTION	755.29	0.40	0.0	
J15	JUNCTION	755.33	0.40	0.0	
J16	JUNCTION	755.02	0.50	0.0	
J17	JUNCTION	754.95	0.50	0.0	
J18	JUNCTION	753.95	0.80	0.0	
J19	JUNCTION	753.85	2.00	0.0	
J20	JUNCTION	753.76	2.00	0.0	
J22	JUNCTION	754.60	0.50	0.0	
J23	JUNCTION	754.61	0.40	0.0	
J24	JUNCTION	754.90	0.40	0.0	
J25	JUNCTION	754.93	0.40	0.0	
J26	JUNCTION	754.71	0.50	0.0	
J27	JUNCTION	754.76	0.40	0.0	
J28	JUNCTION	754.96	0.40	0.0	
J29	JUNCTION	755.18	0.40	0.0	
J3	JUNCTION	756.19	0.40	0.0	
J36	JUNCTION	753.02	0.30	0.0	
J38	JUNCTION	752.88	0.46	0.0	
J39	JUNCTION	752.91	0.46	0.0	
J4	JUNCTION	755.95	0.40	0.0	
J40	JUNCTION	752.84	0.60	0.0	
J41	JUNCTION	752.69	0.60	0.0	
J42	JUNCTION	752.67	0.50	0.0	
J43	JUNCTION	753.17	0.50	0.0	
J44	JUNCTION	752.46	0.50	0.0	
J45	JUNCTION	752.29	0.50	0.0	
J46	JUNCTION	752.24	0.65	0.0	
J47	JUNCTION	752.04	1.00	0.0	
J48	JUNCTION	751.16	1.00	0.0	
J49	JUNCTION	751.50	0.75	0.0	
J50	JUNCTION	753.02	0.60	0.0	
J51	JUNCTION	752.95	0.60	0.0	
J52	JUNCTION	754.11	0.25	0.0	
J53	JUNCTION	753.66	2.00	0.0	
J54	JUNCTION	753.42	2.00	0.0	
J55	JUNCTION	753.29	0.50	0.0	

J56	JUNCTION	0.00	0.00	0.0
J8	JUNCTION	753.27	0.60	0.0
J9	JUNCTION	756.35	0.60	0.0
STCB5A	JUNCTION	753.36	1.51	0.0
STCB5B	JUNCTION	753.54	1.57	0.0
STMH1	JUNCTION	751.52	2.27	0.0
STMH10	JUNCTION	754.20	1.15	0.0
STMH11	JUNCTION	754.23	1.11	0.0
STMH12	JUNCTION	754.48	2.32	0.0
STMH13	JUNCTION	754.80	1.22	0.0
STMH2	JUNCTION	751.87	2.52	0.0
STMH3	JUNCTION	752.20	2.81	0.0
STMH4	JUNCTION	752.32	2.53	0.0
STMH5	JUNCTION	752.64	2.50	0.0
STMH5A	JUNCTION	753.79	2.52	0.0
STMH5B	JUNCTION	755.18	1.85	0.0
STMH6	JUNCTION	752.90	2.55	0.0
STMH6A	JUNCTION	753.00	2.56	0.0
STMH6B	JUNCTION	754.36	2.37	0.0
STMH6C	JUNCTION	754.83	1.94	0.0
STMH7	JUNCTION	753.03	2.35	0.0
STMH8	JUNCTION	753.23	1.65	0.0
STMHS1	JUNCTION	755.64	2.14	0.0
STMHS1A	JUNCTION	755.78	2.16	0.0
STMHS2	JUNCTION	755.62	1.84	0.0
STMHS2A	JUNCTION	755.84	0.95	0.0
STMHS3	JUNCTION	755.23	2.10	0.0
STMHS4	JUNCTION	755.11	2.39	0.0
STMHS5	JUNCTION	754.97	2.26	0.0
OF1	OUTFALL	753.59	0.60	0.0
OF2	OUTFALL	753.22	0.80	0.0
OF3	OUTFALL	752.98	0.30	0.0
OF4	OUTFALL	751.20	1.00	0.0
OF5	OUTFALL	751.50	0.00	0.0
SCHOOL_CSP	STORAGE	755.18	1.00	0.0
SU1	STORAGE	752.40	2.94	0.0
SU2	STORAGE	754.40	2.00	0.0
SU3	STORAGE	754.81	1.00	0.0

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Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	STMHS3	STMHS4	CONDUIT	45.2	0.2657	0.0130
C10	STMH11	STMH10	CONDUIT	33.4	0.0898	0.0130
C11	STMH10	OF1	CONDUIT	75.8	0.8110	0.0130
C12	STMH6C	STMH6B	CONDUIT	167.6	0.2684	0.0130
C13	STMH6B	STMH6A	CONDUIT	121.8	0.8620	0.0130
C14	STMH6A	STMH6	CONDUIT	41.6	0.2165	0.0130
C15	STMH8	STMH7	CONDUIT	103.6	0.1448	0.0130
C16	STMH7	STMH6	CONDUIT	106.1	0.0943	0.0130
C17	STMH5B	STMH5A	CONDUIT	154.3	0.9010	0.0130
C18	STMH5A	STCB5B	CONDUIT	83.4	0.2999	0.0130
C19	STCB5B	STCB5A	CONDUIT	59.0	0.3052	0.0130
C2	STMHS5	SU3	CONDUIT	56.3	0.2844	0.0130
C20	STMH6	STMH5	CONDUIT	100.4	0.2591	0.0130
C21	STMH5	STMH4	CONDUIT	54.4	0.5702	0.0130
C22	STMH4	STMH3	CONDUIT	43.0	0.2095	0.0130
C23	STMH3	STMH2	CONDUIT	169.9	0.1942	0.0130
C24	STMH2	STMH1	CONDUIT	113.2	0.2473	0.0130
C25	STMH1	J49	CONDUIT	13.3	0.1508	0.0130
C26	STCB5A	STMH5	CONDUIT	22.8	0.3070	0.0130

C27	J3	J4	CONDUIT	25.7	0.9430	0.0240
C28	J10	J11	CONDUIT	19.2	0.6460	0.0240
C29	J53	J54	CONDUIT	2.1	11.5572	0.0300
C3	STMHS2	STMHS3	CONDUIT	58.6	0.6661	0.0130
C30	J8	J9	CONDUIT	4.7	-87.5075	0.0240
C31	J12	J13	CONDUIT	17.8	-0.2414	0.0240
C32	J15	J14	CONDUIT	11.6	0.3105	0.0240
C33	J16	J17	CONDUIT	12.7	0.5650	0.0240
C34	J18	J19	CONDUIT	15.7	0.6306	0.0240
C35	J20	OF2	CONDUIT	41.8	1.3061	0.0240
C36	J23	J22	CONDUIT	11.6	0.1297	0.0240
C37	J25	J24	CONDUIT	13.6	0.2423	0.0240
C38	J27	J26	CONDUIT	9.7	0.4952	0.0240
C39	J29	J28	CONDUIT	21.4	1.0550	0.0240
C4	STMHS2A	STMHS2	CONDUIT	47.8	0.4602	0.0130
C40	J28	J25	CONDUIT	60.0	0.0450	0.0300
C41	J52	J53	CONDUIT	18.7	2.3815	0.0240
C42	J54	J55	CONDUIT	30.8	0.3987	0.0240
C43	J50	J51	CONDUIT	11.2	0.6003	0.0240
C44	J46	J47	CONDUIT	19.2	1.0303	0.0240
C45	J48	OF4	CONDUIT	8.3	-0.3990	0.0100
C46	J44	J45	CONDUIT	14.5	1.1652	0.0240
C47	J40	J41	CONDUIT	21.1	0.7024	0.0240
C48	J43	J42	CONDUIT	18.3	2.7286	0.0240
C49	J39	J38	CONDUIT	16.4	0.1768	0.0240
C5	STMHS4	STMHS5	CONDUIT	49.3	0.2839	0.0130
C50	J36	OF3	CONDUIT	6.6	0.7021	0.0240
C51	J55	J50	CONDUIT	144.6	0.1888	0.0300
C52	J51	J46	CONDUIT	128.3	0.5572	0.0300
C53	J47	J48	CONDUIT	3.0	30.1938	0.0300
C54	J49	J46	CONDUIT	49.0	-1.5075	0.0300
C55	J45	J48	CONDUIT	49.4	2.2942	0.0300
C56	J42	J41	CONDUIT	3.7	-0.4293	0.0300
C57	J41	J44	CONDUIT	33.2	0.6747	0.0300
C58	J19	J20	CONDUIT	34.3	0.2682	0.0300
C59	J24	J23	CONDUIT	47.6	0.5970	0.0300
C6	STMHS1A	STMHS1	CONDUIT	57.0	0.2458	0.0130
C60	J22	J18	CONDUIT	67.6	0.9559	0.0300
C61	J26	J19	CONDUIT	123.2	0.6981	0.0300
C62	J4	J10	CONDUIT	150.5	0.2737	0.0300
C63	J11	J15	CONDUIT	91.2	0.0932	0.0300
C64	J15	J16	CONDUIT	25.6	1.2063	0.0300
C65	J9	J12	CONDUIT	143.4	0.8187	0.0300
C66	J13	J14	CONDUIT	92.3	-0.0802	0.0300
C67	J14	J18	CONDUIT	141.9	0.9442	0.0300
C68	J17	J19	CONDUIT	101.6	1.0770	0.0300
C69	SCHOOL_CSP	STMH13	CONDUIT	68.1	0.5583	0.0130
C7	STMHS1	STMHS3	CONDUIT	144.8	0.2832	0.0130
C70	SCHOOL_CSP	SU1	CONDUIT	48.3	6.1396	0.0100
C8	STMH13	STMH12	CONDUIT	156.7	0.2042	0.0130
C9	STMH12	STMH11	CONDUIT	124.3	0.2011	0.0130
P1	SU1	STMH12	TYPE4 PUMP			

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Cross Section Summary
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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.61	0.29	0.15	0.61	1	0.33
C10	CIRCULAR	0.60	0.28	0.15	0.60	1	0.18
C11	CIRCULAR	0.60	0.28	0.15	0.60	1	0.55
C12	CIRCULAR	0.45	0.16	0.11	0.45	1	0.15

C13	CIRCULAR	0.45	0.16	0.11	0.45	1	0.26
C14	CIRCULAR	0.45	0.16	0.11	0.45	1	0.13
C15	CIRCULAR	0.60	0.28	0.15	0.60	1	0.23
C16	CIRCULAR	0.60	0.28	0.15	0.60	1	0.19
C17	CIRCULAR	0.45	0.16	0.11	0.45	1	0.27
C18	CIRCULAR	0.45	0.16	0.11	0.45	1	0.16
C19	CIRCULAR	0.45	0.16	0.11	0.45	1	0.16
C2	CIRCULAR	0.68	0.36	0.17	0.68	1	0.45
C20	CIRCULAR	0.75	0.44	0.19	0.75	1	0.57
C21	CIRCULAR	0.75	0.44	0.19	0.75	1	0.84
C22	CIRCULAR	0.75	0.44	0.19	0.75	1	0.51
C23	CIRCULAR	0.75	0.44	0.19	0.75	1	0.49
C24	CIRCULAR	0.75	0.44	0.19	0.75	1	0.55
C25	CIRCULAR	0.75	0.44	0.19	0.75	1	0.43
C26	CIRCULAR	0.45	0.16	0.11	0.45	1	0.16
C27	CIRCULAR	0.40	0.13	0.10	0.40	1	0.11
C28	CIRCULAR	0.46	0.17	0.12	0.46	1	0.13
C29	TRAPEZOIDAL	2.00	16.00	1.09	14.00	1	192.33
C3	CIRCULAR	0.37	0.11	0.09	0.37	1	0.13
C30	CIRCULAR	0.60	0.28	0.15	0.60	1	3.11
C31	CIRCULAR	0.60	0.28	0.15	0.60	1	0.16
C32	CIRCULAR	0.40	0.13	0.10	0.40	1	0.06
C33	CIRCULAR	0.50	0.20	0.12	0.50	1	0.15
C34	CIRCULAR	0.80	0.50	0.20	0.80	1	0.57
C35	CIRCULAR	0.80	0.50	0.20	0.80	1	0.82
C36	CIRCULAR	0.40	0.13	0.10	0.40	1	0.04
C37	CIRCULAR	0.40	0.13	0.10	0.40	1	0.06
C38	CIRCULAR	0.40	0.13	0.10	0.40	1	0.08
C39	CIRCULAR	0.40	0.13	0.10	0.40	1	0.12
C4	CIRCULAR	0.30	0.07	0.08	0.30	1	0.07
C40	TRAPEZOIDAL	0.40	0.88	0.25	3.40	1	0.25
C41	CIRCULAR	0.25	0.05	0.06	0.25	1	0.05
C42	CIRCULAR	0.50	0.20	0.12	0.50	1	0.13
C43	CIRCULAR	0.60	0.28	0.15	0.60	1	0.26
C44	CIRCULAR	0.65	0.33	0.16	0.65	1	0.42
C45	CIRCULAR	1.00	0.79	0.25	1.00	1	1.97
C46	CIRCULAR	0.50	0.20	0.12	0.50	1	0.22
C47	CIRCULAR	0.60	0.28	0.15	0.60	1	0.28
C48	CIRCULAR	0.50	0.20	0.12	0.50	1	0.34
C49	CIRCULAR	0.46	0.17	0.12	0.46	1	0.07
C5	CIRCULAR	0.61	0.29	0.15	0.61	1	0.34
C50	CIRCULAR	0.30	0.07	0.07	0.30	1	0.04
C51	TRAPEZOIDAL	0.50	1.75	0.34	5.00	1	1.23
C52	TRAPEZOIDAL	0.50	1.75	0.34	5.00	1	2.12
C53	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	65.21
C54	TRAPEZOIDAL	0.50	1.75	0.34	5.00	1	3.48
C55	TRAPEZOIDAL	0.50	1.75	0.34	5.00	1	4.30
C56	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.22
C57	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.54
C58	TRAPEZOIDAL	2.00	12.00	1.10	10.00	1	22.03
C59	TRAPEZOIDAL	0.40	0.88	0.25	3.40	1	0.90
C6	CIRCULAR	0.45	0.16	0.11	0.45	1	0.14
C60	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.83
C61	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.56
C62	TRAPEZOIDAL	0.30	0.57	0.20	2.80	1	0.34
C63	TRAPEZOIDAL	0.30	0.57	0.20	2.80	1	0.20
C64	TRAPEZOIDAL	0.30	0.57	0.20	2.80	1	0.71
C65	TRAPEZOIDAL	0.30	0.57	0.20	2.80	1	0.58
C66	TRAPEZOIDAL	0.30	0.57	0.20	2.80	1	0.18
C67	TRAPEZOIDAL	0.30	0.57	0.20	2.80	1	0.62
C68	TRAPEZOIDAL	0.30	0.57	0.20	2.80	1	0.67
C69	CIRCULAR	0.60	0.28	0.15	0.60	1	0.46
C7	CIRCULAR	0.45	0.16	0.11	0.45	1	0.15
C70	TRIANGULAR	0.15	0.04	0.07	0.60	1	0.18

C8	CIRCULAR	0.60	0.28	0.15	0.60	1	0.28
C9	CIRCULAR	0.60	0.28	0.15	0.60	1	0.28

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NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
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Analysis Options
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Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Starting Date JAN-26-2018 00:00:00
Ending Date JAN-27-2018 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 4
Head Tolerance ..... 0.001524 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	18.082	75.013
Evaporation Loss	0.000	0.000
Infiltration Loss	2.261	9.380
Surface Runoff	14.176	58.811
Final Storage	1.678	6.963
Continuity Error (%)	-0.187	

**********	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
**********	---------	---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	10.637	106.374
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	4.965	49.654
Flooding Loss	4.768	47.684
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	1.362	13.623
Continuity Error (%)	-4.312	

****
Highest Continuity Errors
****
Node J12 (100.00%)
Node J53 (-81.93%)
Node J13 (27.67%)
Node J42 (4.98%)
Node J54 (1.16%)

****
Time-Step Critical Elements
****
Link C25 (72.31%)
Link C50 (19.38%)
Link C43 (1.39%)

****
Highest Flow Instability Indexes
****
Link C29 (13)
Link C41 (7)
Link C42 (7)
Link C25 (3)
Link C22 (2)

****
Routing Time Step Summary
****
Minimum Time Step   :   0.50 sec
Average Time Step   :   1.91 sec
Maximum Time Step   :   5.00 sec
Percent in Steady State   :   0.00
Average Iterations per Step :   2.36
Percent Not Converging   :   2.67

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Pea Runof CM
A	75.01	0.00	0.00	10.41	60.05	16.62	3.5
B	75.01	0.00	0.00	10.74	59.58	8.04	1.5
C	75.01	0.00	0.00	10.90	59.35	5.48	1.0
D	75.01	0.00	0.00	10.07	58.01	8.71	1.2
E	75.01	0.00	0.00	10.26	59.56	5.21	0.9
F1	75.01	0.00	0.00	5.60	66.05	1.05	0.3
F2	75.01	0.00	0.00	5.45	66.21	0.30	0.0
F3	75.01	0.00	0.00	10.61	51.64	25.88	2.4
F4	75.01	382.32	0.00	10.95	426.41	28.83	1.3
G1	75.01	0.00	0.00	4.36	68.15	1.51	0.6
G2	75.01	0.00	0.00	6.79	65.32	1.89	0.8
H	75.01	0.00	0.00	7.51	64.54	1.36	0.7
I1	75.01	0.00	0.00	10.90	56.46	8.77	0.9
I2	75.01	233.82	0.00	7.54	294.60	11.05	1.0

I3	75.01	0.00	0.00	7.64	63.12	5.72	1.4
I4	75.01	0.00	0.00	7.51	64.21	0.42	0.1
I5	75.01	12.45	0.00	6.16	77.84	2.61	0.7
I6	75.01	0.00	0.00	2.79	70.03	1.01	0.4
I7	75.01	0.00	0.00	6.25	65.86	0.80	0.3
J1	75.01	0.00	0.00	4.64	67.65	5.14	2.0
J2	75.01	0.00	0.00	5.96	66.38	1.00	0.5
J3A	75.01	0.00	0.00	7.51	64.14	1.44	0.5
J3B	75.01	0.00	0.00	7.51	64.45	0.48	0.2
J3C	75.01	0.00	0.00	7.51	64.45	0.73	0.3
J3D	75.01	0.00	0.00	2.42	70.78	0.11	0.0
J4A	75.01	0.00	0.00	7.51	64.47	0.06	0.0
J4B	75.01	0.00	0.00	7.51	64.28	1.16	0.4
J4C	75.01	0.00	0.00	6.48	65.82	0.47	0.2
J4D	75.01	0.00	0.00	3.39	69.61	0.42	0.2
J4E	75.01	0.00	0.00	2.42	70.63	0.18	0.1
J5	75.01	0.00	0.00	2.66	69.66	1.17	0.3
J6	75.01	0.00	0.00	7.83	63.37	3.77	1.1
J7	75.01	0.00	0.00	7.51	64.14	0.71	0.2
K	75.01	0.00	0.00	3.39	69.25	0.86	0.3
L	75.01	0.00	0.00	7.13	64.86	2.17	0.9
M	75.01	0.00	0.00	8.83	62.67	1.92	0.7
N1	75.01	0.00	0.00	10.90	58.56	4.69	0.6
N2	75.01	177.60	0.00	7.53	238.49	6.30	0.6
N3	75.01	251.73	0.00	6.68	314.94	7.87	0.7
O1	75.01	0.00	0.00	9.20	61.83	0.43	0.1
O2	75.01	0.00	0.00	7.51	64.09	0.73	0.2
O3	75.01	0.00	0.00	7.51	64.42	0.41	0.1
O4	75.01	0.00	0.00	10.90	59.98	3.01	0.8
P1	75.01	0.00	0.00	7.51	64.10	0.57	0.2
P2	75.01	0.00	0.00	7.51	64.06	0.99	0.3
P3	75.01	0.00	0.00	7.51	64.18	1.55	0.5
P4	75.01	0.00	0.00	10.90	59.73	2.93	0.6
Q	75.01	0.00	0.00	9.69	61.53	1.28	0.4

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Node Depth Summary
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Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J10	JUNCTION	0.08	0.34	755.88	0 08:25	0.10
J11	JUNCTION	0.07	0.26	755.68	0 08:26	0.08
J12	JUNCTION	0.08	0.11	755.29	1 00:00	0.03
J13	JUNCTION	0.05	0.07	755.29	0 08:42	0.02
J14	JUNCTION	0.00	0.03	755.33	0 08:29	0.01
J15	JUNCTION	0.03	0.11	755.44	0 08:27	0.03
J16	JUNCTION	0.07	0.26	755.28	0 08:27	0.08
J17	JUNCTION	0.03	0.12	755.07	0 08:28	0.04
J18	JUNCTION	0.40	0.80	754.75	0 08:04	0.24
J19	JUNCTION	0.32	0.76	754.62	0 08:23	0.23
J20	JUNCTION	0.38	0.85	754.61	0 08:22	0.26
J22	JUNCTION	0.05	0.18	754.78	0 08:06	0.05
J23	JUNCTION	0.12	0.35	754.97	0 08:38	0.11
J24	JUNCTION	0.04	0.15	755.05	0 08:38	0.05
J25	JUNCTION	0.11	0.36	755.29	0 08:38	0.11
J26	JUNCTION	0.03	0.17	754.88	0 08:21	0.05
J27	JUNCTION	0.08	0.40	755.16	0 07:51	0.12
J28	JUNCTION	0.09	0.35	755.31	0 08:38	0.11
J29	JUNCTION	0.09	0.40	755.58	0 07:50	0.12

J3	JUNCTION	0.08	0.40	756.59	0	07:55	0.12
J36	JUNCTION	0.21	0.30	753.33	0	07:38	0.09
J38	JUNCTION	0.00	0.00	752.88	0	00:00	0.00
J39	JUNCTION	0.00	0.00	752.91	0	00:00	0.00
J4	JUNCTION	0.04	0.18	756.13	0	08:24	0.06
J40	JUNCTION	0.07	0.47	753.31	0	08:00	0.14
J41	JUNCTION	0.03	0.27	752.95	0	08:02	0.08
J42	JUNCTION	0.04	0.28	752.95	0	08:02	0.09
J43	JUNCTION	0.00	0.00	753.17	0	00:00	0.00
J44	JUNCTION	0.07	0.47	752.93	0	08:02	0.14
J45	JUNCTION	0.01	0.12	752.42	0	08:02	0.04
J46	JUNCTION	0.05	0.30	752.54	0	08:00	0.09
J47	JUNCTION	0.01	0.04	752.08	0	08:00	0.01
J48	JUNCTION	0.10	0.40	751.56	0	08:02	0.12
J49	JUNCTION	0.71	0.75	752.25	0	04:26	0.23
J50	JUNCTION	0.16	0.60	753.62	0	07:59	0.18
J51	JUNCTION	0.07	0.27	753.23	0	08:45	0.08
J52	JUNCTION	0.09	0.25	754.36	0	07:46	0.08
J53	JUNCTION	0.11	2.00	755.66	0	07:57	0.54
J54	JUNCTION	0.26	2.00	755.42	0	07:57	0.61
J55	JUNCTION	0.09	0.50	753.79	0	08:00	0.15
J56	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
J8	JUNCTION	0.57	0.60	753.87	0	04:07	0.18
J9	JUNCTION	0.00	0.00	756.35	0	00:00	0.00
STCB5A	JUNCTION	0.15	1.51	754.87	0	07:51	0.46
STCB5B	JUNCTION	0.15	1.57	755.11	0	07:51	0.48
STMH1	JUNCTION	0.71	0.91	752.43	0	07:51	0.27
STMH10	JUNCTION	0.26	0.52	754.72	0	08:00	0.16
STMH11	JUNCTION	0.37	0.81	755.04	0	07:59	0.24
STMH12	JUNCTION	0.49	1.74	756.22	0	07:59	0.51
STMH13	JUNCTION	0.58	1.22	756.02	0	07:51	0.37
STMH2	JUNCTION	0.45	1.86	753.73	0	07:59	0.56
STMH3	JUNCTION	0.35	2.73	754.93	0	07:59	0.82
STMH4	JUNCTION	0.32	2.53	754.85	0	07:51	0.77
STMH5	JUNCTION	0.25	2.50	755.14	0	07:51	0.70
STMH5A	JUNCTION	0.14	2.52	756.31	0	07:52	0.77
STMH5B	JUNCTION	0.03	1.85	757.03	0	07:56	0.56
STMH6	JUNCTION	0.26	2.55	755.45	0	07:51	0.69
STMH6A	JUNCTION	0.23	2.56	755.56	0	07:51	0.78
STMH6B	JUNCTION	0.14	2.37	756.73	0	07:52	0.72
STMH6C	JUNCTION	0.14	1.94	756.77	0	07:53	0.59
STMH7	JUNCTION	0.28	2.25	755.28	0	07:59	0.67
STMH8	JUNCTION	0.24	1.65	754.88	0	07:51	0.50
STMHS1	JUNCTION	0.10	2.14	757.78	0	07:56	0.65
STMHS1A	JUNCTION	0.07	2.16	757.94	0	07:56	0.66
STMHS2	JUNCTION	0.10	1.50	757.12	0	07:57	0.39
STMHS2A	JUNCTION	0.09	0.95	756.79	0	07:53	0.29
STMHS3	JUNCTION	0.29	1.57	756.80	0	07:57	0.35
STMHS4	JUNCTION	0.37	1.38	756.49	0	07:57	0.26
STMHS5	JUNCTION	0.46	0.67	755.64	1	00:00	0.20
OF1	OUTFALL	0.26	0.49	754.08	0	08:00	0.15
OF2	OUTFALL	0.33	0.60	753.82	0	08:22	0.18
OF3	OUTFALL	0.15	0.21	753.18	0	07:39	0.06
OF4	OUTFALL	0.05	0.34	751.54	0	08:02	0.10
OF5	OUTFALL	0.00	0.00	751.50	0	00:00	0.00
SCHOOL_CSP	STORAGE	0.47	1.00	756.18	0	08:38	0.30
SU1	STORAGE	2.09	2.94	755.34	0	09:55	0.89
SU2	STORAGE	1.38	2.00	756.40	0	13:07	0.61
SU3	STORAGE	0.55	0.83	755.64	1	00:00	0.25

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Fl Balan Err Perce
J10	JUNCTION	0.000	0.128	0	08:24	0	0.913	0.4
J11	JUNCTION	0.000	0.127	0	08:25	0	0.909	0.1
J12	JUNCTION	0.000	0.003	0	08:52	0	0.0105	10523.1
J13	JUNCTION	0.000	0.003	0	08:29	0	0.0145	38.2
J14	JUNCTION	0.000	0.015	0	08:27	0	0.0675	-0.0
J15	JUNCTION	0.000	0.126	0	08:26	0	0.908	0.0
J16	JUNCTION	0.000	0.112	0	08:27	0	0.839	0.0
J17	JUNCTION	0.000	0.112	0	08:27	0	0.839	0.0
J18	JUNCTION	1.318	1.465	0	08:35	28.8	30.1	0.1
J19	JUNCTION	0.000	1.148	0	08:04	0	28.1	0.1
J20	JUNCTION	0.000	0.971	0	08:22	0	28	0.0
J22	JUNCTION	0.000	0.136	0	08:38	0	1.25	-0.0
J23	JUNCTION	0.000	0.136	0	08:38	0	1.25	0.1
J24	JUNCTION	0.000	0.136	0	08:38	0	1.25	0.0
J25	JUNCTION	0.000	0.136	0	08:38	0	1.26	0.1
J26	JUNCTION	0.000	0.175	0	07:51	0	1.02	-0.3
J27	JUNCTION	0.701	0.701	0	08:00	1.36	1.35	0.0
J28	JUNCTION	0.000	0.139	0	07:52	0	1.26	0.1
J29	JUNCTION	0.879	0.879	0	08:00	1.89	1.89	0.0
J3	JUNCTION	0.314	0.314	0	08:00	1.05	1.05	0.0
J36	JUNCTION	1.269	1.269	0	08:00	8.71	8.71	0.0
J38	JUNCTION	0.000	0.000	0	00:00	0	0	0.0
J39	JUNCTION	0.000	0.000	0	00:00	0	0	0.0
J4	JUNCTION	0.000	0.138	0	07:55	0	0.914	0.0
J40	JUNCTION	0.370	0.370	0	08:00	0.859	0.859	0.0
J41	JUNCTION	0.000	0.369	0	08:00	0	0.861	0.0
J42	JUNCTION	0.000	0.004	0	08:00	0	0.00228	5.2
J43	JUNCTION	0.000	0.000	0	00:00	0	0	0.0
J44	JUNCTION	0.000	0.347	0	08:00	0	0.858	0.0
J45	JUNCTION	0.000	0.329	0	08:02	0	0.857	0.0
J46	JUNCTION	0.955	1.511	0	08:00	2.17	7.61	0.0
J47	JUNCTION	0.000	0.184	0	08:00	0	0.705	0.0
J48	JUNCTION	0.000	0.507	0	08:01	0	1.56	0.2
J49	JUNCTION	0.000	2.459	0	08:00	0	18.4	0.3
J50	JUNCTION	0.000	0.981	0	08:03	0	6.04	0.2
J51	JUNCTION	0.000	0.581	0	07:59	0	5.45	0.0
J52	JUNCTION	0.570	0.633	0	08:00	1.55	1.74	0.0
J53	JUNCTION	1.083	31.458	0	08:33	4.21	5.8	-45.0
J54	JUNCTION	0.000	45.340	0	08:36	0	10.2	1.1
J55	JUNCTION	0.718	1.151	0	08:00	1.92	6.06	0.0
J56	JUNCTION	0.000	0.000	0	00:00	0	0	0.0
J8	JUNCTION	0.088	0.088	0	08:00	0.298	0.298	0.4
J9	JUNCTION	0.000	0.000	0	00:00	0	0	0.0
STCB5A	JUNCTION	0.248	0.591	0	08:00	0.418	1.88	0.0
STCB5B	JUNCTION	0.261	0.602	0	08:00	0.474	1.66	-0.0
STMH1	JUNCTION	0.000	1.187	0	08:00	0	11.5	0.2
STMH10	JUNCTION	0.000	0.581	0	08:00	0	16.8	0.0
STMH11	JUNCTION	0.000	0.581	0	08:00	0	16.8	0.0
STMH12	JUNCTION	0.672	0.691	0	08:00	1.51	16.8	0.0
STMH13	JUNCTION	0.460	0.570	0	08:00	1.01	14.5	0.0
STMH2	JUNCTION	0.253	1.187	0	08:00	0.705	11.5	0.2
STMH3	JUNCTION	1.105	1.105	0	08:00	3.77	10.8	0.0
STMH4	JUNCTION	0.362	0.969	0	08:00	1.17	7.63	0.0
STMH5	JUNCTION	0.096	0.662	0	07:50	0.184	6.59	0.0
STMH5A	JUNCTION	0.453	0.481	0	08:00	1.16	1.23	-0.0
STMH5B	JUNCTION	0.027	0.076	0	07:56	0.058	0.0669	-0.2
STMH6	JUNCTION	0.066	0.614	0	07:51	0.106	5.29	0.0

STMH6A	JUNCTION	0.340	0.619	0	08:00	0.735	2.34	-0.0
STMH6B	JUNCTION	0.223	0.280	0	08:00	0.483	1.6	-0.0
STMH6C	JUNCTION	0.514	0.514	0	08:00	1.44	1.44	0.0
STMH7	JUNCTION	0.498	0.511	0	07:51	1	3.47	0.1
STMH8	JUNCTION	2.007	2.356	0	08:00	5.14	5.58	0.0
STMHS1	JUNCTION	0.253	0.373	0	08:00	0.73	1.16	0.0
STMHS1A	JUNCTION	0.120	0.120	0	08:00	0.427	0.427	-0.0
STMHS2	JUNCTION	0.199	0.199	0	08:00	0.57	1.29	0.0
STMHS2A	JUNCTION	0.337	0.381	0	08:00	0.986	0.994	0.0
STMHS3	JUNCTION	0.184	0.618	0	08:00	0.412	2.84	0.7
STMHS4	JUNCTION	0.000	0.618	0	08:00	0	2.82	0.4
STMHS5	JUNCTION	0.000	0.618	0	08:00	0	2.8	0.6
OF1	OUTFALL	0.000	0.578	0	08:00	0	16.8	0.0
OF2	OUTFALL	0.000	0.970	0	08:22	0	28	0.0
OF3	OUTFALL	0.000	0.070	0	07:39	0	3.26	0.0
OF4	OUTFALL	0.000	0.504	0	08:02	0	1.56	0.0
OF5	OUTFALL	0.000	0.000	0	00:00	0	0	0.0
SCHOOL_CSP	STORAGE	3.121	3.564	0	08:00	19.4	19.6	0.0
SU1	STORAGE	0.337	0.516	0	08:00	0.797	4.09	0.8
SU2	STORAGE	0.756	0.756	0	08:10	7.87	7.87	-44.9
SU3	STORAGE	0.826	1.440	0	08:00	3.01	5.8	-49.9

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J18	JUNCTION	2.93	0.000	0.000
J27	JUNCTION	0.49	0.000	0.000
J29	JUNCTION	0.80	0.000	0.000
J3	JUNCTION	0.46	0.000	0.000
J36	JUNCTION	7.79	0.000	0.000
J49	JUNCTION	19.55	0.000	0.000
J50	JUNCTION	0.69	0.000	0.000
J52	JUNCTION	1.81	0.000	0.000
J53	JUNCTION	0.04	0.000	0.000
J54	JUNCTION	0.52	0.000	0.000
J55	JUNCTION	0.05	0.000	0.000
J56	JUNCTION	24.00	0.000	0.000
J8	JUNCTION	19.87	0.000	0.000
STCB5A	JUNCTION	1.25	1.056	0.000
STCB5B	JUNCTION	1.21	1.123	0.000
STMH1	JUNCTION	0.98	0.089	1.361
STMH11	JUNCTION	1.02	0.207	0.303
STMH12	JUNCTION	8.80	1.137	0.583
STMH13	JUNCTION	9.23	0.620	0.000
STMH2	JUNCTION	1.54	1.106	0.664
STMH3	JUNCTION	1.62	1.947	0.083
STMH4	JUNCTION	1.60	1.770	0.000
STMH5	JUNCTION	1.26	1.400	0.000
STMH5A	JUNCTION	1.12	2.070	0.000
STMH5B	JUNCTION	0.28	1.400	0.000
STMH6	JUNCTION	1.33	1.800	0.000
STMH6A	JUNCTION	1.31	1.800	0.000
STMH6B	JUNCTION	1.02	1.900	0.000
STMH6C	JUNCTION	0.88	1.490	0.000
STMH7	JUNCTION	1.42	1.601	0.099
STMH8	JUNCTION	1.39	1.050	0.000

STMHS1	JUNCTION	0.50	1.692	0.000
STMHS1A	JUNCTION	0.41	1.712	0.000
STMHS2	JUNCTION	0.78	1.137	0.337
STMHS2A	JUNCTION	0.85	0.645	0.000
STMHS3	JUNCTION	0.31	0.964	0.526
STMHS4	JUNCTION	0.23	0.767	1.013
SCHOOL_CSP	STORAGE	7.88	0.400	0.000
SU1	STORAGE	16.13	2.786	0.000
SU2	STORAGE	24.00	2.000	0.000
SU3	STORAGE	13.12	0.151	0.174

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Node Flooding Summary
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Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days	hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Depth Meters
J18	2.93	0.744	0	08:27	3.847	0.000
J27	0.49	0.533	0	08:00	0.337	0.000
J29	0.80	0.741	0	08:00	0.635	0.000
J3	0.46	0.186	0	08:00	0.136	0.000
J36	7.79	1.199	0	08:00	5.455	0.000
J49	19.55	2.458	0	08:00	18.309	0.000
J50	0.69	0.421	0	08:03	0.576	0.000
J52	1.81	0.626	0	08:00	1.137	0.000
J53	0.01	14.167	0	08:33	0.181	0.000
J54	0.28	22.267	0	08:35	5.027	0.000
J55	0.05	0.157	0	08:00	0.013	0.000
J8	19.87	0.088	0	08:00	0.297	0.000
STCB5A	0.69	0.590	0	08:00	0.733	0.000
STCB5B	0.59	0.418	0	08:00	0.356	0.000
STMH13	0.51	0.127	0	08:00	0.038	0.000
STMH4	0.38	0.968	0	08:00	0.547	0.000
STMH5	0.01	0.085	0	07:51	0.000	0.000
STMH5A	0.13	0.248	0	07:52	0.031	0.000
STMH5B	0.01	0.068	0	07:56	0.000	0.000
STMH6	0.01	0.165	0	07:51	0.000	0.000
STMH6A	0.41	0.334	0	08:00	0.184	0.000
STMH6B	0.01	0.172	0	07:52	0.001	0.000
STMH6C	0.54	0.457	0	08:00	0.320	0.000
STMH8	1.08	2.354	0	08:00	3.129	0.000
STMHS1	0.11	0.095	0	08:00	0.017	0.000
STMHS1A	0.01	0.068	0	07:56	0.000	0.000
STMHS2A	0.62	0.380	0	08:00	0.272	0.000
SCHOOL_CSP	2.23	0.993	0	08:38	2.851	0.000
SU1	7.46	0.095	0	09:55	1.895	0.000
SU2	10.87	0.098	0	13:07	1.441	0.000

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maxi Outf

SCHOOL_CSP	1.788	34	0	0	5.214	100	0	08:38	0.
SU1	0.997	70	0	0	1.434	100	0	09:55	0.
SU2	4.334	67	0	0	6.430	100	0	13:07	0.
SU3	3.870	55	0	0	5.783	83	1	00:00	0.

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	99.06	0.238	0.578	16.805
OF2	97.93	0.407	0.970	28.034
OF3	99.69	0.045	0.070	3.256
OF4	95.31	0.024	0.504	1.558
OF5	0.00	0.000	0.000	0.000
System	78.40	0.714	1.972	49.653

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Link Flow Summary
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Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.618	0	08:00	2.11	1.87	1.00
C10	CONDUIT	0.581	0	08:00	2.12	3.16	0.93
C11	CONDUIT	0.578	0	08:00	2.28	1.05	0.84
C12	CONDUIT	0.171	0	08:25	1.08	1.16	1.00
C13	CONDUIT	0.279	0	08:00	1.76	1.05	1.00
C14	CONDUIT	0.341	0	08:17	2.14	2.57	1.00
C15	CONDUIT	0.404	0	07:51	1.43	1.73	1.00
C16	CONDUIT	0.511	0	07:51	1.81	2.71	1.00
C17	CONDUIT	0.058	0	07:56	0.52	0.21	1.00
C18	CONDUIT	0.342	0	08:03	2.15	2.19	1.00
C19	CONDUIT	0.185	0	08:14	1.16	1.17	1.00
C2	CONDUIT	0.617	0	08:00	3.78	1.38	0.99
C20	CONDUIT	0.507	0	07:50	1.44	0.89	1.00
C21	CONDUIT	0.553	0	08:55	1.41	0.66	1.00
C22	CONDUIT	0.618	0	07:53	1.40	1.21	1.00
C23	CONDUIT	0.981	0	08:17	2.22	2.00	1.00
C24	CONDUIT	1.187	0	08:00	2.69	2.14	1.00
C25	CONDUIT	1.187	0	07:59	2.69	2.75	1.00
C26	CONDUIT	0.172	0	08:33	1.34	1.09	1.00
C27	CONDUIT	0.138	0	07:55	1.55	1.26	0.73
C28	CONDUIT	0.127	0	08:25	1.09	0.96	0.66
C29	CONDUIT	45.340	0	08:36	4.50	0.24	1.00
C3	CONDUIT	0.190	0	07:56	1.81	1.42	1.00
C30	CONDUIT	0.000	0	00:00	0.00	0.00	0.50
C31	CONDUIT	0.003	0	08:52	0.27	0.02	0.15
C32	CONDUIT	0.015	0	08:27	0.93	0.23	0.18
C33	CONDUIT	0.112	0	08:27	1.67	0.73	0.37
C34	CONDUIT	0.909	0	08:04	2.02	1.60	0.98
C35	CONDUIT	0.970	0	08:22	2.08	1.19	0.88
C36	CONDUIT	0.136	0	08:38	1.71	3.34	0.65
C37	CONDUIT	0.136	0	08:38	1.59	2.44	0.64

C38	CONDUIT	0.175	0	07:51	1.98	2.20	0.71
C39	CONDUIT	0.139	0	07:52	1.21	1.20	0.94
C4	CONDUIT	0.105	0	07:53	1.43	1.52	1.00
C40	CONDUIT	0.136	0	08:38	0.22	0.55	0.89
C41	CONDUIT	0.077	0	08:04	1.85	1.56	1.00
C42	CONDUIT	0.488	0	08:12	2.51	3.78	1.00
C43	CONDUIT	0.581	0	07:59	2.85	2.25	0.72
C44	CONDUIT	0.184	0	08:00	2.68	0.44	0.26
C45	CONDUIT	0.504	0	08:02	1.88	0.26	0.37
C46	CONDUIT	0.329	0	08:02	2.76	1.49	0.59
C47	CONDUIT	0.369	0	08:00	2.08	1.32	0.60
C48	CONDUIT	0.000	0	00:00	0.00	0.00	0.28
C49	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C5	CONDUIT	0.618	0	08:00	2.17	1.81	0.94
C50	CONDUIT	0.070	0	07:39	1.10	1.59	0.84
C51	CONDUIT	0.981	0	08:03	0.56	0.80	1.00
C52	CONDUIT	0.567	0	08:45	0.88	0.27	0.54
C53	CONDUIT	0.184	0	08:00	0.33	0.00	0.22
C54	CONDUIT	1.283	0	08:00	1.01	0.37	0.80
C55	CONDUIT	0.329	0	08:02	0.45	0.08	0.53
C56	CONDUIT	0.004	0	08:00	0.01	0.00	0.55
C57	CONDUIT	0.347	0	08:00	0.51	0.23	0.73
C58	CONDUIT	0.971	0	08:22	0.46	0.04	0.40
C59	CONDUIT	0.136	0	08:38	0.32	0.15	0.64
C6	CONDUIT	0.120	0	08:00	0.76	0.86	1.00
C60	CONDUIT	0.147	0	08:06	0.25	0.08	0.68
C61	CONDUIT	0.168	0	08:21	0.46	0.11	0.67
C62	CONDUIT	0.128	0	08:24	0.36	0.38	0.81
C63	CONDUIT	0.126	0	08:26	0.43	0.64	0.63
C64	CONDUIT	0.112	0	08:27	0.39	0.16	0.62
C65	CONDUIT	0.000	0	00:00	0.00	0.00	0.19
C66	CONDUIT	0.003	0	08:29	0.09	0.02	0.17
C67	CONDUIT	0.011	0	08:29	0.05	0.02	0.55
C68	CONDUIT	0.112	0	08:28	0.33	0.17	0.70
C69	CONDUIT	0.447	0	07:59	1.64	0.97	1.00
C7	CONDUIT	0.290	0	08:04	1.84	1.93	1.00
C70	CONDUIT	0.183	0	07:53	4.06	0.99	1.00
C8	CONDUIT	0.386	0	11:15	1.37	1.39	1.00
C9	CONDUIT	0.581	0	08:00	2.05	2.11	1.00
P1	PUMP	0.018	0	07:49		1.00	

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Flow Classification Summary
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	Adjusted	Fraction of Time in Flow Class								
Conduit	/Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C11	1.00	0.00	0.00	0.00	0.01	0.98	0.00	0.00	0.38	0.00
C12	1.00	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.01	0.00
C13	1.00	0.00	0.00	0.00	0.07	0.00	0.00	0.93	0.01	0.00
C14	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.79	0.00
C15	1.00	0.00	0.00	0.00	0.94	0.00	0.00	0.06	0.07	0.00
C16	1.00	0.00	0.00	0.00	0.49	0.00	0.00	0.51	0.00	0.00
C17	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.97	0.00
C18	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.95	0.00
C19	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.94	0.00
C2	1.00	0.00	0.00	0.00	0.75	0.25	0.00	0.00	0.00	0.00
C20	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.00

C21	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.89	0.00
C22	1.00	0.00	0.00	0.00	0.93	0.00	0.00	0.07	0.08	0.00
C23	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.79	0.00
C24	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.07	0.00
C25	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C26	1.00	0.00	0.00	0.00	0.07	0.00	0.00	0.93	0.00	0.00
C27	1.00	0.00	0.00	0.00	0.04	0.96	0.00	0.00	0.00	0.00
C28	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
C29	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.87	0.00
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.96	0.00
C30	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C31	1.00	0.11	0.00	0.00	0.89	0.00	0.00	0.00	0.01	0.00
C32	1.00	0.04	0.00	0.00	0.79	0.17	0.00	0.00	0.00	0.00
C33	1.00	0.04	0.00	0.00	0.03	0.93	0.00	0.00	0.00	0.00
C34	1.00	0.00	0.00	0.00	0.45	0.55	0.00	0.00	0.00	0.00
C35	1.00	0.01	0.00	0.00	0.96	0.03	0.00	0.00	0.00	0.00
C36	1.00	0.01	0.00	0.00	0.39	0.61	0.00	0.00	0.00	0.00
C37	1.00	0.00	0.00	0.00	0.35	0.64	0.00	0.00	0.00	0.00
C38	1.00	0.00	0.00	0.00	0.04	0.96	0.00	0.00	0.00	0.00
C39	1.00	0.00	0.00	0.00	0.99	0.01	0.00	0.00	0.78	0.00
C4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.94	0.00
C40	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.04	0.00
C41	1.00	0.00	0.00	0.00	0.12	0.88	0.00	0.00	0.01	0.00
C42	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C43	1.00	0.01	0.00	0.00	0.02	0.97	0.00	0.00	0.00	0.00
C44	1.00	0.00	0.00	0.00	0.06	0.94	0.00	0.00	0.00	0.00
C45	1.00	0.00	0.04	0.00	0.91	0.04	0.00	0.00	0.00	0.00
C46	1.00	0.00	0.00	0.00	0.02	0.98	0.00	0.00	0.00	0.00
C47	1.00	0.00	0.00	0.00	0.03	0.97	0.00	0.00	0.00	0.00
C48	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C49	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.28	0.00
C50	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C51	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.90	0.00
C52	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.10	0.00
C53	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.99	0.00
C54	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.98	0.00
C55	1.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.97	0.00
C56	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.00
C57	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.97	0.00
C58	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.26	0.00
C59	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.94	0.00
C6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.97	0.00
C60	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.78	0.00
C61	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.91	0.00
C62	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.92	0.00
C63	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C64	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.87	0.00
C65	1.00	0.18	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C66	1.00	0.06	0.00	0.00	0.94	0.00	0.00	0.00	0.65	0.00
C67	1.00	0.00	0.06	0.00	0.94	0.00	0.00	0.00	0.85	0.00
C68	1.00	0.00	0.05	0.00	0.95	0.00	0.00	0.00	0.86	0.00
C69	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.60	0.00
C7	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.97	0.00
C70	1.00	0.00	0.46	0.00	0.03	0.51	0.00	0.00	0.28	0.00
C8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.58	0.00
C9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.40	0.00

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Conduit Surcharge Summary
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Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	0.23	0.31	0.23	0.63	0.23
C10	0.01	1.01	0.01	9.89	0.01
C11	0.01	0.01	0.01	0.08	0.01
C12	0.88	0.88	1.02	0.23	0.23
C13	1.04	1.04	1.31	0.08	0.08
C14	1.51	1.51	1.54	1.16	1.17
C15	1.39	1.39	1.42	0.32	0.12
C16	1.40	1.46	1.40	0.84	0.59
C17	0.28	0.28	1.12	0.01	0.01
C18	1.12	1.12	1.21	0.51	0.51
C19	1.21	1.21	1.25	0.65	0.66
C2	0.01	0.01	13.12	0.28	0.01
C20	1.33	1.33	1.45	0.01	0.01
C21	1.45	1.45	1.60	0.01	0.01
C22	1.61	1.61	1.62	0.87	0.87
C23	1.54	1.65	1.54	1.77	1.54
C24	0.98	1.54	0.98	1.71	0.98
C25	0.01	2.00	0.01	2.00	0.01
C26	1.25	1.25	1.26	0.07	0.09
C27	0.01	0.46	0.01	0.57	0.01
C3	0.78	0.78	8.53	0.75	0.74
C34	0.01	0.01	0.01	5.37	0.01
C35	0.01	0.74	0.01	3.66	0.01
C36	0.01	0.01	0.01	2.10	0.01
C37	0.01	0.01	0.01	1.65	0.01
C38	0.01	0.49	0.01	0.92	0.01
C39	0.01	0.80	0.01	0.93	0.01
C4	0.82	0.85	0.82	0.68	0.56
C41	0.01	0.01	1.85	0.61	0.01
C42	0.01	1.88	0.01	2.46	0.01
C43	0.01	0.69	0.01	1.81	0.01
C46	0.01	0.01	0.01	0.20	0.01
C47	0.01	0.01	0.01	0.11	0.01
C5	0.01	0.23	9.06	0.59	0.01
C50	0.01	7.79	0.01	10.36	0.01
C51	0.01	0.01	0.96	0.01	0.01
C54	0.01	0.01	20.24	0.01	0.01
C6	0.41	0.41	0.50	0.01	0.01
C60	0.01	0.01	5.92	0.01	0.01
C61	0.01	0.01	4.33	0.01	0.01
C62	0.01	0.01	0.59	0.01	0.01
C67	0.01	0.01	12.14	0.01	0.01
C68	0.01	0.01	8.59	0.01	0.01
C69	7.88	7.88	9.23	0.01	0.01
C7	0.50	0.50	0.69	0.44	0.44
C70	9.27	9.27	16.13	0.01	0.01
C8	8.78	9.23	8.80	8.84	8.31
C9	1.01	8.80	1.01	9.49	1.01

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Pumping Summary
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Pump	Percent Utilized	Number of Start-Ups	Min Flow CMS	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Power Usage Kw-hr
P1	97.69	1	0.00	0.01	0.02	1.112	1.31

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Analysis begun on:  Fri Sep 21 09:20:32 2018
Analysis ended on:  Fri Sep 21 09:20:35 2018
Total elapsed time: 00:00:03
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Village of Duchess - Infrastructure Master Plan
Storm Water Collection System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

	Margaret Avenue Storm Pond Expansion	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 26,000.00	$ 26,000.00
2	Topsoil Stripping and Stockpiling	6,000	m^2	$ 3.00	$ 18,000.00
3	Surcharge Pond Waste Excavation	6,000	m^3	$ 20.00	$ 120,000.00
4	Grass Restoration - Topsoil and Seed	6,000	m^2	$ 6.00	$ 36,000.00
				SUBTOTAL	$ 200,000.00
CONTINGENCY (15%)					$ 30,000.00
MATERIAL TESTING (2.5%)					$ 6,000.00
ENGINEERING (12%)					$ 28,000.00
				TOTAL	**$ 270,000.00**

	Highway 873 Storm Pond	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 83,000.00	$ 83,000.00
2	Topsoil Stripping and Stockpiling	17,000	m^2	$ 3.00	$ 51,000.00
3	Surcharge Pond Waste Excavation	20,000	m^3	$ 20.00	$ 400,000.00
4	Grass Restoration - Topsoil and Seed	17,000	m^2	$ 6.00	$ 102,000.00
				SUBTOTAL	$ 636,000.00
CONTINGENCY (15%)					$ 95,000.00
MATERIAL TESTING (2.5%)					$ 18,000.00
ENGINEERING (12%)					$ 90,000.00
				TOTAL	**$ 840,000.00**

	Highway 873 Culvert Upgrades	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 8,000.00	$ 8,000.00
2	1050mm Culvert Installation	20	m	$ 1,500.00	$ 30,000.00
5	Asphalt Road Restoration - Highway 873	200	m^2	$ 120.00	$ 24,000.00
				SUBTOTAL	$ 62,000.00
CONTINGENCY (15%)					$ 9,000.00
MATERIAL TESTING (2.5%)					$ 2,000.00
ENGINEERING (12%)					$ 9,000.00
				TOTAL	**$ 90,000.00**