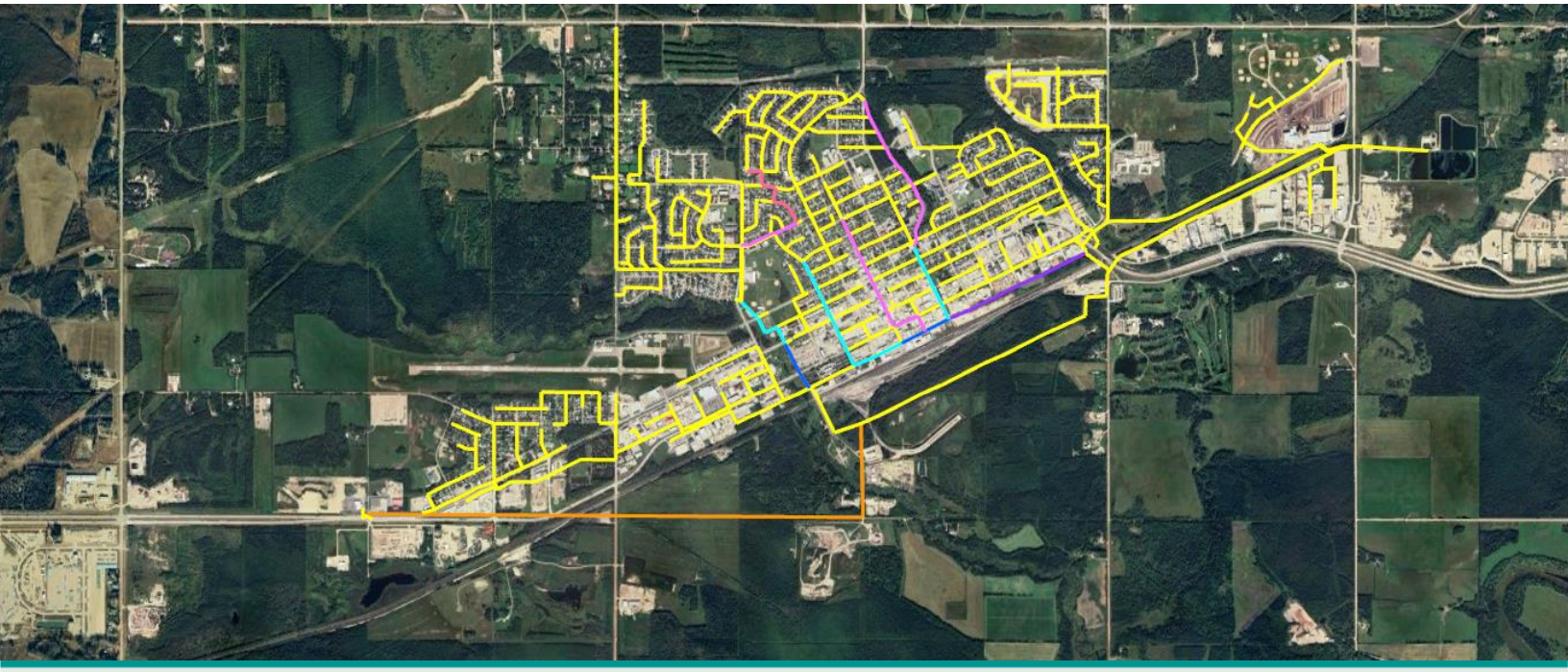

Town of Edson Sanitary Sewer Condition Assessment

August 15, 2023
Council Resolution #171 - 2023

Submitted to: Town of Edson
Prepared by McElhanney

Contact
Jeff Amundson, P.Eng.
Project Manager
780-423-0192
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Address
201, 13455 114 Avenue NW,
Edmonton, Alberta Canada
T5M 2E2

Our file: 3231-10590-00

Your Challenge.
Our Passion.

Our File: 3231-10590-00

July 25, 2023

Town of Edson
Civic Centre | 605 – 50 Street, Edson, AB
Edson, Alberta T7E 1N7

Attention: Clayton Kittlitz, General Manager, Infrastructure and Planning

Town of Edson Sanitary Capital Plan

McElhanney Ltd. is pleased to submit the Town of Edson Sanitary Capital Plan covering the Edson sanitary system.

A detailed investigation and assessment was undertaken by McElhanney to:

1. Calibrate the sanitary collection system model to match recorded flow conditions,
2. Identify capacity-related deficiencies in the existing sanitary collection system;
3. Develop a condition assessment and repair program based on review of existing CCTV reports;
4. Evaluate and recommend alternatives to improve the sanitary collection system, to suit existing and expected future development conditions; and
5. Prepare a cost estimate and capital plan to budget and prioritize projects to improve the sanitary collection system.

The existing piped collection system was evaluated using a computational hydraulic model developed for the Town. Loading rates were established based on recorded flow conditions, using the following as a basis for analysis:

1. For residential areas, per capita population loading
2. For institutional / commercial / industrial (ICI) area, land area loading rates

Diurnal curves have been established based on flow monitoring data. Inflow and infiltration (including rainfall dependent inflow) has been established by calibrating hydrograph RTK values to flow monitoring observed data. Recommendations were developed based on the analysis completed using the calibrated computational model.

We trust this report provides the necessary information as needed by the Town for capital planning related to the sanitary sewer collection system.

Sincerely,

Prepared by:

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Reviewed by:

Michael Maltais, P.Eng.
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Executive Summary

The Town of Edson (the Town) sanitary sewer system, comprised a gravity collection pipe network discharging to the Town of Edson lagoon wastewater treatment system, services a population of 8,374. Future development of the Town has been broken into 10-yr and 20-yr horizons. Residential growth is forecasted in the north and southwest of the Town, commercial growth is forecasted to the southwest, and industrial growth to the south.

The Town has reported ongoing significant inflow and infiltration (I/I) into their sanitary collection system. This has resulted in capacity concerns at the wastewater treatment plant (WWTP), as well as capacity concerns for sanitary mains across the Town, such as 56th Street and 10th Avenue. At the WWTP specifically, the Town is currently reviewing future upgrade requirements that may be required to meet regulatory obligations.

Additionally, the existing model has not been accurately calibrated, as buffering at an overflow pond prior to the WWTP resulted in underestimation of peak and total inflow.

To investigate the high I/I, and to recalibrate the model, the Town has initiated a sewer condition assessment project, with the following objectives:

- A flow monitoring program to both identify problem neighbourhoods with respect to I&I, and to calibrate the Town computational hydraulic model,
- Review Town CCTV documentation to identify high priority repairs,
- Identify capacity deficiencies in the Town sanitary sewer system,
- Recommend repairs and upgrades to accommodate existing and expected future development conditions, and
- Prepare a capital plan, including recommendation order of necessity and Class ‘D’ Cost Estimate for budgeting and planning purposes.

Findings of the report included very high inflow and infiltration, as suspected. This is anticipated to cause a combination of surcharging and flooding in extreme storm events. Recommendations to address I/I, and to make the sanitary sewer system more robust to accommodate these extreme storm events, are summarized below and elaborated on in the body of the report:

1. Isolate sources of high I/I

    a. Direct Connections

    Through conversations with Town operational staff, one of the key issues identified is direct connections to the sanitary system, including direct connections for sump systems and other stormwater controls. This is a likely explanation for the high I/I present in the north residential areas. These connections should not be permitted moving forward, and steps should be taken to disconnect direct connections where possible.

    b. High Groundwater Infiltration, SW Commercial

    Another key finding of the report is continuous high groundwater infiltration from the SW commercial area west of Bench Creek. An estimated 17.5% of total inflow is from this problem area. An investigation should be launched immediately to determine the source of this high groundwater infiltration. Correction of this problem could have a drastic effect on lagoon capacity in particular.

    c. High Groundwater Infiltration, NW Residential

    Similar to the previous point, high groundwater infiltration is noted at the NW residential area of Town, although not as severe as the SW Commercial area, at 5.3%. An investigation of this area should be undertaken following correction to the SW Commercial area.

2. Upgrades to the sanitary pipe system

    A series of upgrades to the sanitary pipe system have been identified to increase the system capacity, generally located at the following locations, per ***Figure 17: Proposed System Upgrades – Capacity Related***:

    - A1 – 10th Avenue Sanitary Main
    - A2 – 54th Street / 56th Street Sanitary Trunk
    - A3 – 52nd Street Sanitary Trunk
    - A4 – 50th Street Sanitary Main
    - A5 – 1st Avenue Sanitary Trunk
    - A6 – 48th Street Sanitary Main
    - B1 – 52nd Street / 54th Street / 13th Ave / 54th Street / 14th Avenue Sanitary Main

3. Development of a sewer flushing program

    Several locations within the Town are noted to have flat pipe, and as a result do not achieve self-cleansing velocities. This can lead to accumulation of solids and eventual blockages. A figure

within the report has identified these areas. A sewer flushing program is recommended at these locations as part of the Town operation and maintenance program.

An additional recommendation for a new lift station has been made to accommodate new development to the southwest, but this is unrelated to capacity concerns, rather is intended to address the depth constraints in the sanitary sewer system at the southwest corner of the Town.

The final section of the report has been prepared to prioritize capital projects, and assign costs to the different upgrade and repair programs for Town budgeting purposes. A brief summary of capital projects has been included for quick reference below:

Capital Projects Summary (Includes 35% Contingency)

Location	Cost
A1 – 10th Avenue Sanitary Main	$589,000.00
B1 – 52nd Street / 54th Street / 13th Ave / 54th Street / 14th Avenue	$857,000.00
A2 – 54th Street / 56th Street Sanitary Trunk	$2,059,000.00
A3 – 52nd Street Sanitary Main	$1,219,000.00
A4 – 50th Street	$2,399,000.00
A5 – 1st Avenue Sanitary Trunk	$3,255,000.00
A6 – 48th Street Sanitary Main	$2,790,000.00

Aside from the recommended capital projects, there are other measures recommended to help the Town increase inflow and infiltration and improve the capacity of the sanitary sewer system. These are covered in detail within the body of the report.

Contents

Table of Figures

Table of Tables

1. Introduction

The Town of Edson (the Town) sanitary sewer system is comprised of a gravity collection pipe network discharging to the Town of Edson lagoon wastewater treatment system. The Town sanitary system is shown in ***Figure 1: Existing Sanitary System***.

McElhanney Ltd. (McElhanney) was retained by the Town to complete an assessment of the Town sanitary system and complete a capital plan for upgrades. The Town has identified significant ongoing issues with Inflow and infiltration (I&I) into the Town of Edson wastewater collection system. This has resulted in capacity concerns at the wastewater treatment plant (WWTP), as well as capacity concerns for sanitary mains across the Town, such as 56th Street and 10th Avenue. At the WWTP specifically, the Town is currently reviewing future upgrade requirements that may be required to meet regulatory obligations.

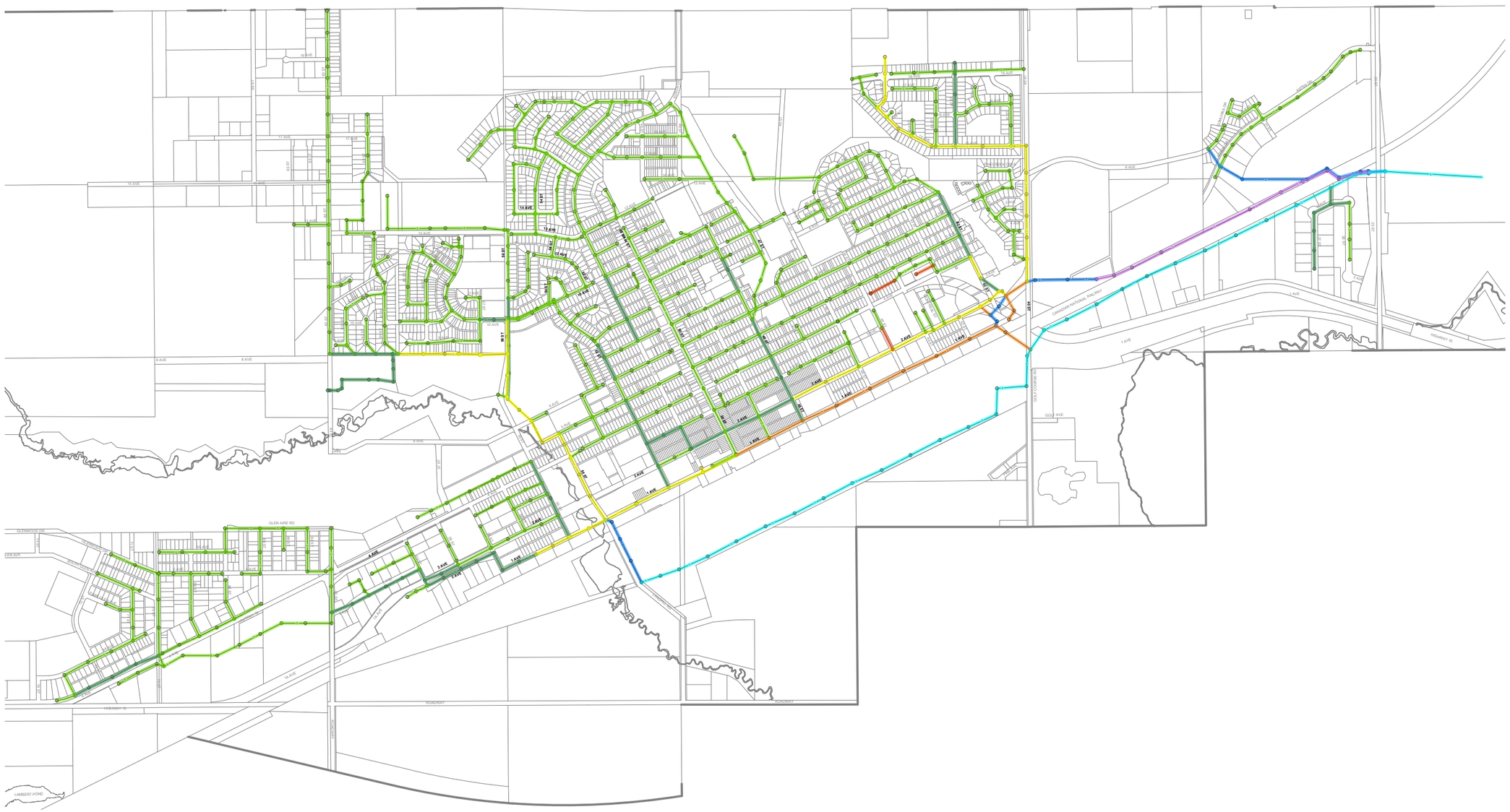
Additionally, the existing model is not accurately calibrated, as described in the *Water and Sanitary Modeling Memo* (McElhanney, 2020). Substantial under-estimation of flows was being under-reported at the WWTP due to buffering at overflow ponds, where some of the flow would bypass the flow meter. Due to the inaccuracies noted in the existing model, the model could not be fully relied upon, affecting the ability of the Town to accurately assess the effects of new development and upgrades on the Town sanitary system.

Based on these concerns and the objectives of the study as outlined by the Town, the following tasks were identified and completed.

- A flow monitoring program to both identify problem neighbourhoods with respect to I&I, and to calibrate the Town computational hydraulic model. The flow monitoring stations and corresponding areas used for calibration are identified in ***Figure 2: Flow Monitoring Program***.
    - The calibrated hydraulic model has been used to complete a capacity assessment of the existing sanitary collection system and determine capacity related shortfalls. Upgrades required as a result of the capacity assessment have been recommended herein.
- Development of an inspection program to identify specific condition related issues such as breakages, disconnected joints.
- A capital plan to recommend repairs and upgrades, including order of necessity and associated cost.

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25



McElhanney

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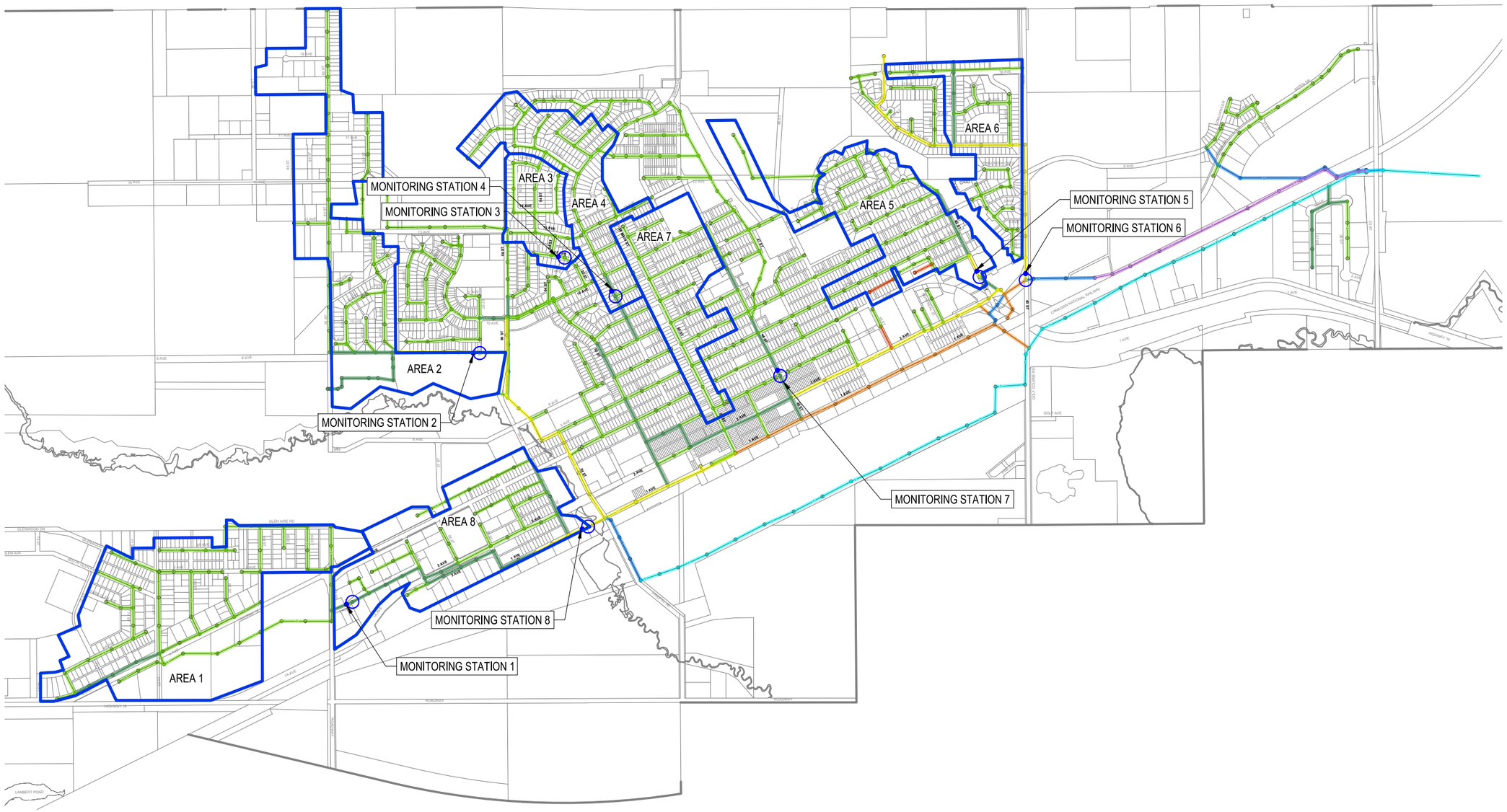
FIGURE 1: EXISTING SANITARY SYSTEM

SCALE 1:20000

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25



DATE: July 25, 2023, 1:36 PM FILE: X:\3231\Projects\3231-10590-00 Sanitary Sewer Condition Assessment\10.0 DRAWINGS\10.3 Engineering\10.3.2 Sketches\01 - Sanitary Figures (for Report)\3231-10590-00-FIG2-FLOW-MONITORING.dwg

McElhanney

FIGURE 2: FLOW MONITORING PROGRAM

SCALE 1:20000

1.1. SCOPE OF WORK

Based on study objectives as identified by the Town, the scope of the work is summarized as follows.

EXISTING DATA REVIEW

- Review background information, including GIS data, as-built information and past reports.
- Complete 'gap' analysis to identify areas of missing information.
- Perform topographic field survey to collect manhole elevations and pipe inverts, as required to complete model geometry.
- Closed Circuit Television (CCTV) Video Review
    - Review and document the Town CCTV library according to NAASCO standards
    - Perform a QA of the Thuro CCTV video
    - Identify additional areas requiring CCTV inspection

FLOW MONITORING PROGRAM & MODEL CALIBRATION

- Develop and implement a flow monitoring program to facilitate modeled flow calibration.
- Develop and agree on applicable design criteria and level of service for system loading and pipe functionality.
- Development of a calibrated hydraulic model, to assess the capacity of the existing sanitary collection system.
- Analyse the existing system based on the following scenarios:
    - Peak Dry Weather Flow (PDWF) based on existing population.
    - Peak Wet Weather Flow (PWWF) based on existing population and 25 Year design storm (current IDF)

DEVELOPMENT OF AN INSPECTION / ASSESSMENT FRAMEWORK

- Delineate priority areas for CCTV inspections. This includes an action plan for CCTV video inspection and smoke testing.

QA REVIEW OF INSPECTIONS / REPORTS GENERATED BY THE INSPECTION PLAN

- Review and document Town CCTV library to NAASCO standards.
- Perform a QA of the Thuro CCTV video.
- Use video to inform decisions on additional areas requiring CCTV inspection.

ASSET MANAGEMENT DATABASE

- Generate an asset inventory and asset condition database of the Town's existing sanitary sewer infrastructure. This data has been gathered from available information including record drawings, topographic survey, CCTV inspection, sanitary flow monitoring data and previously completed reports.

CAPITAL PLAN

- Develop a series of proposed capital upgrades if needed, which would, once constructed, meet the agreed upon design criteria and level of service outlined.
- Prepare preliminary, Class 'D', cost estimates for the construction of the proposed capital upgrades.

1.2. BACKGROUND DOCUMENTS

1.2.1. Municipal Servicing Plan

The Town sanitary model was updated in 2018 as part of the *Municipal Servicing Plan (MSP)*, (GHD, 2018). The MSP provided recommendations for repair and capital upgrades following a condition assessment, and capacity analysis. Condition assessment upgrades were focused on the downtown commercial area and nearby residential area. Performance upgrades generally focussed on the sanitary trunk at 54 Street and 47 Street.

The MSP sanitary model was used as the basis for the hydraulic analysis.

1.2.2. Technical Memorandum - 2020 Water & Sewer Network Modeling

During the development of the *2020 Water & Sewer Network Modeling Technical Memorandum* (McElhanney, Dec 2020), discussions were held with Town staff to discuss the significant inflow and infiltration problems in the sanitary sewer system. The outcome of the discussions was that the model required additional review to confirm the wet weather conditions. The wet weather model results were checked against Town flow and rainfall data for the July 7 and July 8 (2020), event. This event was a long duration storm, and no bypassing was observed. Approximately 32mm and 13mm (43mm total) of rain was recorded on July 7th and 8th, respectively. For general comparison purposes, the Environment Canada IDF curve for the Edson Climate rain gauge shows 43.3 mm for as a 2-year 24-hour duration return period event. This is significantly smaller than the 25-year 4-hour event used in the analysis as per MSP 2018 Updated design criteria. The 2-yr 24-hour return period was analyzed to validate the model results.

For the July 7th and 8th storms, the Town reported a peak inflow of 320 L/s at the Town Wastewater Treatment Plant (WWTP). The model, under the 25-year 4-hour event, computed a peak inflow of 250 L/s. An additional check was performed for the 2-year 24-hour event to compare similar rainfall; the model, under the 2-year 24-hour event, computed a peak inflow of 166 L/s. This was a significant variance in results, resulting in significant uncertainty in the model.

As a result, a recommendation was made to perform an infiltration and inflow study, for the purposes of identifying critical I&I locations and to recalibrate the model.

1.2.3. Technical Memorandum – 10th Avenue Flooding

The 10th Avenue Flooding Technical Memorandum (McElhanney, 2021) assessed flooding issues reported in the sanitary pipe system along 10th Avenue between 52nd Street (N) and 54th Street. Based on the assessment, recommendations were made to re-establish a previous pipe connection to fully

utilize a downstream twinned pipe, and to upsize a segment of pipe from 52nd Street (N) to 52nd Street (S).

1.2.4. Technical Memorandum – Major Storm Summary & Sanitary Overflow

The Major Storm Summary & Sanitary Overflow Technical Memorandum (McElhanney, 2022) was prepared to characterize the major storm event that occurred the June 28, 2022 to June 29, 2022, and to review flooding calculated through the Town PCSWMM computational model. The model results indicated surface flooding of 97 m^3 at MH S358 on 6th Avenue, between 55th Street and 53rd Street, due to surcharged conditions.

1.3. FLOW MONITORING PROGRAM

The first stage in the calibration is to undertake a flow monitoring program. Eight (8) Isco Type 2150 Area-Velocity flow meters were installed at selected locations across the Town. These meters measure the depth of flow using a differential pressure transducer. Both the velocity and depth sensor are enclosed in the same sensor head. As depth increases, it puts more strain on the sensor which in turn sends out a larger signal to the data logger. The sensors are accurate to the following.

- ±0.1 ft/s from -5 to 5 ft/s (±0.03 m/s from -1.5 to +1.5 m/s)
- ±2% of reading from 5 to 20 ft/s (1.5 to 6.1 m/s)

The objective of selecting sites for flow monitoring is to identify manholes suitable for model calibration and validation. The flow meters were installed at key locations shown in ***Figure 1***. The monitoring stations were selected to capture key areas of the Town, which may have different loading characteristics.

Table 1: Relevant Criteria from Town of Ponoka Sanitary Design Standards (2013)

STATION	PRIMARY LAND USE	CATCHMENT AREA	PIPE SIZE
Station 1 SW Residential	Residential	68.1 ha	250mm
Station 2 NW Residential	Residential	63.3 ha	375mm
Station 3 N-Central	Residential	13.6 ha	300mm
Station 4 N-Central	Residential	31.3 ha	300mm
Station 5 NE Residential	Residential	41.9 ha	375mm
Station 6 SE Residential	Residential	41.4 ha	375mm
Station 7 Commercial	Commercial	25.2 ha	200mm
Station 8 Commercial*	Commercial	116.6 ha	300mm

*Includes Station 1 area

Rainfall data was gathered over the same time period. The rainfall data is used to produce a rainfall response curve, detailed in Section 3.6. The rain gauge was an ISCO 674 Rain Gauge; the rain gauge recorded measurements over 5 minute intervals, in 0.254mm (0.01 inch) increments.

1.4. SITE INVESTIGATION

There is a west-east sanitary sewer bypass located south of the Town and south of the railway. The Town identified a possible pipe connection from the sanitary sewer bypass to the sanitary network at the end of the Highway 16 overpass was not captured in the original model build.

McElhanney staff coordinated with the Town to complete a topographic survey of the manholes in the area to confirm the pipe configuration and confirm the presence of the bypass. The survey confirmed the bypass and the model was updated to reflect this change.

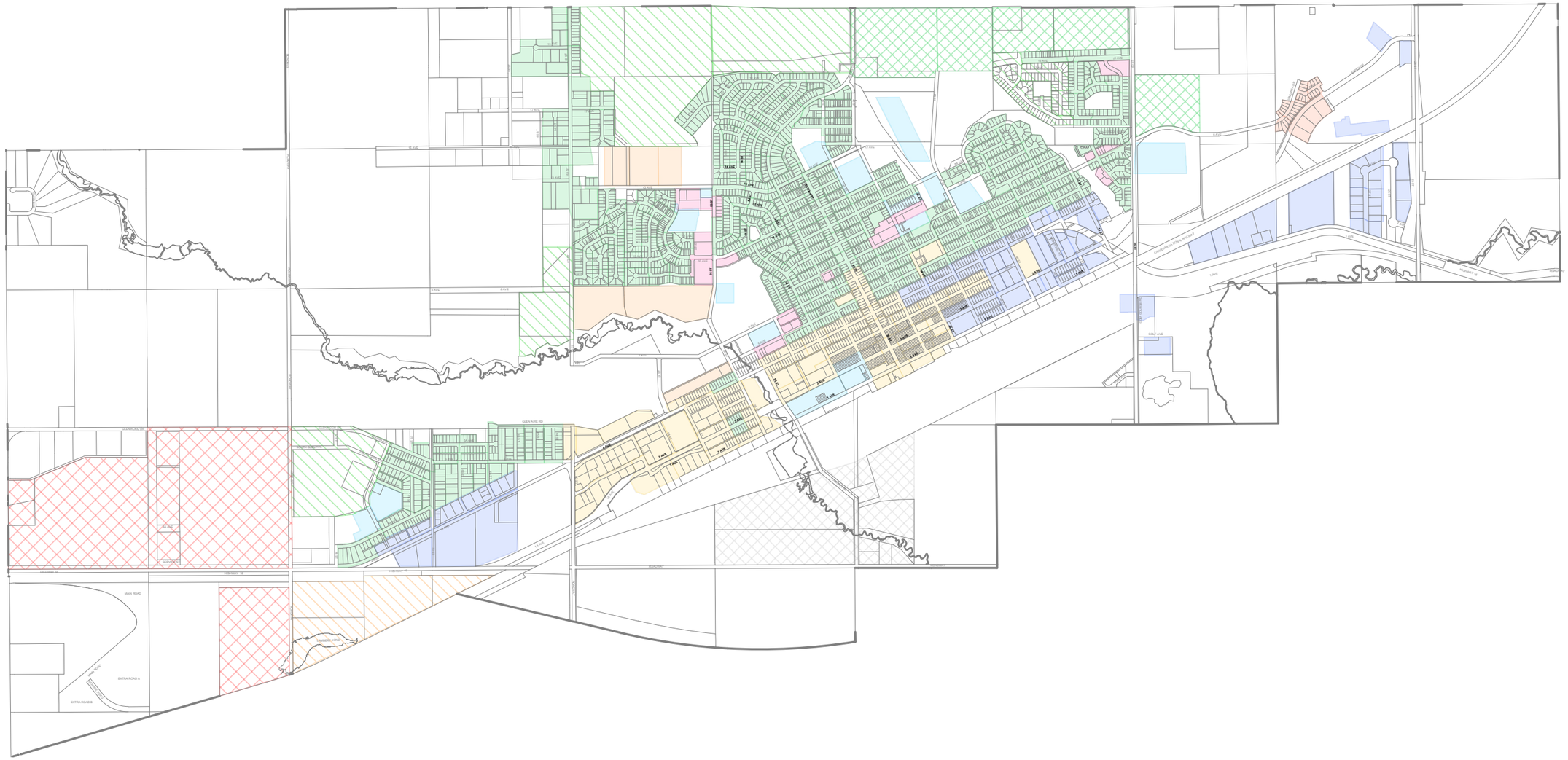
As an additional note, the survey elevations were universally lower than the model elevations. The model elevations were therefore not updated as part of this exercise, as there is a possibility of a different datum originally used for the model build. Adjusting to the survey would create an artificial low area in the model, affecting the hydraulics and not properly representing the system performance.

1.5. TOWN OF EDSON GROWTH HORIZONS

The Town has provided updated 10 year and 20-year growth horizons for use in planning necessary upgrades. This has been included in ***Figure 3: Town of Edson Growth Horizons***.

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25



McElhanney

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FIGURE 3: GROWTH HORIZONS

SCALE 1:25000

2. Design Criteria

Hydraulic modeling was undertaken to ascertain the performance of the existing and proposed sanitary collection system. The hydraulic model was developed in PCSWMM version 7.1. Sanitary inflow, or loading, was calculated outside of the PCSWMM model via spreadsheet and applied as input flows at each manholes, based on the contributing catchment. Model results were evaluated based on the capacity analysis criteria outlined in ***Table 2***.

The Town of Edson does not have published engineering standards or guidelines; the following guidelines and standards were used to establish design criteria, in order of hierarchy.

- *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems: Part 3 Wastewater Systems Standards for Performance and Design of a Total of 5 Parts* (March 2013), published by Alberta Government.
- *Existing Municipal Servicing Plan Update Report* (July 2018), published by GHD.
- *Volume 3 Drainage. Vol 3-03: Design Guidelines* (February 2022), published by EPCOR.
- *Code of Practice for the Hydraulic Modeling of Urban Drainage Systems Version 01*, published by Chartered Institution of Water and Environmental Management (CIWEM).

Table 2: Design Criteria

DESIGN PARAMETER	VALUE
Capacity (Pipes > 200 mm diameter)	80% d/D*
Minimum Velocity	0.6 m/s**
Maximum Velocity	6.0 m/s**
Minimum Pipe Diameter	200 mm**
Minimum Cover Depth	2.7 m
Maximum Manhole Spacing	120 m

*Volume 3 Drainage. Vol 3-03: Design Guidelines, Section 1.8.2.iii (February 2022). EPCOR. https://www.epcor.com/products-services/drainage/service-for-new-developments/Documents/design-standards-volume-3-03-drainage.pdf

**Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems: Part 3 Wastewater Systems Standards for Performance and Design of a Total of 5 Parts, Section 3.3.1.1 (March 2013). Alberta Government. https://open.alberta.ca/dataset/f57fec02-7de8-4985-b948-dcf5e2664aee/resource/6df3ae50-cacb-4e4c-b5b3-98d829ab661a/download/part3-wastewatersystemsstandards-2013.pdf

3. Sanitary Loading

Sanitary loading for the analysis was broken down into three components:

- Base Sanitary Flow (BSF)
- Base Inflow and Infiltration (I&I)
- Rainfall Dependent Inflow and Infiltration (RDII)

The base sanitary flow was determined based on land use, separating catchments into residential, commercial, and industrial land use. Base sanitary loading was evaluated under a per capita loading rate for residential areas, and a land area loading rate for industrial and commercial / institutional.

3.1. CATCHMENT ANALYSIS

The model developed for the *Existing Municipal Servicing Plan Update Report* (2018) by GHD was used as the basis for the calibration exercise. Catchments were updated using a current orthophoto, land use and sanitary pipe layout. Catchments were evaluated at a level of approximately ½ block, depending on individual characteristics.

3.2. BASE SANITARY LOADING

3.2.1. Dry Weather Flow

Choosing an appropriate reporting period was difficult as data was noted to oscillate over the entire reporting period from March to September, and later data was noted to be influenced by rainfall dependant inflow and infiltration (RDII). The best suitable time interval used for evaluating dry weather flow was April 7-14. No rainfall was noted over this period or the five days preceding. Flow data was observed for consistency and confirmation that flow patterns were representative of long-term data, with no unusual spikes or troughs, although flow patterns trend down slightly over the dry weather period.

3.2.2. Residential

Residential flow rates were determined by evaluating flow at Monitoring Station 2, 3, 4, 5, and 6, as the contributing catchments at these locations are residential.

- Residential per capita use was determined by performing a count of individual residences per catchment and assigning a population density. High density apartment block unit density was determined by observation at street level where professional judgement was used to assume a layout.

- Population density per private residence was assigned through application of Statistics Canada census data, per ***Table 3***. Population density for single family and high density housing was determined by using published design estimates, and reducing proportionally to equate to the Edson population.

Table 3: Population Density Analysis

NAME	VALUE
Edson Population*	8,374
Single Family Homes*	2,780
Single Family Population Density**	2.66
High Density Housing Units*	605
High Density Housing Population Density**	1.57

*Census Profile, 2021 Census of Population. Statistics Canada. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=edson&DGUIDlist=2021A00054814024&GENDERlist=1,2,3&STATISTICIist=1,4&HEADERlist=0

**Ratio of single family to high density population density based off typical design estimate comparing single family density to multi-family density. Vol. 3-03: Design Guidelines (February 2022). EPCOR. https://www.epcor.com/products-services/drainage/service-for-new-developments/Documents/design-standards-volume-3-03-drainage.pdf

- The per capita loading rate was calculated at 160 L/c/d under dry weather flow conditions.
    - This rate is lower than expected, as typical design estimates range from 220 L/c/d to 300 L/c/d.

Table 4: Residential Loading Rate Analysis

NAME	VALUE
Residential Loading Rate	160 L/c/d
Monitoring Station 2*	
-Observed	332 m^3/d
-Modeled	359 m^3/d
-Absolute Percent Difference	8.1%
Monitoring Station 3	
-Observed	86 m^3/d

NAME	VALUE
-Modeled	92 m^3/d
-Absolute Percent Difference	8.1%
Monitoring Station 4**	
-Observed	135 m^3/d
-Modeled	82 m^3/d
-Absolute Percent Difference	39.1%
Monitoring Station 5	
-Observed	286 m^3/d
-Modeled	278 m^3/d
-Absolute Percent Difference	2.6%
Monitoring Station 6	
-Observed	186 m^3/d
-Modeled	191 m^3/d
-Absolute Percent Difference	2.7%

*Includes 2.7 L/s baseflow

** Monitoring Station 4 was not used for determination of residential loading rate. Review of influent data showed results not consistent with other areas of the Town. This may be a result of the fact that there are overflow pipes and pipe splits within this area, so may not be represented properly in the model. Recommendations for further analysis are discussed in ***Section 8***.

3.2.3. Industrial / Commercial / Institutional

ICI flow rates were determined by calculating the difference in daily flow from residential flow. ICI loading was based on contributing ICI area, less residential loading. Residential loading was determined by applying the residential per capita flow rate and population density from ***Section 3.2.2*** to the counted private residences.

ICI loading was determined as a function of gross land area. ICI gross land area loading rates were adjusted to account for the higher ratio of commercial to industrial sanitary loading.

Loading rates for hospitals and schools were manually entered according to number of patients and students respectively.

Table 5: Monitoring Station 3 ICI Loading Rate Analysis

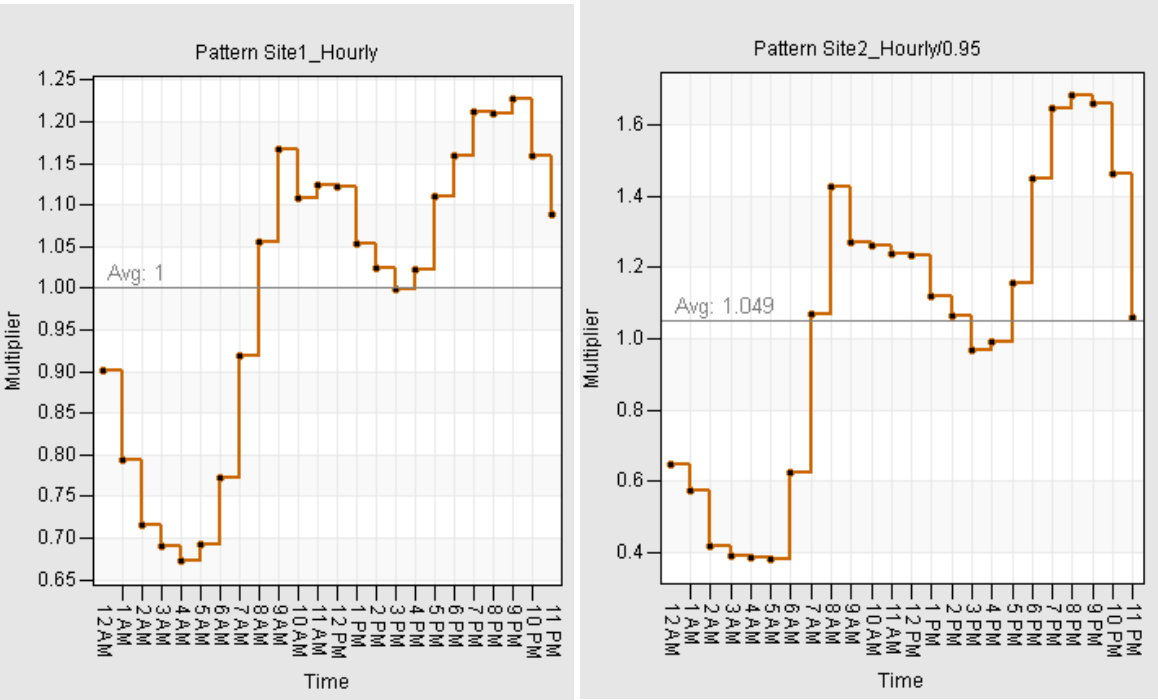
NAME	VALUE
Town of Edson Daily Inflow Analysis Dates	April 7 – April 18
Town of Edson Average Daily Inflow[1]	4434 m^3 / d
Contributing Residential Population	8375
Per Capita Loading Rate	160 L/c/d
Residential Daily Loading	- 1340 m^3 / d (15.5 L/s)
Base Inflow and Infiltration Total	- 1097 m^3 / d (12.7 L/s) (1.0 L/s + 2.7 L/s + 9.0 L/s)
Hospital Total[2]	- 74 m^3 / d (0.9 L/s)
ICI Daily Loading	+ 1923 m^3 / d (22.3 L/s)
ICI Contributing Area	188.6 ha
ICI Gross Area Loading Rate Average	10.2 m^3 / ha / d
Commercial Loading Rate	12 m^3 / ha / d
Industrial Loading Rate	8 m^3 / ha / d
Check	
Model Output Daily Inflow	4440 m^3 / d
Percent Difference	0.1%

[1] Edson WWTP Sampling & Analysis Requirements – Performance and Compliance Monitoring, Town of Edson
[2] Alberta Health Services Utility Account, Town of Edson

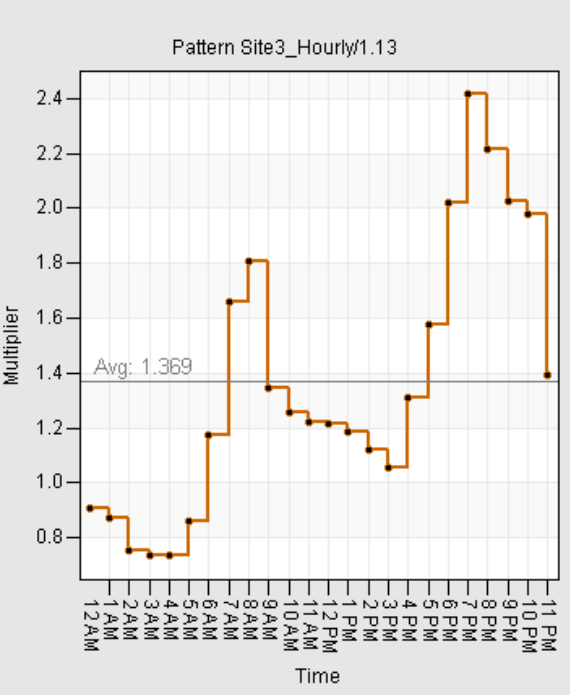
3.3. PEAKING FACTOR

Diurnal patterns were created for each monitoring station and assigned to subcatchments. Flow data was reviewed for consistency in recorded data over the event period used to create diurnal patterns. March 24-26, April 7-19 and May 25-31 were used to create the diurnal patterns, as there was no rainfall over these intervals; a longer period than the April 7-14 validation period was used to minimize short-term variability. For the analysis, the base diurnal curve established from the flow monitoring data was used to better match observed flow patterns, rather than a 2X or 3X peaking factor.

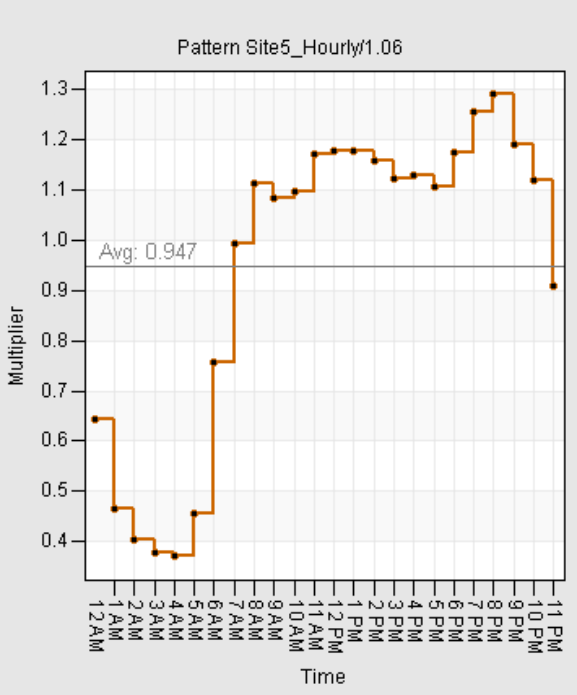
Figure 4 outlines the diurnal patterns established based on the flow monitoring. For explanation of the flow pattern for Monitoring Station 3 and 4, refer to ***Section 3.4***.



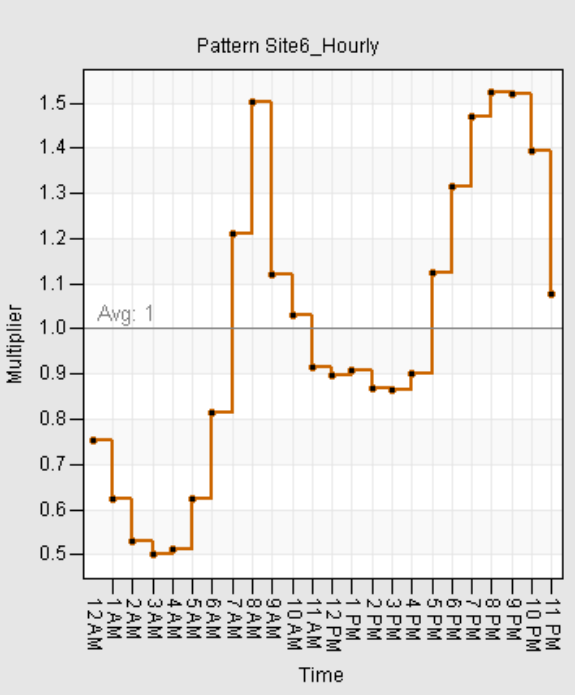
Site 1: SW Residential, Upstream of 3rd Ave / 63 St
Site 2: NW Residential, Upstream of Vanier Community Catholic School / 56th St (West)



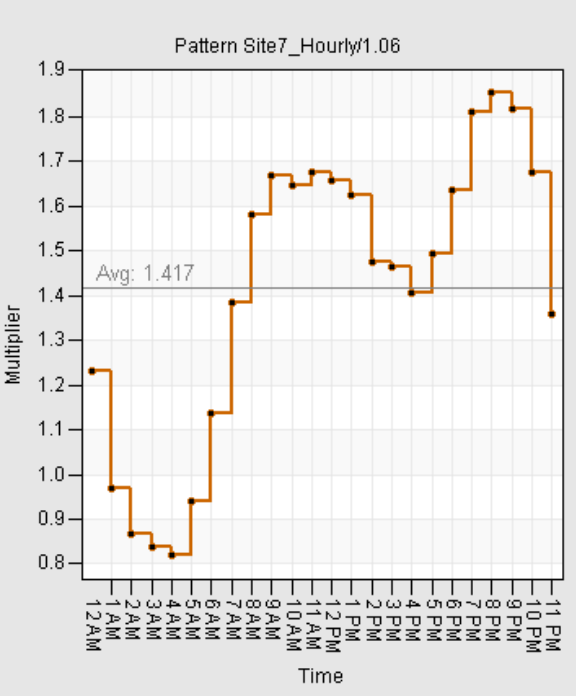
Site 3: N-Central Residential, Upstream of 12th Ave / 63rd St



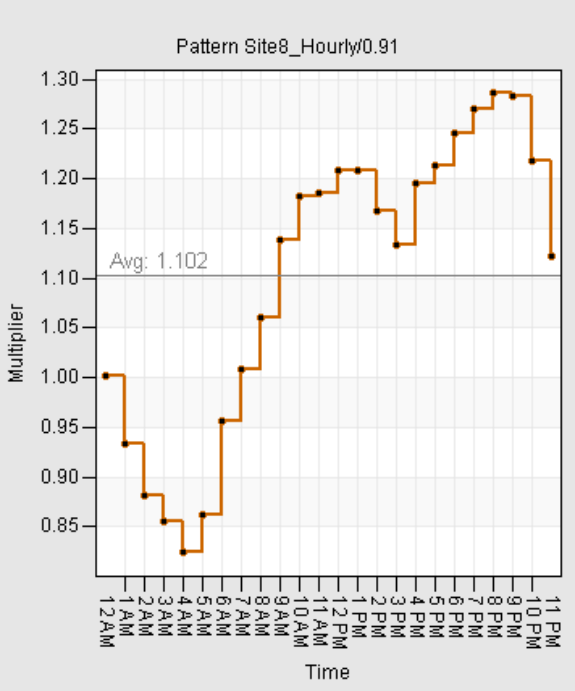
Site 5: NE Residential, Upstream of 3rd Ave / 42nd St



Site 6: SE Residential, Upstream of 40th St (North)



Site 7: Commercial, Upstream of 3rd Ave 48th St



Site 8: Commercial, Upstream of 1st Ave / 54th St

Figure 4: Diurnal Curves

3.4. MODEL VERIFICATION

Model verification was performed to determine if the diurnal curves established can be used to accurately estimate the PDWF. Rainfall data retrieved from the tipping bucket rain gauge located at the Edson Civic Center building was analysed to determine a suitable time period of dry weather.

The dates April 7-14 were selected for DWF analysis. To limit short interval peaks / troughs from skewing the analysis, the mean flow was calculated during the maximum flow period from 6PM to 10PM. The following additional observations were made and applied to the analysis.

- The Monitoring Station 1 observed data was significantly lower than modeled flow, and was not in line with average Town loading. To manage this inconsistency, the contributing catchment for Monitoring Station 1 was incorporated into the larger analysis for the Monitoring Station 8, as all inflow to Monitoring Station 1 eventually discharges downstream to Monitoring Station 8.

- Monitoring Station 3 and 4 were placed to fully capture an area of the central north residential subdivision. Review of results indicate Station 4 modeled flow results to be significantly lower than observed flow data. To manage this inconsistency, patterns established for Monitoring Station 3 was used for the entire North-Central area.

- The DWF absolute error for Monitoring Station 3 at 23.6% was noted to be higher than the targeted 10%. Closer analysis of individual days indicated data oscillating high and low, as well

as variation in flow patterns. The time pattern for the Monitoring Station 3 contributing catchment was not adjusted further, as the modeled curve followed the overall peaks / troughs in the data reasonably close, and the average error (not absolute average) was 0.1%.

Table 6 and ***Figure 5: PDWF Model Verification*** shows the modeled and monitored PDWF values and the percent differences during the analysed dry period. For estimation of PDWF, a percent difference less than 10% is typically targeted. As shown, an average percent difference of 10.1% has been achieved for the analyzed dry period.

Table 6: Modeled and Monitored PDWF, Sites 2, 3, 5, 6, 7, 8

Monitoring Station 1 – not used, results not consistent with Town patterns; suspect loss in system

Monitoring Station 2

DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 7, 2022	4.88	5.39	-9.4%
April 8, 2022	4.91	5.65	-13.1%
April 9, 2022	4.87	5.00	-2.6%
April 10, 2022	4.91	5.14	-4.6%
April 11, 2022	4.87	4.90	-0.7%
April 12, 2022	4.91	4.74	3.6%
April 13, 2022	4.87	4.84	0.6%
April 14, 2022	4.90	4.57	7.4%
Absolute Average			5.2%

Monitoring Station 3

DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 7, 2022	1.998	2.993	-33.2%
April 8, 2022	2.018	2.592	-22.1%
April 9, 2022	2.001	1.595	25.5%
April 10, 2022	2.014	2.212	-9.0%
April 11, 2022	1.998	1.53	30.6%

DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 12, 2022	2.018	1.463	37.9%
April 13, 2022	2.001	2.079	-3.8%
April 14, 2022	2.014	2.739	-26.5%
Absolute Average			23.6%

Monitoring Station 4 – not used, DWF results not consistent with Town patterns; Monitoring Station 3 patterns used to avoid under-designing upgrades

Monitoring Station 5

DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 7, 2022	3.625	4.339	-16.5%
April 8, 2022	3.654	4.112	-11.1%
April 9, 2022	3.623	3.755	-3.5%
April 10, 2022	3.655	4.192	-12.8%
April 11, 2022	3.625	3.5	3.6%
April 12, 2022	3.654	3.35	9.1%
April 13, 2022	3.623	3.112	16.4%
April 14, 2022	3.655	3.483	4.9%
Absolute Average			9.7%

Monitoring Station 6

DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 7, 2022	3.081	3.352	-8.1%
April 8, 2022	3.11	3.289	-5.4%
April 9, 2022	3.084	2.977	3.6%

DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 10, 2022	3.105	3.075	1.0%
April 11, 2022	3.08	3.101	-0.7%
April 12, 2022	3.11	2.972	4.6%
April 13, 2022	3.084	2.684	14.9%
April 14, 2022	3.105	3.14	-1.1%
Absolute Average			4.9%

Monitoring Station 7

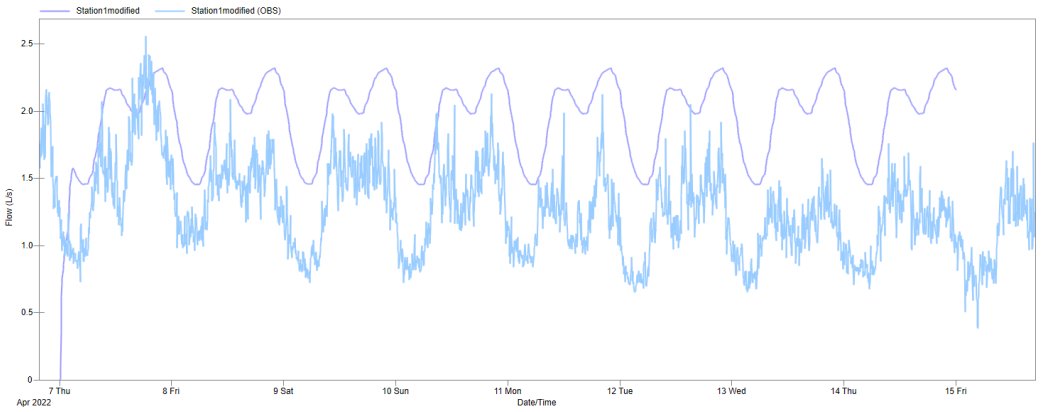
DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 7, 2022	2.956	2.636	12.1%
April 8, 2022	2.976	3.453	-13.8%
April 9, 2022	2.951	3.639	-18.9%
April 10, 2022	2.975	2.842	4.7%
April 11, 2022	2.95	2.721	8.4%
April 12, 2022	2.976	2.951	0.8%
April 13, 2022	3.141	3.033	3.6%
April 14, 2022	2.975	2.711	9.7%
Absolute Average			9.0%

Monitoring Station 8

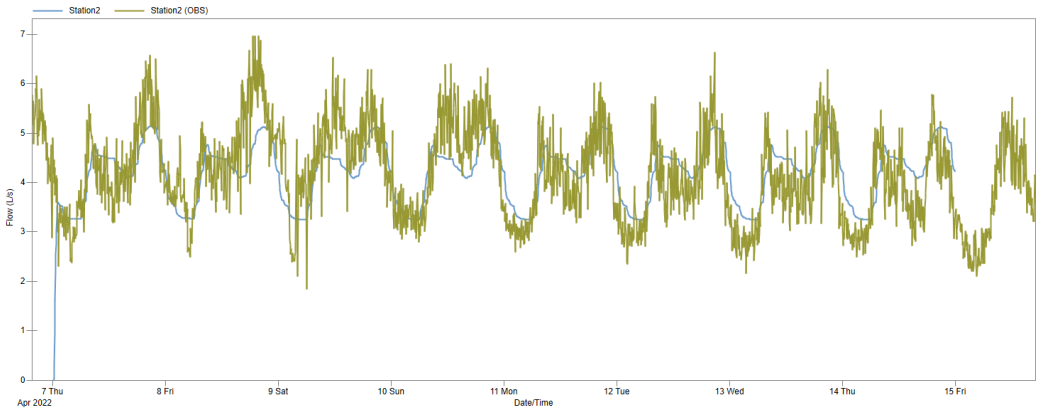
DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 7, 2022	17.9	22.42	-20.2%
April 8, 2022	18.05	20.71	-12.8%
April 9, 2022	17.9	18.62	-3.9%

DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
April 10, 2022	18.04	19.65	-8.2%
April 11, 2022	17.9	19.82	-9.7%
April 12, 2022	18.04	18.9	-4.6%
April 13, 2022	17.9	18.92	-5.4%
April 14, 2022	18.04	18.37	-1.8%
Absolute Average			8.3%

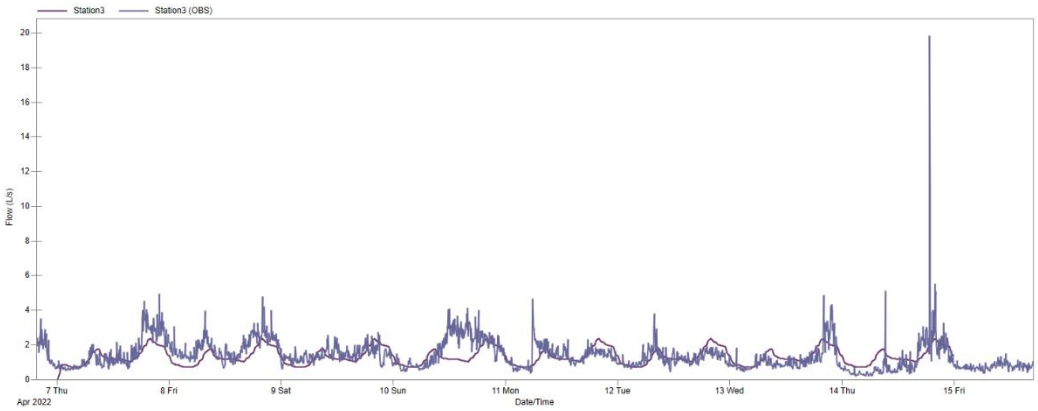
Station 1



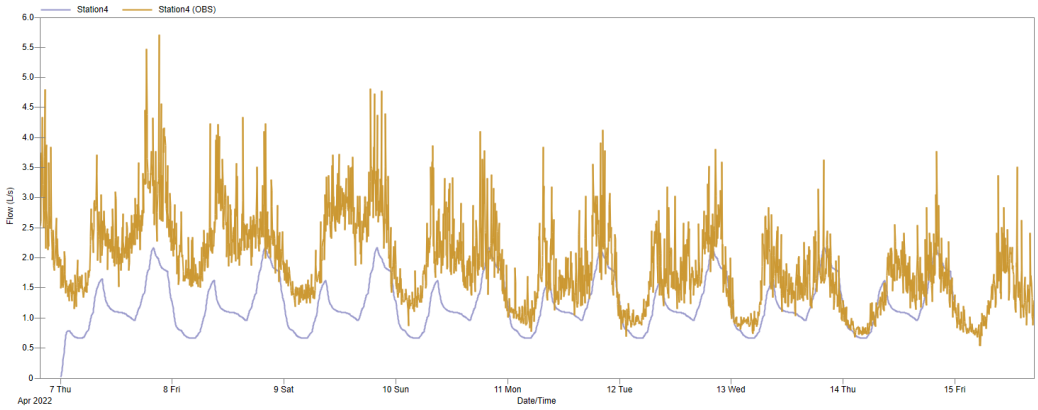
Station 2



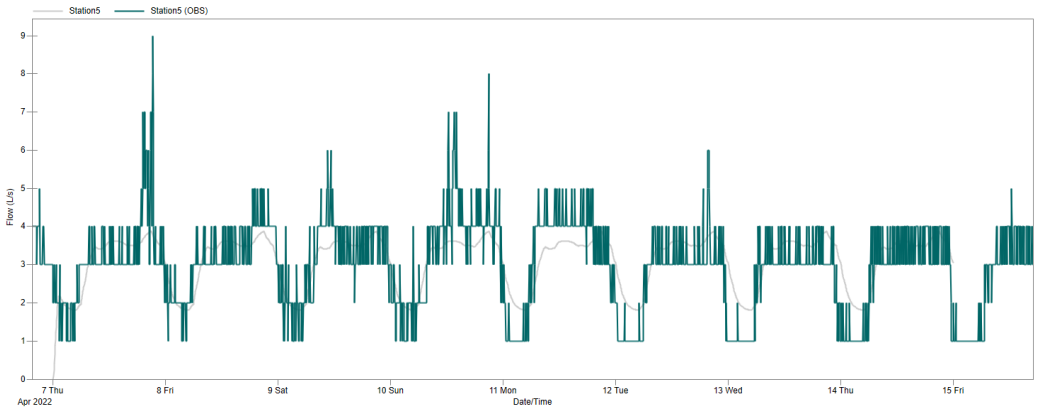
Station 3



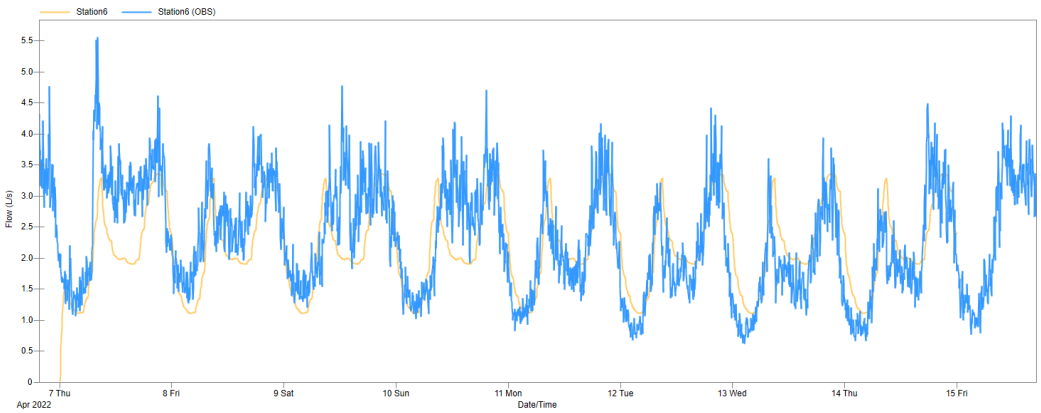
Station 4



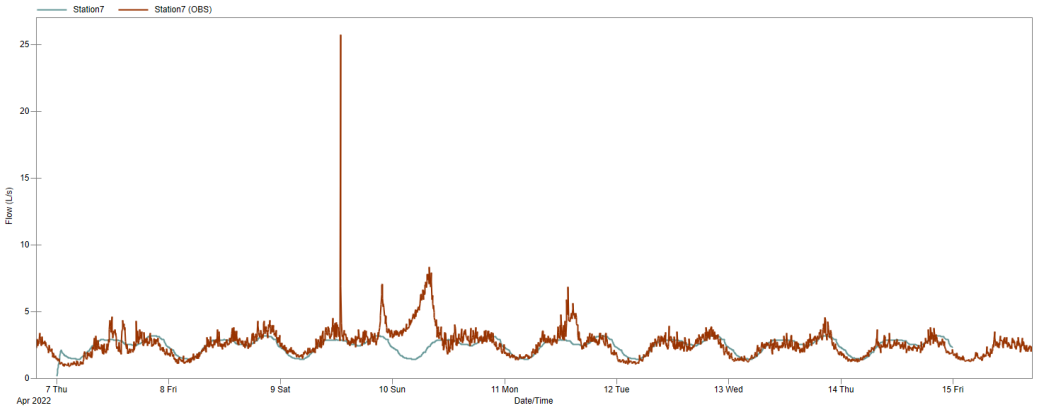
Station 5



Station 6



Station 7



Station 8

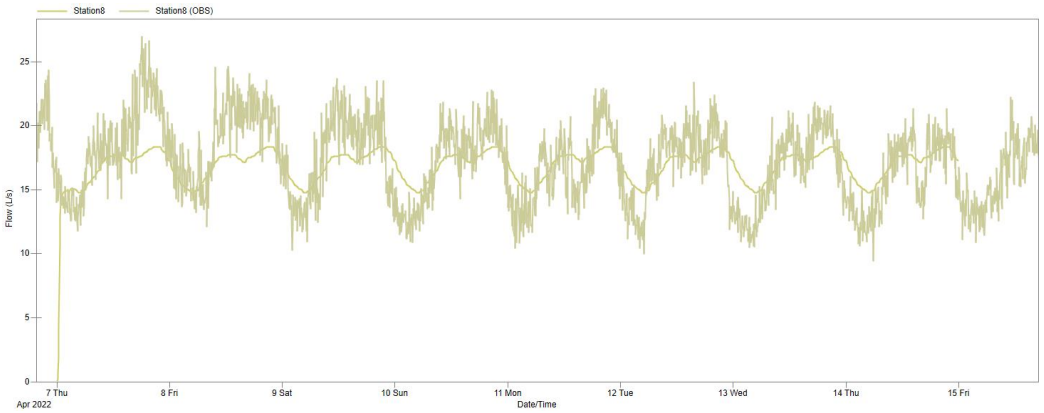


Figure 5: PDWF Model Verification

3.5. BASELINE GROUNDWATER INFILTRATION (GWI)

The baseline groundwater infiltration (GWI) rate was reviewed at the different monitoring stations. For simplicity, GWI was incorporated into the per capita usage and gross area loading rates determined in the previous sections. However, as GDI inflow is an important parameter in understanding the Town inflow and infiltration, GWI was estimated based on minimum inflow during the dry weather flow period. ***Table 7: Baseline Groundwater Infiltration (GWI)*** outlines the estimated GWI per monitoring station area. Only areas showing consistent baseline groundwater infiltration were included in this table.

Table 7: Baseline Groundwater Infiltration (GWI)

NAME	STN 2 (AREA 2)	STN 5 (AREA 5)	STN 8 (AREA 8)	TOTAL
Unit Area Flowrate (L/s/ha)	0.05	0.024	0.19	
Area (ha)	54.4	41.9	47.1	
Minimum DWF (L/s)	2.7	1.0	9.0	**12.7**
Minimum DWF (m^3/d)	233	86	778	**1097**
Percent of Overall Sanitary Inflow	5.3%	1.9%	17.5%	**24.7%**

- The high baseline groundwater infiltration suggests a high frequency of cracks / fractures / broken seals and joints within the sanitary sewer network in three areas of Town:
    - The residential subdivision to the northeast (Area 5), bounded by the Yellowhead Highway to the south, 42nd Street to the east, 45th Street to the west, and 10th Avenue to the north.
    - The residential subdivision to the northwest (Area 2), bounded by and including the Creekside Village / Sunset Mobile Estates to the south, 56th Street to the east, 63rd Street to the west, and Township Road 534 to the north.
    - The commercial development to the southwest (Area 8), bounded by 54th Street to the east, 63rd Street to the west, and Township Road 534 to the north. There is negligible baseflow for the area west of 63rd Street, narrowing down the problem area.
- Area 8 has a high amount of baseline GWI. From discussions with Town staff, there is a reasonable probability of I&I attributable to the proximity with Bench Creek.

3.6. RAINFALL DEPENDENT INFLOW AND INFILTRATION (RDII)

In addition to baseline I&I rates used, Rainfall Dependent Inflow and Infiltration (RDII) was estimated and applied using the RTK method. RTK factors were calibrated based on the flow monitoring completed and using local rainfall data. The RTK method is based on establishing three-unit hydrographs which estimate the flow response due to rainfall for a specified time period. The RTK factors are used to establish the unit hydrograph and represent the following.

R = Fraction of rainfall falling on the sewer-shed that enters the sanitary collection system

T = Time to peak

K = Ratio of the time of the recession to the time of peak

A tipping bucket rain gauge was installed at the Town of Edson Civic Centre for the calibration of the RTK factors during an extended period simulation. The rain gauge provides rainfall totals at a 5-minute timestep.

Table 8 outlines the calibrated RTK factors based on the flow monitoring and rainfall data collected from March 2022 to September 2022.

Table 8: RDII RTK Factors

RESPONSE	R	T	K
Monitoring Station 2			
Short Term	0.025	6	0.125
Medium Term	0.036	24	0.4
Long Term	0.1	70	1.5
Monitoring Station 3			
Short Term	0.075	6	0.125
Medium Term	0.036	24	0.4
Long Term	0.1	70	1.5
Monitoring Station 4			
Short Term	0.083	6	0.125
Medium Term	0.045	25	0.4
Long Term	0.01	70	1.5

RESPONSE	R	T	K
Monitoring Station 5			
Short Term	0.021	4.5	0.1
Medium Term	0.072	43	0.4
Long Term	0.002	140	3
Monitoring Station 6			
Short Term	0.028	6	0.125
Medium Term	0.036	24	0.4
Long Term	0.05	70	1.5
Monitoring Station 7			
Short Term	0.11	6	0.1
Medium Term	0.07	21	0.4
Long Term	0.002	140	1.5
Monitoring Station 8			
Short Term	0.023	5	0.1
Medium Term	0.09	50	0.4
Long Term	0.01	70	0.75

Three (3) weather events with heavy rainfall were evaluated to determine RDII patterns.

- June 28-29 2022
- July 29 2022
- August 20-25 2022

The August 20-25 2022 event was used for calibration and the June 28-29 2022 and July 29 2022 events were used for validation.

The following additional observations were made and applied to the analysis.

- As discussed in ***Section 3.4***, the Monitoring Station 1 observed data was significantly lower than modeled flow, and was not in line with average Town loading. RTK values for the region were developed by using Monitoring Station 8.

- Monitoring Station 3 showed a greater percent error in peak flow than the targeted 10%, at 14.9%. Efforts were made to adjust RTK factors further to reduce the error, however, were unsuccessful. The reason for this could be attributable to several factors.
    - Upstream pipes are surcharging. This could result in buffered flows not being accurately captured in the model.
    - There are flow splits in the sanitary pipe network, under rainfall conditions, flow may be distributed differently than modeled due to pipe hydraulics.
- Monitoring Station 6 could not be calibrated to the three storm events, as there was too great of a distribution in recorded flows and a corresponding high absolute error; the cause for the deviation cannot be determined with the information available. The August 20-25 storm event was used for RTK calibration at Monitoring Station 6 given the large rainfall, greater distribution period, and saturated antecedent conditions.

Tables 9-12 and ***Figures 3-10*** highlight the modeled and monitored PWWF and the percent difference.

Table 9: June 28-29 Modeled and Monitored PWWF

STATION	DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
2	June 28-29	-	-	-
3	June 28-29	46.4	50.7	-8.4%
4	June 28-29	61.1	59.7	2.3%
5	June 28-29	37.3	37.0	0.9%
6	June 28-29	25.4	46.4	-45.1%
7	June 28-29	61.5	84.2	-27.0%
8	June 28-29	88.5	83.8	5.6%

Table 10: July 29 Modeled and Monitored PWWF

STATION	DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
2	July 29	22.1	23.7	-6.4%
3	July 29	20.0	28.4	-29.6%
4	July 29	24.1	30.7	-21.5%
5	July 29	17.1	15.0	14.0%
6	July 29	10.5	7.8	35.2%
7	July 29	35.0	34.6	1.2%
8	July 29	44.9	39.3	14.3%

Table 11: Aug 20-25 Modeled and Monitored PWWF

STATION	DAY	MODELED (L/s)	MONITORED (L/s)	DIFFERENCE (%)
2	August 20-25	-	-	-
3	August 20-25	31.1	29.2	6.5%
4	August 20-25	36.4	34.1	6.7%
5	August 20-25	25.7	31.0	-17.3%
6	August 20-25	18.7	18.4	1.5%
7	August 20-25	50.7	51.1	-0.6%
8	August 20-25	69.9	75.3	-7.2%

Table 12: Absolute Average Percent Difference

STATION	JUNE 28-29 (%)	JULY 29-30 (%)	AUGUST 20-25 (%)	ABSOLUTE AVERAGE PERCENT DIFFERENCE (%)
2	-	-6.4%	-	-
3	-8.4%	-29.6%	6.5%	14.9%
4	2.3%	-21.5%	6.7%	10.2%
5	0.9%	14.0%	-17.3%	10.7%
6	-45.1%	35.2%	1.5%	27.3%
7	-27.0%	1.2%	-0.6%	9.6%
8	5.6%	14.3%	-7.2%	9.1%

Rainfall

June 28-29, 2022 July 29, 2022 August 20-25, 2022

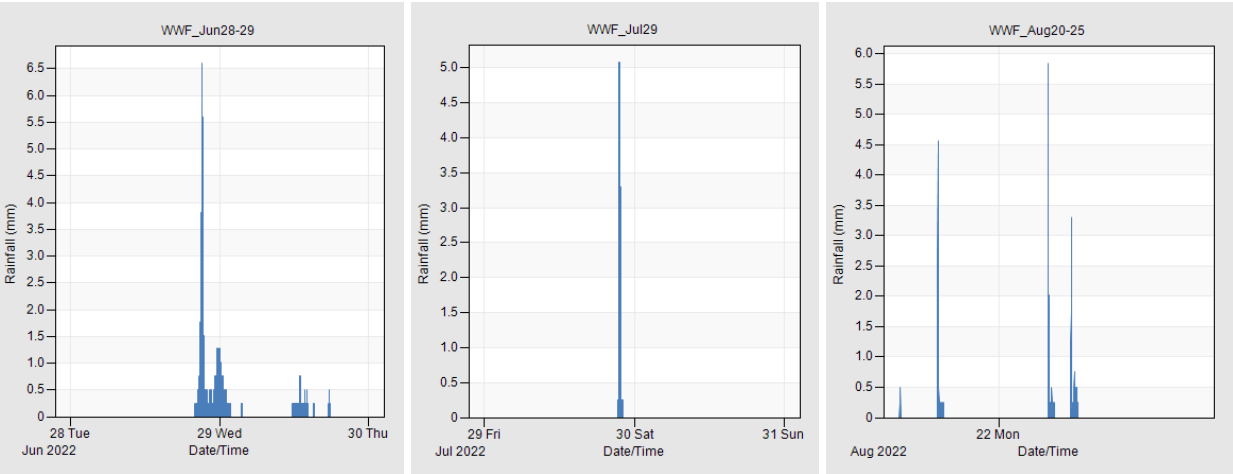


Figure 6: WWF Calibration & Validation Rainfall

Monitoring Station 2

July 29

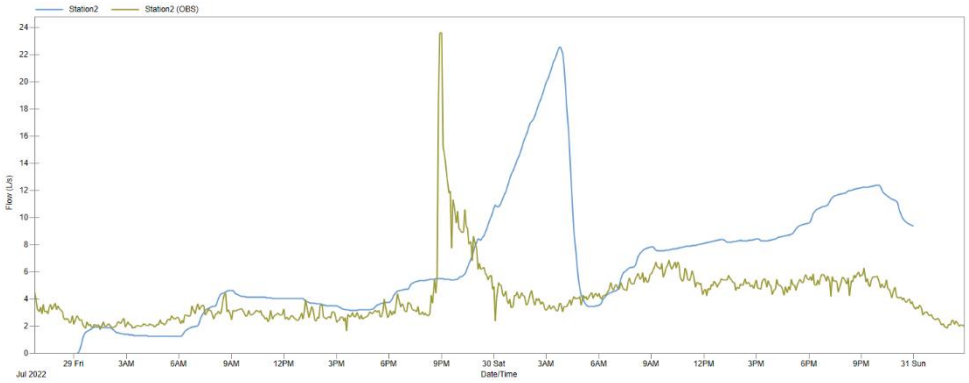
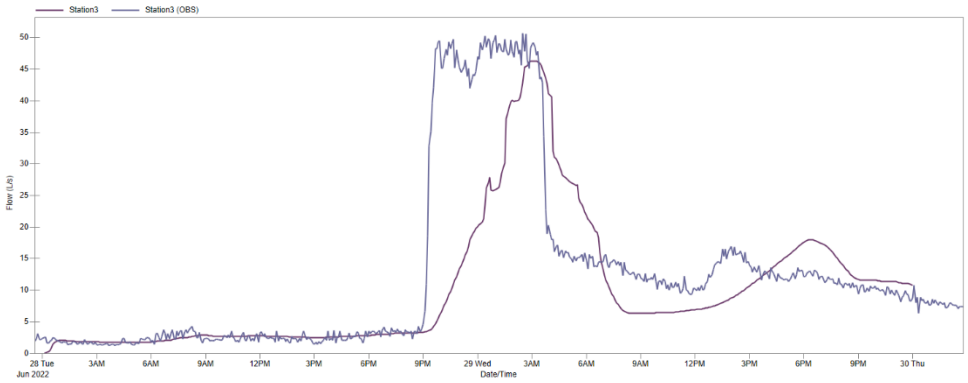


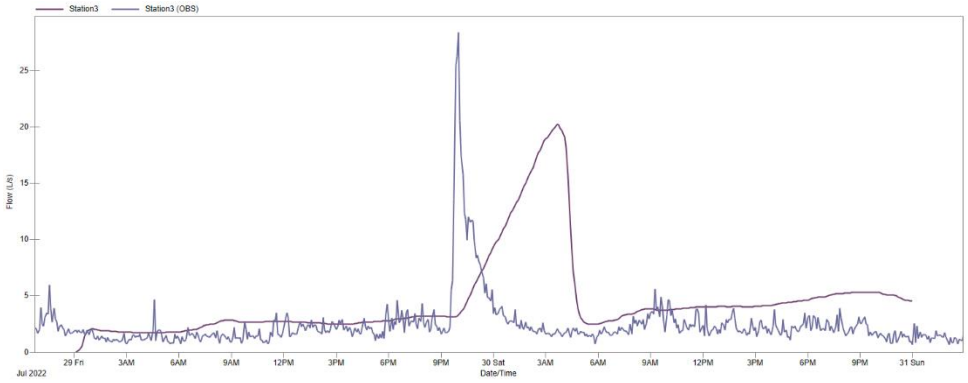
Figure 7: Station 2 PWWF Validation

Monitoring Station 3

June 28-29



July 29-30



August 20-25

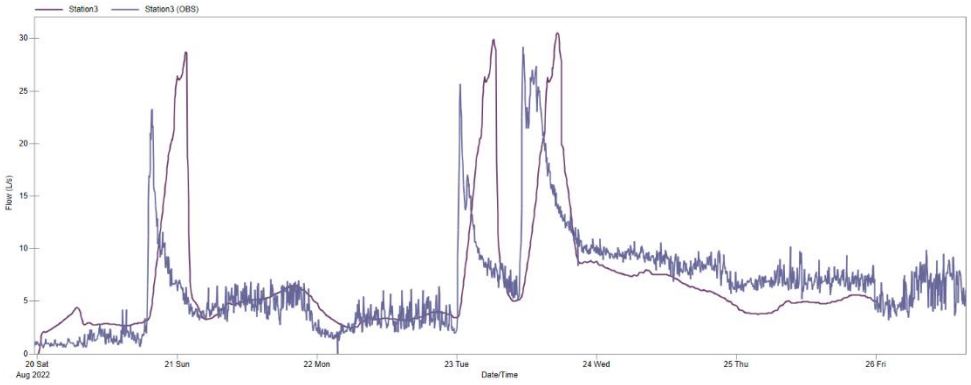
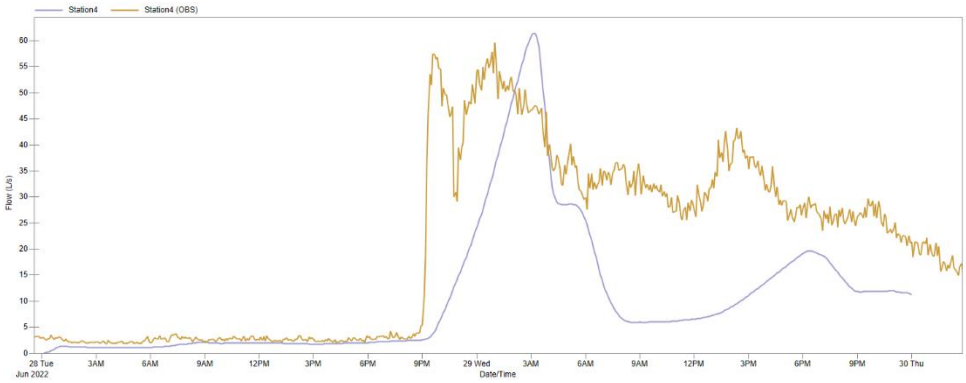


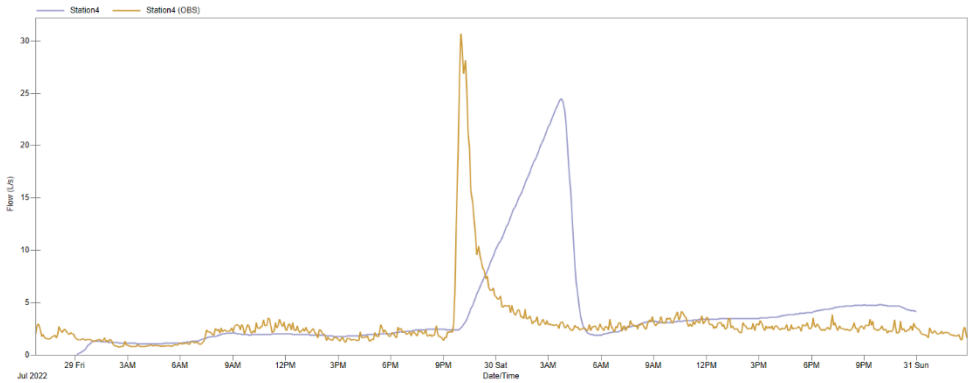
Figure 8: Station 3 PWWF Validation

Monitoring Station 4

June 28-29



July 29-30



August 20-25

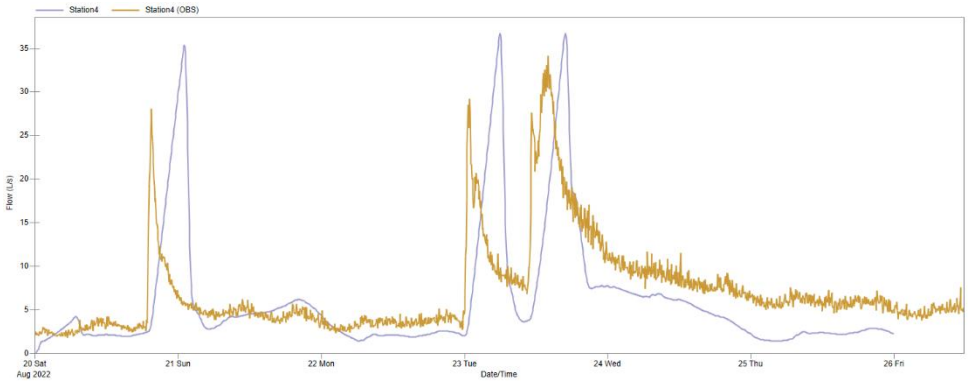
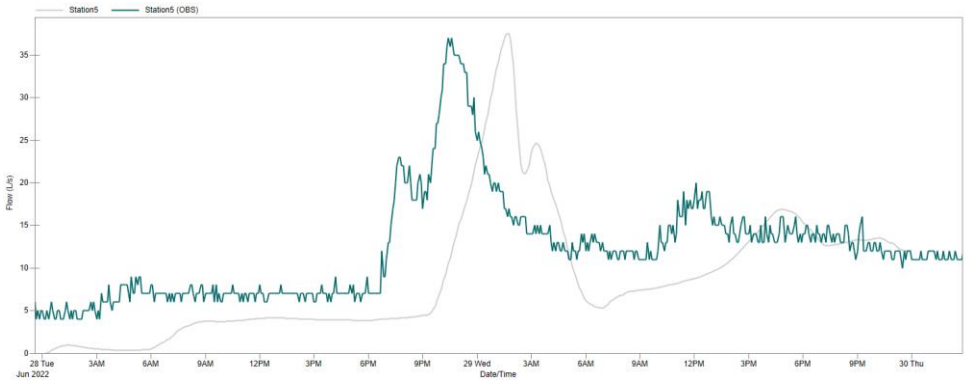


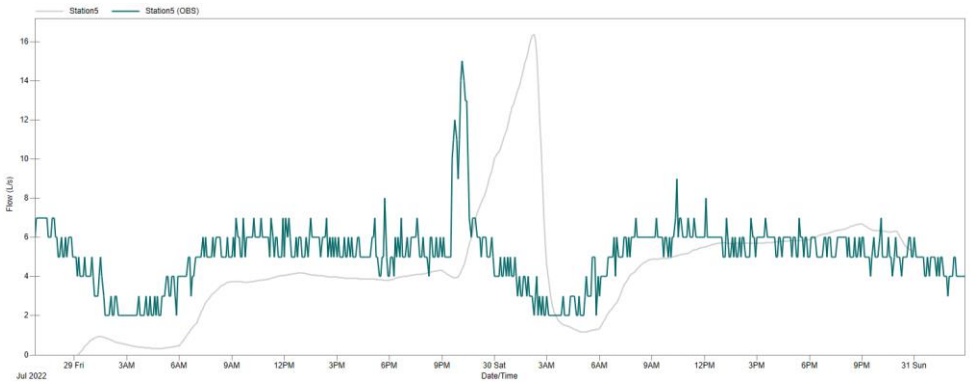
Figure 9: Station 4 PWWF Validation

Monitoring Station 5

June 28-29



July 29-30



August 20-25

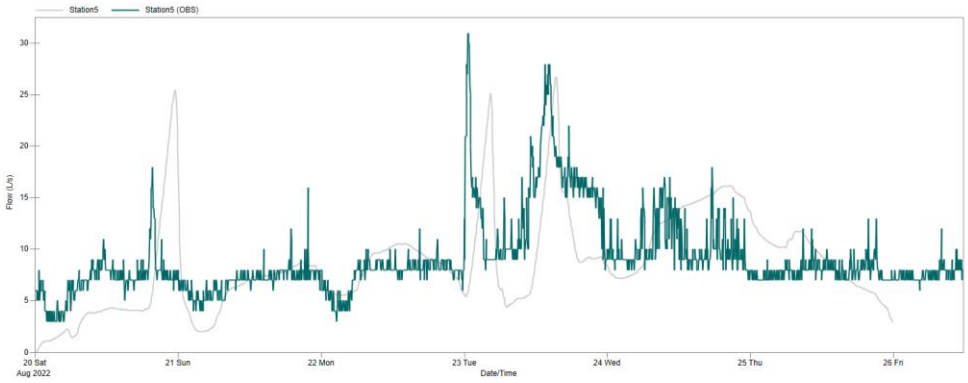
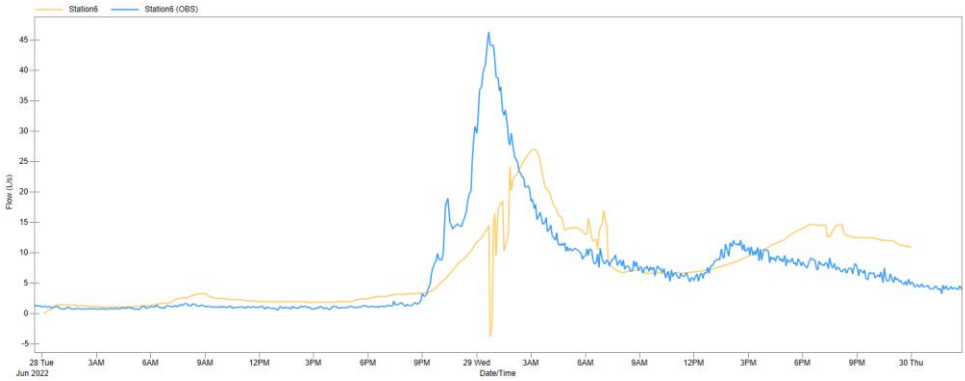


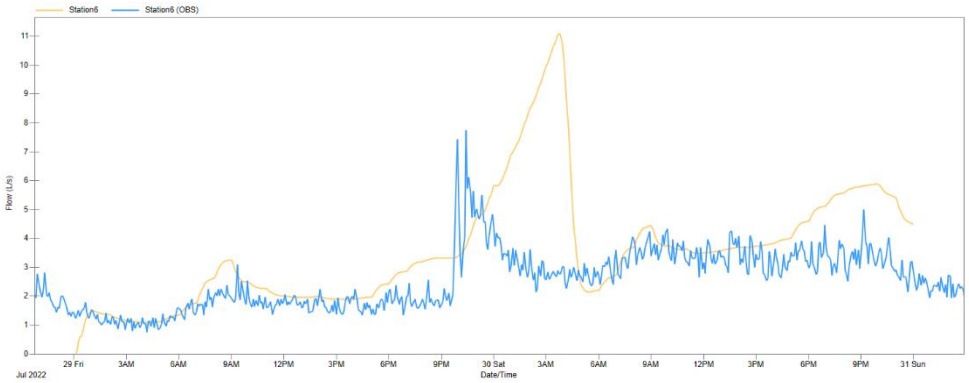
Figure 10: Station 5 PWWF Validation

Monitoring Station 6

June 28-29



July 29-30



August 20-25

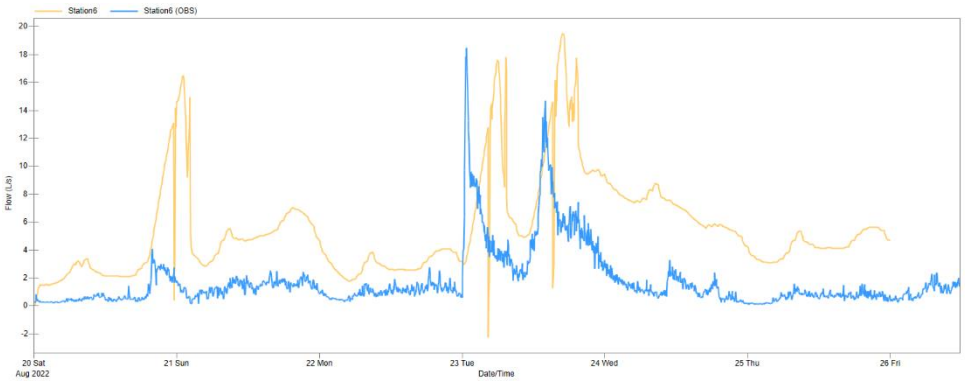
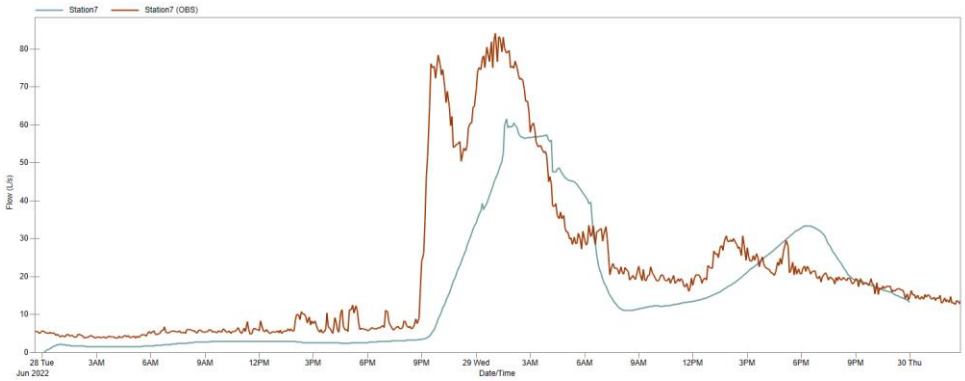


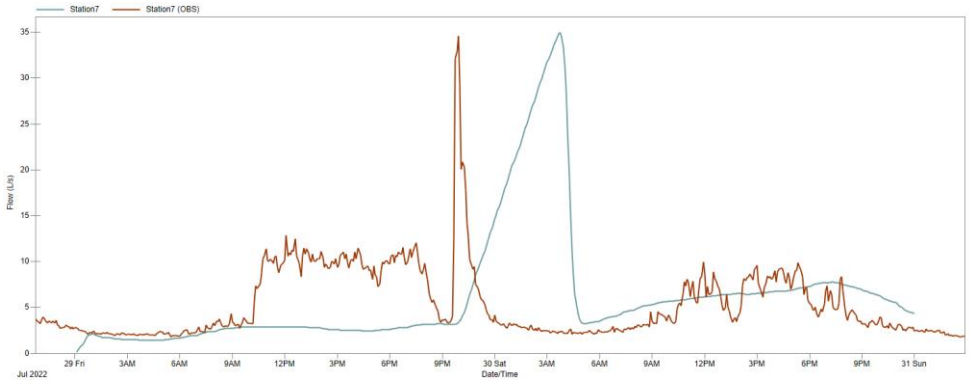
Figure 11: Station 6 PWWF Validation

Monitoring Station 7

June 28-29



July 29-30



August 20-25

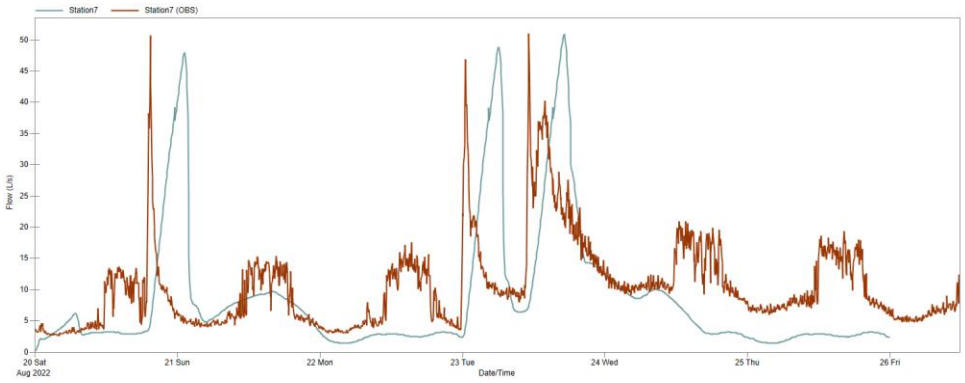
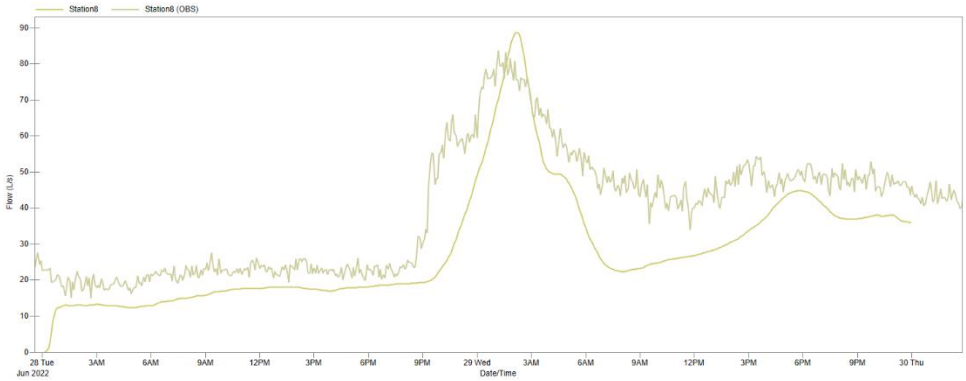


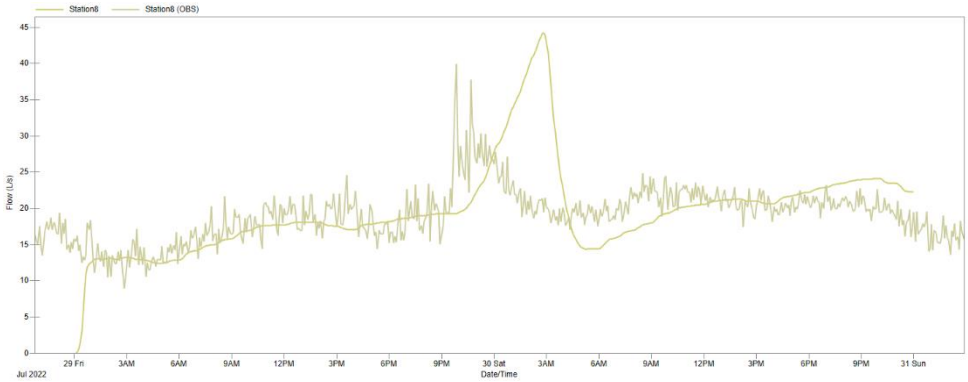
Figure 12: Station 7 PWWF Validation

Monitoring Station 8

June 28-29



July 29-30



August 20-25

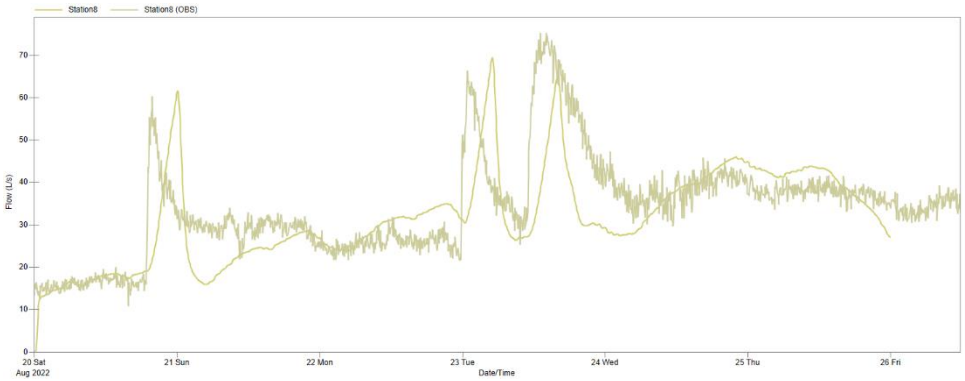


Figure 13: Station 8 PWWF Validation

Evaluation of the flow data, and the comparatively high short-term R-value in the RDII analysis, indicates a very rapid response to storm events. This is likely triggered by direct connection / overflows from the Town storm system, or surface flooding. Evaluation of sources of wet weather inflow are discussed further in ***Section 8***.

4. System Modeling

PCSWMM version 7.1 was used for the hydraulic model development. McElhanney gathered and reviewed background information to determine gaps in knowledge regarding the existing sanitary collection system. The conveyance network geometry (i.e. inverts, size, material, etc.) for the stormwater system was then compiled based on the GIS data, record drawing and the topographic survey.

The existing and proposed networks were analysed based on the following scenarios.

- Peak Dry Weather Flow (PDWF) based on existing, 10-yr, and 20-yr growth horizon.
- Peak Wet Weather Flow (PWWF) based on the existing, 10-yr, and 20-yr growth horizon and 25-year design storm.

4.1. DESIGN STORMS

The system was analysed using the 25-year return period 1-hour design storm I&I rates based on the RTK method. The analysis used synthetic design storms with the aforementioned applied probability, or return period, as derived from the IDF data applicable to the Edson gauging station. As no design storm is recommended for use in the Edson Engineering documents a design storm was selected that is representative of rainfall distributions in the region. The Atmospheric Environmental Service (AES) distribution for the Prairies region was used to generate the synthetic design storm for the short duration rainfall event (1 hour).

Table 13: 1 Hour Design Storm Rainfall Totals

RETURN PERIOD	CURRENT (2023) (mm)
25 Year	29

5. Results

System model results were used to assess the performance of the sanitary collection system based on two metrics:

- Pipe Capacity
- Pipe Velocity

This section focuses on the capacity assessment alone. Discussion on the condition assessment is provided in ***Section 7***.

5.1. EXISTING PIPE CAPACITY

The colour classification used in depicts the maximum depth of flow in the pipe (d) as a percentage of the diameter of the pipe (D). Design criteria related to pipe flow has been discussed in ***Section 2***; for this analysis pipe full greater than 80% is considered deficient. The modeling completed indicates several deficiencies in the ability of the existing gravity system to convey the design PDWF and PWWF, with several specific areas of concern. ***Figure 14: PWWF Capacity Assessment Existing Population*** shows pipe not meeting this design criteria.

Additionally, problem areas can be delineated by reviewing areas where surcharged pipe is within 2.2m of surface; these areas are more likely to have flooded basements as the sanitary service is within the hydraulic grade line. These locations are identified in ***Figure 15: PWWF HGL < 2.2m of Surface: Existing*** Population.

5.1.1. Area of Concern #1 – 10th Avenue / 52nd Street / 12th Avenue / 54th Street / 14th Avenue Sanitary Main

The Town has reported sewer backup at several residences along the sanitary main from 10th Avenue continuing to 14th Avenue. This is supported by the computational modeling. This was covered in the 10th Avenue Flooding Technical Memorandum (McElhanney, 2022) where recommendations were made to complete the following.

- Re-establish a previous pipe connection to fully utilize a downstream twinned pipe.
- Upsize a segment of pipe from 52nd Street (N) to 52nd Street (S).

Town operational staff indicated the previous pipe connection has since been re-established.

5.1.2. Area of Concern #2 – 54th Street / 56th Street Sanitary Trunk

The existing 375mm / 450 mm diameter sewer trunk along 1st Avenue is shown as surcharged. This is attributed to a combination of the high base groundwater inflow from the northwest residential subdivision, high RDII inflow from the north central subdivision, and flat pipe slopes. This was discussed in the Major Storm Summary & Sanitary Overflow Technical Memorandum (McElhanney, 2022). Model results indicated surface flooding of 97 m^3 at MH S358 on 6th Avenue, between 55th Street and 53rd Street, due to surcharged conditions. This was supported by reports of flooding by Town operations staff.

5.1.3. Area of Concern #3 – 52nd Street Sanitary Trunk

The existing 250 mm diameter sewer trunk along 52nd Street is shown as surcharged. This is significant as this sanitary trunk services a large residential area, with associated high inflow and infiltration.

5.1.4. Area of Concern #4 – 50th Street Sanitary Main

The existing 200 mm diameter sewer main along 50th Street is shown as surcharged. Similar to Area of Concern #3, this sanitary main services a large residential area, with associated high inflow and infiltration.

5.1.5. Area of Concern #5 – 1st Avenue Sanitary Trunk

The existing 375mm / 450 mm diameter sewer trunk along 1st Avenue is shown as surcharged. This is significant as this sanitary trunk services the majority of the Town. This capacity issues are attributed to the flat pipe slopes (0.1% – 0.16%).

5.1.6. Area of Concern #6 – 48th Street / 47th Street Sanitary Main

Similar to Area of Concern #3. However, this area was not specifically captured in the flow monitoring program, rather RDII inflow assumptions was based on the surrounding area. While the model results indicate this area to have significant flooding / surcharging, this segment is recommended for additional review per ***Section 9***.

5.2. EXISTING PIPE VELOCITY

Shallow slopes and the inability to meet minimum cleansing velocities may result in an increase in Fat, Oil and Grease (FOG) buildup and increased sedimentation in the network. This FOG buildup can impede pipe flow, reducing capacity and further exacerbating any capacity related issues noted.

Modeled velocities in sections of the pipe network across the Town are less than the minimum self cleansing velocity of 0.6 m/s. The inability of mains to reach a cleansing velocity during the PDWF analysis can be attributed to the shallow slopes found throughout the pipe network. Approximately 59% of the pipes within the Town have a slope less than 1.0%, and 27% of sewers have a slope less than 0.4% (minimum slope for a 200mm pipe).

PDWF was used to model the minimum pipe velocity, simulating an extended dry period when I&I is significantly reduced. The purpose of this analysis is to identify pipes that do not meet the minimum pipe

cleansing velocity of 0.6 m/s as per the Alberta Government requirements[3]. Selection criteria for this analysis was modified to exclude pipes with flow under 20% d/D (flow depth / diameter, to describe pipe capacity utilized) under PDWF, as pipes with small inflows will not meet self-cleansing velocity even at reasonable pipe slope.

Several areas have been identified under this selection criteria, per ***Figure 16: PDWF Velocity Analysis Existing Population***; pipes with flow under 20% d/D was excluded. These areas are in the following key areas:

- The sanitary trunk running east-west parallel, on 3rd Avenue / Yellowhead Highway / 1st Avenue, and the final segment connecting the Town sanitary collection system to the lagoon.
- A flat pipe segment on 10th Avenue, from 52nd Street to 56th Street.
- The sanitary main on 47th Street.

[3] Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems: Part 3 Wastewater Systems Standards for Performance and Design of a Total of 5 Parts, Section 3.3.1.1 (March 2013). Alberta Government. https://open.alberta.ca/dataset/f57fec02-7de8-4985-b948-dcf5e2664aee/resource/6df3ae50-cacb-4e4c-b5b3-98d829ab661a/download/part3-wastewatersystemsstandards-2013.pdf

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25

McElhanney

FIGURE 14: PWWF CAPACITY ASSESSMENT EXISTING POPULATION

SCALE 1:20000

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25

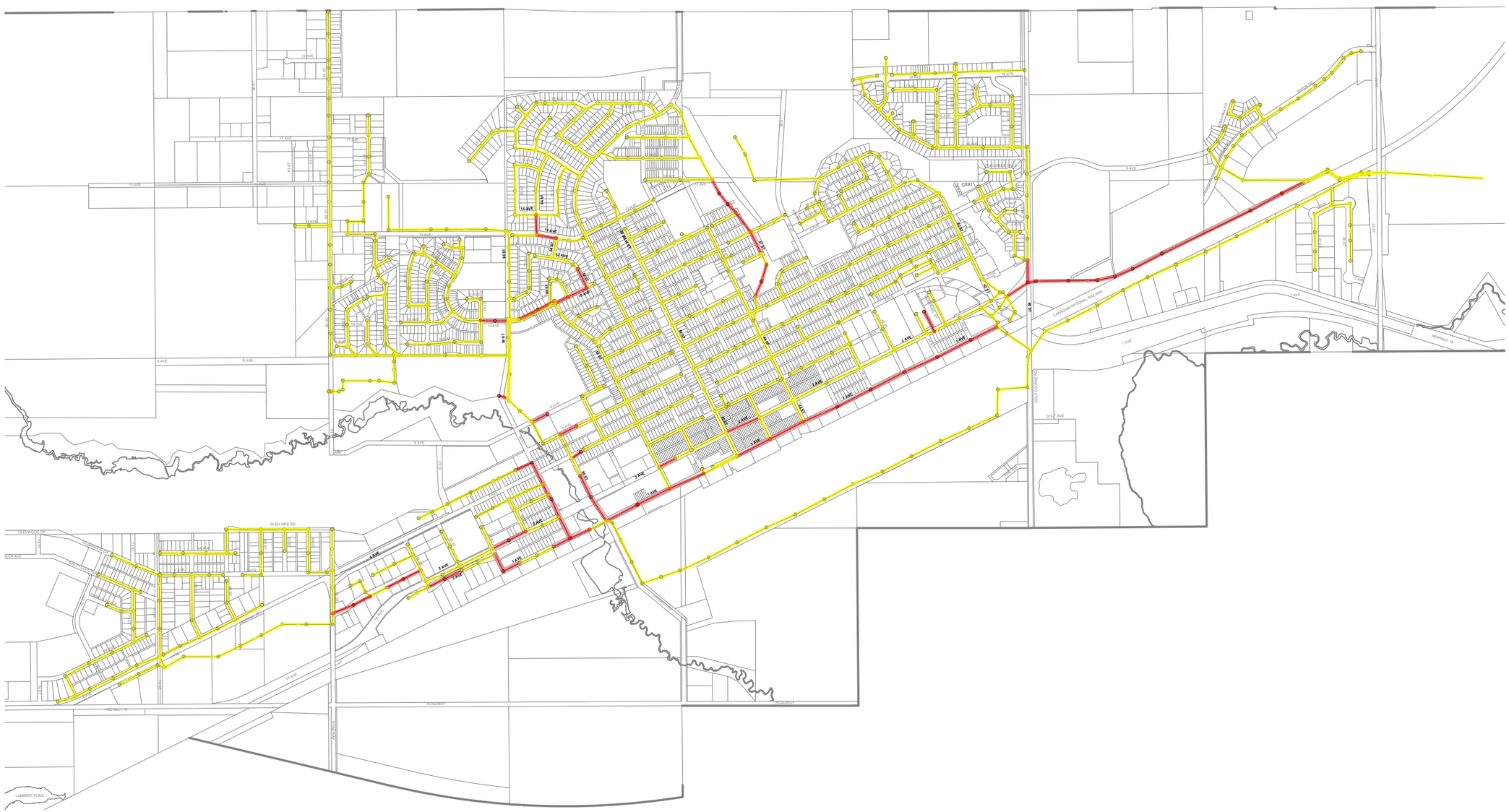
McElhanney

FIGURE 15: PWWF HGL < 2.2m OF SURFACE: EXISTING POPULATION

SCALE 1:20000

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25



McElhanney

FIGURE 16: PDWF VELOCITY ANALYSIS EXISTING POPULATION

SCALE 1:20000

6. Proposed System Upgrades (Capacity Related)

Refer to ***Figure 17: Proposed System Upgrades – Capacity Related*** for the proposed capital plan. Recommended upgrades have been designed to incorporate future development.

Table 14: Pipe Upgrades

Location	U/S MH	D/S MH	Ex Diameter (mm)	Prop Diameter (mm)
A1 – 10th Avenue Sanitary Main	S250	S337	200mm	300mm
B1 – 52nd Street / 54th Street / 13th Ave / 54th Street / 14th Avenue	S337	S265	200mm	300mm
A2 – 54th Street / 56th Street Sanitary Trunk	S379 S581	S581 S562	375mm 375mm	450mm 600mm
A3 – 52nd Street Sanitary Main	S369	S565	200mm	300mm
A4 – 50th Street	S410	S604	200mm	300mm
A5 – 1st Avenue Sanitary Trunk	S565 S567 S605	S567 S605 S653	375mm 450mm 450mm	450mm 600mm 750mm
A6 – 48th Street Sanitary Main	S331 S644	S644 S605	200mm 250mm	300mm 450mm

6.1. HIGH PRIORITY

- **A1 – 10th Avenue Sanitary Main**. The Town has reported sewer backup at several residences along the 10th Avenue sanitary main. This is supported by the computational modeling. This was covered in the 10th Avenue Flooding Technical Memorandum (McElhanney, 2021), where recommendations were made to re-establish a previous pipe connection to fully utilize a downstream twinned pipe, and

to upsize a segment of pipe from 52nd Street (N) to 52nd Street (S). Town operations staff indicated the previous pipe connection has since been re-established.

- **A2 – 54th Street / 56th Street Sanitary Trunk**. The existing 375mm / 450 mm diameter sewer trunk along 54th Street, from the intersection of 1st Avenue and 54th Street to 56th Street has modeled surcharging, with reports of flooding supported by Town operations staff. The Town has identified this as a priority project and is currently planning the design upgrades. Design upgrades consist of upsizing 465m of pipe to 450mm and 330m of pipe to 600mm.

- **A3 – 52nd Street Sanitary Main**. The existing 200 mm diameter sewer trunk along 52nd Street has modeled surcharging. This is a direct result of the high RDII inflow from the north central residential area. Under reduced I&I this upgrade would not be required. Design upgrades consist of upsizing 765m of pipe to 450mm.

- **A4 – 50th Street Sanitary Main**. The existing 200 mm diameter sewer trunk along 50th Street has modeled surcharging. This is a direct result of the high RDII inflow from the north central residential area. Under reduced I&I this upgrade would not be required. Design upgrades consist of upsizing 1065m of pipe to 300mm.

- **A5 – 1st Avenue Sanitary Trunk**. The existing 375mm / 450mm diameter sewer trunk along 1st Avenue has modeled surcharging. This is significant as this sanitary trunk services the majority of the Town. Two upgrade options are proposed to alleviate the surcharging and meet level of service requirements.

    - Upsize relevant pipe segments, 350m segment length to 450mm, 350m segment length to 600mm, 1000m segment length to 750mm.

    - Directional drill a new 450mm sanitary line to the sanitary sewer bypass south of the railway, starting at the intersection of 48th Street and 1st Avenue. This will relieve loading on the downstream sanitary main, reducing the scope of the pipe upgrades.

- **A6 – 48th Street Sanitary Main**. The existing 200 mm diameter sewer trunk along 48th Street has modeled surcharging. This is a direct result of the high RDII from the north central residential area. Design upgrades consist of upsizing 525m of pipe to 450mm, and 1085m to 300mm.

    - This existing pipe size should be suitable for a catchment of this size. The pipe upgrades are being entirely driven by the high RDII inflow. The RDII calculated by the model is based off RDII calibrated in the neighbouring subdivision.

    - Given the cost of upgrading this section of pipe, additional flow monitoring is recommended to confirm the calibration assumptions are correct. This would take the form of a small study, with the deliverable being additional calibration of the model pertaining to this section of pipe, and confirmation of upgrade requirements. The Town currently owns and operates several manhole

flow meters. It is suggested the Town install a manhole flow meter on the downstream end of this area, at MH N350, for use in this calibration exercise to keep costs low.

6.2. MEDIUM PRIORITY

Medium-priority upgrades include pipes with capacity constraints which result in minor surcharging of the system under PWWF under 0.5m of the pipe obvert.

- **B1 – 52nd Street / 54th Street / 13th Ave / 54th Street / 14th Avenue Sanitary Main**. While the 10th Avenue sanitary main upgrades will significantly improve conditions related to the sanitary backups, the upstream pipe is also noted to be surcharging. This section of pipe should be upgraded according to established design criteria. As an additional note, recent large storm events have resulted in additional flooding in this area, and so has been moved to high priority for the Capital Plan.

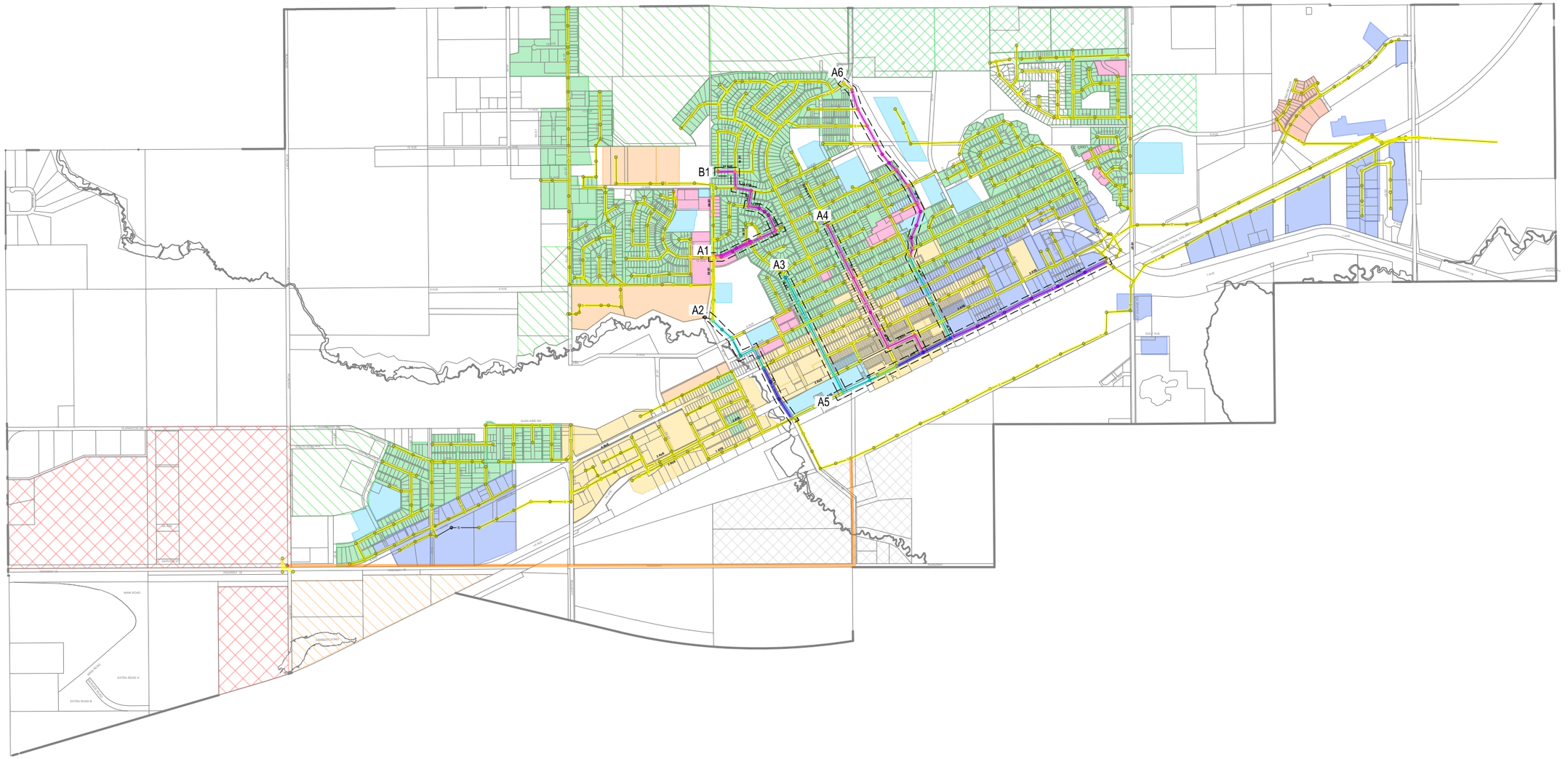
6.3. NEW LIFT STATION

The Town is planning development west of 75th Street. The existing sanitary main terminates near this location, and new infrastructure will be required to accommodate the new development. The sanitary main is shallow at this location, so connection to this main by gravity will not be possible as it will not meet minimum cover requirements. Furthermore, additional development will put additional loading on the downstream sanitary main, which will necessitate further upgrades.

To address elevation constraints, a new lift station is proposed to the southwest (LS-SW). This would service the new southwest development. To avoid putting additional loading on an existing downstream sewer main, a new forcemain is recommended to be installed, tying into the sewer bypass south of the CN rail line. This will mitigate upgrades to the downstream sewer main, and minimal to no road disruption.

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25



LEGEND

CONDUITS
- VISIBLE
- FORCE MAIN
- UPGRADE 250 mm
- UPGRADE 300 mm
- UPGRADE 450 mm
- UPGRADE 600 mm
- UPGRADE 750 mm

SANITARY CATCHMENT

EXISTING CONDITIONS
- VACANT LAND
- RESIDENTIAL
- MOBILE HOME
- COMMERCIAL
- INDUSTRIAL
- INSTITUTIONAL
- HIGH DENSITY

FUTURE CONDITIONS
- FUTURE 20 YR RESIDENTIAL
- FUTURE 20 YR COMMERCIAL
- FUTURE 10 YR RESIDENTIAL
- FUTURE 10 YR COMMERCIAL
- FUTURE 10 YR INDUSTRIAL

McElhanney

0 1:25,000 1000

FIGURE 17: PROPOSED SYSTEM UPGRADES - CAPACITY RELATED

SCALE 1:25000

7. Asset Inventory and Asset Condition Assessment

7.1. BACKGROUND INFORMATION

During the background document review and through discussion with the Town contact Pat Fisher, he noted the Town has a large database of CCTV video taken by Town operations staff at sites where work has been performed. McElhanney noted this video could potentially be very useful and could be used to substitute a substantial amount of CCTV video needed for the condition assessment. Following this discussion, McElhanney proceeded to do a Quality Assurance review the CCTV database, and identify high priority repairs per ***Figure 18: Capital Plan Upgrade & Repair Schedule***.

The Town has video from the following sources:

- Town of Edson internal CCTV videos
- Thuro Inc. sewer videos and reports
- AK Underground Services Inc. sewer videos and reports

CCTV inspection and pipe condition reports were provided for review and evaluation.

For this CCTV video to be useful, the video location needed to be tracked, and reports on pipe condition generated according to NAASCO standards. McElhanney undertook this review, and has prepared reports on the CCTV video included in ***Appendix A***. CCTV video locations are identified in ***Appendix C***.

7.2. EVALUATION

To determine pipe condition severity, the NASSCO Pipeline Assessment & Certification Program (PACP) Condition Grading System was used which is the North American Standard for pipeline defect identification and assessment. The PACP is able to assess each pipe by assigning each segment of pipe a score from 1 to 5, with 5 being the most severe, see ***Table 15: Pipe Condition*** Rating. Separate scoring is completed for structural defects as well as operational and maintenance defects. A Structural Defect can include cracks, fractures, breaks, offset joints, deformations and pipe failures along the pipe. Operation & Maintenance (O&M) defects include significant changes in grade increasing flow and defects inhibiting flow such as sediment deposits, roots, intruding service connections, and other obstructions.

Table 15: Pipe Condition Rating

Rating	Description
1	Minor Defect Grade
2	Minor to Moderate
3	Moderate Defect Grade
4	Significant
5	Most Significant Defect Grade

PACP Quick Score:

The PACP Quick Scoring method has 4 digits and represents the two most severe defects and their number of occurrences. For example, a PACP Quick Score of 4323 identifies that a segment of pipe with the most severe defect is 4 and occurs 3 times and the next most severe defect is a 2 that occurs 3 times. If a defect exceeds 9 occurrences, then alphabetic characters are used as follows, A-(10-14), B-(15-19), C-(20-24, etc. Using such a system allows quick identification of pipe that may require closer scrutiny.

The Index Rating:

The Index method takes a sum of all the defects scores and divides it by the number of defects essentially calculating an average defect score for a segment of pipe. Caution with this method is to be applied to this method as severe defects can be diluted by many less sever defects.

Overall Scoring:

These two ratings are used in conjunction to assist the reviewer in identifying pipe segments that may require rehabilitation. Though it was noted that these scoring methods can deceive the reviewer into recommending replacing a whole segment of pipe while a spot replacement might be sufficient. To acknowledge an additional scoring option is provided.

This scoring method takes the number of defects and divides it by the length of pipe. This score will help us determine if a segment requires a full replacement or is better suited for a spot replacement depending how many total defects exist in the length of pipe.

7.3. CCTV INSPECTIONS

7.3.1. Summary

CCTV inspections were completed by Town of Edson, Thuro Inc, and AK Underground Services Inc. on the Town's sanitary network from 2017 to 2022. A pipe analysis summary can be found in Appendix B –

Grade 4 & 5 Pipe Analysis Summary. Each individual pipe assessment can be found in Appendix A – CCTV Reports. After analyzing CCTV video, a recommended repair plan was developed and is outlined below.

Structural defects include cracks, fractures, deformations, and any broken pipe segments. These defects are categorized as noted in the previous section.

In ***Table 16: Structural Assessment for Replacement/Repair – Grade*** 5 and ***Table 17: Structural Assessment for Replacement/Repair – Grade*** 4 a list is provided of pipes that are recommended to be fully replaced or require an immediate spot repair. All pipes with a moderate PACP quick score and moderate Index score should be inspected annually or biennial to assess progression of defects and if any further action is necessary.

Table 16: Structural Assessment for Replacement/Repair – Grade 5

Pipe Section	PACP Quick Score (Overall)	Overall Index	Defects per M	Length of Pipe (Approx Length to Be Repaired)	Recommendation	Description
S111-S112	5143	4.25	2.2989	1.74	Spot Repair	Fractured Pipe
S26- S27	5142	2.40	0.2800	71.42	Flush or Spot Repair	Rock Debris Obstruction
S271-S272	5142	2.89	0.1895	47.5	Spot Repairs (2X)	Broken Pipe and Fracture
S392-S393	5133	2.44	0.7739	11.63	Spot Repair	Broken Pipe
S398-S397	5141	2.29	0.8347	25.16	Spot Repair	Void at Service Tie-in
S412-S411	5242	2.31	0.9510	27.34	Spot Repair	Void at Service Tie-In
S412-S413	5242	4.00	1.2469	4.01	Spot Repair	Void at Manhole
S417-S416	5133	2.36	0.6962	20.11	Spot Repair	Void at Service Tie-In
S447-S446	5148	2.57	0.5580	62.72	Spot Repair	Pipe Section
S450-S449	5144	2.62	0.2867	118.58	Spot Repair	Multiple Fractures Pipe Deforming
S587-S588	5142	2.50	0.2100	104.75	Spot Repair	Void Uninstalled Service in Cored Holes
S601-S602	5341	3.14	0.1252	111.86	Spot Repair	Void at Service Tie-In and Service Tie-Ins Excessive Intrusion into Pipe

S602-S603	5242	3.00	0.0906	110.33	Spot Repair	Broken Pipe, Multiple Fractures, and Deformation
S604-S609	5142	2.75	0.3338	47.93	Spot Repair	Broken Pipe
S618-S617	5143	2.65	0.2655	64.04	Remove Deposits	Segment Blocking 40% of Pipe
S627-S635	5342	3.63	0.4348	18.4	Spot Repair	Hole in Pipe (Camera Work Unclear)
S55-S75	5141	2.15	0.5284	77.6	CIPP Repair	Hinge Cracking No Deformation
S528-S527	5143	3.25	0.0743	107.6	Spot Repair	Void at Service Tie-In
S336-S337	5143	2.43	0.2770	75.8	Remove Blockage	Root Ball 50% of Pipe
S645-S610	5244	2.33	0.2368	114	Spot Repair	Broken Pipe (Possible Exterior Repair)
S612B-S613B	5131	2.50	0.0526	76.1	Spot Repair	Missing Wall
S272-S271	5131	2.20	0.3080	48.7	Include in Above Defect	
S272-S271	5141	2.56	0.3644	24.7	Include in Above Defect	Fractured Pipe
S298-S299	5143	2.87	0.8108	18.5	Flush or Spot Repair	Rock Debris Obstruction
S330-S310	5134	2.15	0.3118	83.4	Remove Deposits	Encrustation 35%
S310-S330	5121	3.50	0.5263	3.8	Include in Above Defect	
S331-S299	5141	2.35	0.1532	111	Remove Deposits	Grease 40%

Table 17: Structural Assessment for Replacement/Repair – Grade 4

Pipe Section	PACP Quick Score (Overall)	Overall Index	Defects per M	Length of Pipe (Approx Length to Be Repaired)	Recommendation	Description
S111- S110	4332	2.86	0.5937	11.79	Spot Repair	Multiple Fractures and Deformation
S127- S129	4332	2.42	0.2289	82.99	Spot Repair	Joint Displacement Sealed with Fernco (Check Capacity)
S146- S145	4124	2.40	0.1904	26.26	Re-Review Video – Lineup 50%	
S231- S175	4227	2.44	0.1162	77.42	Spot Repair	Sag and Unusual Fitting (Check

						Capacity and Re-Review Video)
S243- S244	4131	2.33	0.0843	71.18	Spot Repair	Broken Pipe & Deformation
S337- S336	4831	3.42	0.1306	91.85	Flush and Recheck – Possible Replacement Section	Camera Underwater
S337- S338	4132	2.67	0.3623	16.56	Spot Repair – Likely Manhole Replacement (Check Flow Direction)	Sag at Manhole
S363- S594	463A	2.62	0.3131	108.59	Replacement –Re-Camera to Verify Low Flows	Significant Sags Along Length and Several Cracked Pipe Sections
S363- S366	4232	2.23	0.5094	25.52	Replacement –Re-Camera to Verify Low Flows	Significant Sags Along Length
S367- S368	4334	2.13	0.4051	59.24	Spot Repair, Consider Rehabilitation for I/I	Roots Balls, Sag
S390- S601	4434	2.92	0.1120	116.09	Segment Repair	25m Hinge, Cracking and Deformation
S392- S391	4133	2.83	3.4091	1.76	Spot Repair (Check Capacity)	Large Displacement
S394- S644	4533	2.50	0.4977	32.15	Replacement (Check Traffic Loading)	Sags and Hinge Crack
S398- S399	4133	2.00	1.2712	11.8	Spot Repair (Check Capacity)	Large Joint Displacement
S417- S418	4221	3.33	8.3333	0.36	Spot Repair (Check Capacity)	Large Joint Displacement
S423- S422	4232	3.00	5.8252	1.03	Spot Repair (Check Capacity)	Multiple Fractures No Displacement & Large Joint Displacement
S431- S644	4337	2.87	0.3451	43.46	Spot Repair Check Capacity)	Sag
S436- S435	4133	2.56	0.1807	49.82	Spot Repair (Check Capacity)	Sag
S439- S437	4237	2.60	0.2522	59.47	Spot Repair	Hinge Cracks With Displacement
S440- S439	4339	2.45	0.2161	134.22	Spot Repair (Check Capacity)	Sag
S445- S442	473C	2.88	0.3689	108.43	Replacement	Significant Sags Along Length (Re-Camera to Verify Low Flows)
S447- S448	4237	2.58	0.3828	49.64	Spot Repair (Check Capacity)	Large Joint Displacement
S453- S438	4100	4.00	0.0220	45.46	Spot Repair (Check Capacity)	Sag
S541- S540	4132	2.80	0.4730	10.57	Spot Repair (Check Capacity)	Sag
S528- S686	4222	3.00	0.0711	56.24	Spot Repair (Check Capacity)	Sag

S542- S539	4334	2.62	0.2635	49.33	Maintenance, Spot Repair (Check Capacity)	Root Ball, Sag
S570- S575	453A	2.50	0.4064	93.5	Replacement	Multiple Fractures
S565- S571	4221	3.33	0.0952	31.52	Spot Repair (Check Capacity)	Sag
S577- S571	4131	2.60	0.0448	111.59	Maintenance (Check Capacity)	Grease Buildup
S587- S586	413A	2.65	0.9033	18.82	Spot Repair (Check Capacity)	Service Intrusion
S594- S593	4331	2.38	0.1376	94.48	Spot Repair	Fractured Pipe and Displacement
S603- S575	4235	2.36	0.2050	107.31	Spot Repair	Void at Service Tap
S603- S614	4434	2.92	0.2453	53	Segment Repair	Multiple Sags and 1 Broken Pipe
S615- S616	443B	2.43	0.4694	100.12	Spot Repair (x2)	Multiple Fractures No Displacement
S616- S609	4334	2.26	0.2097	109.66	Spot Repair (x3)	Significant Joint Displacement & Sag
S632- S601	4228	2.40	0.1370	73	Monitor	Ovaled Pipe Causing Joint Displacement (Top of Pipe)
S635- S627	4229	2.36	0.1032	106.55	Spot Repair (Check Capacity)	Short Sag
S636- S635	4231	2.83	0.0517	116.09	Spot Repair (Check Capacity), Maintenance	Short Sag, Sediment Buildup 30%
S638- S637	4227	2.44	0.1110	81.05	Spot Repair (Check Capacity)	Short Sag
S638- S639	4132	2.80	0.0599	83.41	Maintenance, Check Manhole Condition	Debris in Manhole
S644- S635	4234	2.15	0.2558	78.19	Monitor	Small Broken Pipe at Joint @ 12 O'Clock
S65- S74	4138	2.43	0.2898	79.37	Spot Repair (Check Capacity)	Short Sag
S81- S82	4331	3.17	0.1029	58.29	Spot Repair (Check Capacity)	Short Sag
S82- S83	4221	3.33	0.0437	68.66	Maintenance	Grease Buildup
S84- S83	4125	2.33	0.1176	51.03	Spot Repair (Check Capacity)	Short Sag
S87- S88	4235	2.60	0.1781	84.24	Maintenance – I/I Repair	Encrustation and Ragging
S89- S88	4131	2.50	0.0714	84.09	Spot Repair	Multiple Fracture & Deformation
S442- S453	4539	2.95	0.3662	54.62	Replacement (Re-Camera to Verify Low Flows)	Significant Sags Along Length
S539- S536	4133	2.30	0.1153	86.7	Spot Repair	Hole in Pipe with Root Intrusion

S537- S534	4121	3.00	0.7407	2.7	Spot Repair	Very Large Joint Displacement 50%
S537- S534	4100	4.00	0.1786	5.6	Spot Repair	Very Large Joint Displacement 50%
S394- S431	4121	3.00	0.0680	29.4	Spot Repair	Fracture and Joint Displacement, Potentially from Jacking Manhole
S478- S482	412A	2.14	0.1645	85.1	Spot Repair (Check Capacity)	Sag
S435- S431	4100	4.00	0.0806	12.4	(Check Video)	
S432- S431	4222	3.00	0.1023	39.1	Spot Repair (Check Capacity)	Sag
S401- S394	4223	2.50	0.0700	85.7	Spot Repair	Multiple Fracture But No Displacement
S434- S433	4233	2.18	0.1249	88.1	Spot Repair	Broken Pipe at Joint
S442- S453	4131	2.25	0.0718	55.7	Spot Repair (Check Capacity)	Sag
S627A- S645	4126	1.90	0.1155	86.6	Spot Repair (Check Capacity)	Sag
S100- S91	422C	2.18	0.1915	114.9	Spot Repair (X2)	Sag Location and Multiple Fractures
S609- S610	4122	2.25	0.1702	23.5	Maintenance	Encrustation 40%
S610- S609	412A	2.13	0.1074	149	Maintenance	Encrustation 40%
S585- S577	4133	2.67	0.3681	16.3	Spot Repair, CIPP Candidate	Multiple Cracks No Displacement
S692- S693	4131	3.50	0.5882	3.4	Maintenance	Large Encrustation
S656- S657	4231	3.25	0.1034	38.7	Maintenance – Flush and Re-Camera	Debris in Pipe
S355- S337	4234	2.37	0.1987	95.6	Maintenance, Spot Repair (Check Capacity)	Encrustation 25%, Short Sag
S286- S287	4134	1.65	0.6216	91.7	Spot Repair	Broken Pipe at Joint
S299- S298	4432	1.74	0.8051	47.2	Spot Repairs (x2)	Very Large Joint Displacement 50%, Multiple Fracture But No Displacement
S445- S444	4533	3.30	0.5155	19.4	Spot Repairs (x4)	Broken, Multiple Fracture, Deformed Rigid, Fracture Hinge 4

8. Next Steps

It is recommended these proposed upgrade projects be included in an update to the Sanitary Master Plan.

8.1. INFLOW AND INFILTRATION

8.1.1. Direct Connections

Discussion with Town operations staff indicate that there are a significant number of direct connections to the sanitary system, specifically from sump pump discharge at individual residences, which can have a significant impact on sewer capacity. This is specifically an issue in the northern residential area, which shows a rapid, elevated response to storm events. As a result of these connections, the downstream sanitary mains may have capacity issues resulting from the increased loading, requiring upgrades to the downstream pipe system.

The current engineering standards do not prohibit direct connections; a priority task for the Town should be to separate direct connections to the sanitary system. Moving forward, this practice should be stopped to the extent possible through an update to the Town engineering standards / bylaws. Removal of existing direct connections could be encouraged through a grant system.

8.1.2. High Groundwater Infiltration, SW Commercial Area from 63rd Street to 70th Street

Per ***Section 3.5***, and flow data per ***Figure 5: PDWF Model Verification***, a very significant contribution to the total sanitary inflow is the SW Commercial Area from 63rd Street to 70th Street. Given that 17.5% of the Town sanitary inflow is attributable to this single source of I/I, this is the highest priority deficiency for investigation. The cause is currently unknown, however, given the proximity to Bench Creek it is possible there is a direct source of inflow. An investigation should be performed, with the following scope:

- Collection of anecdotal information from Town operational staff.
- Manhole inspections, to see where constant inflow is present to further isolate the I/I source.
- Review of historical CCTV video, if available, and additional CCTV video where required, to determine if the source can be further isolated.
- Smoke testing, to determine possible cross-connections.
- Detailed CCTV video inspection to locate the actual source location.

Correction of this deficiency could significantly reduce the incoming volume being treated at the Town WWTF, and could improve the WWTF lifecycle, and delay future upgrades, reducing long-term Town capital expenditures.

8.1.3. High Groundwater Infiltration, NW Residential Area West of 63rd Street

A secondary high contribution to the total sanitary inflow is the NW Residential Area West of 63rd Street. Approximately 5.3% of the Town sanitary inflow is attributable to I&I from this area. The cause is also currently unknown. An investigation would follow similar methodology to the previous section.

8.2. DEVELOP A SEWER FLUSHING PROGRAM

Several pipe segments did not meet the minimum pipe cleansing velocity of 0.6 m/s under average flow. As discussed in ***Section 5.2*** selection criteria for this analysis was modified to exclude pipe under 20% d/D (flow depth / diameter, to describe pipe capacity utilized) under PDWF, as pipe with small inflows will not meet self-cleansing velocity even at reasonable pipe slope. Relevant areas have been identified in ***Figure 16: PDWF Velocity Analysis Existing Population***.

Shallow slopes and the inability to meet minimum cleansing velocities may result in an increase in Fat, Oil and Grease (FOG) buildup in the network. The FOG buildup can impede pipe flow reducing capacity, further exacerbating any capacity related issues noted. To mitigate this problem, a regular flushing and maintenance schedule should be established in consultation with Town operations staff.

8.3. PROPOSED UPGRADE PHASING – CAPACITY RELATED

Refer to ***Figure 17: Proposed System Upgrades – Capacity Related*** for the upgrade plan.

Phase 1 includes upgrades for pipes with capacity constraints which result in flooding or surcharging of the system under PWWF over 0.5m from the pipe obvert. These locations are high-priority upgrades. Results have been summarized in **Section 6**, and includes:

- 1st Avenue Sanitary Trunk
- 54th Street / 56th Street Sanitary Trunk
- 50th Street
- 10th Avenue Sanitary Main
- 48th Street / 47th Street Sanitary Main Flow Monitoring, per **Section 5.1.4**.

While modeling results indicate minor surcharging of the following pipe under PWWF, under 0.5m from the pipe obvert, recent storms indicate sanitary backup in this area, and so the following section has also been included as a high priority upgrade.

- 52nd Street / 54th Street / 13th Ave / 54th Street / 14th Avenue

8.3.1. New SW Lift Station

Per Section 6.3, the Town has proposed development within the 10-year horizon in the southwest, west of 75th Street. As the existing sanitary main terminates at shallow elevation near this location. A new lift station to the southwest is recommended; as this is required to facilitate new development only, this cost should be passed on to the developers.

8.4. PROPOSED UPGRADE PHASING – CONDITION RELATED

Refer to ***Figure 18: Capital Plan Upgrade & Repair Schedule*** for Grade 5 and Grade 4 operation and maintenance repair locations. Required upgrades are also listed in ***Table 16: Structural Assessment for Replacement/Repair – Grade*** 5 and ***Table 17: Structural Assessment for Replacement/Repair – Grade 4***.

8.5. CCTV PROGRAM

To complete the assessment of the Town sanitary sewer infrastructure, the remainder of the Town should be assessed through a CCTV program. This will identify major breakages, pipe disconnects, or other factors that may contribute to sanitary system failures. Repair of these noted issues can also help reduce the high I/I present in the Town sanitary sewer system.

To date, the Town has completed CCTV review of approximately 17.98 km of the 56.30 km pipe system.

9. Cost Estimate and Capital Planning

An opinion of probable costs was prepared for each of the high and medium priority projects presented in **Section 7** and **Section 8**. An approximate unit cost based on pipe diameter was applied per linear metre for each proposed pipe length and has been itemized in ***Table 18: Upgrade Cost Estimate***. The higher cost of placing the upgrades on developed land is to account for additional considerations like utility locates, installing around other buried utilities, re-graveling/paving, temporary measures, traffic management, and emergency services. This is a Class 'D' cost estimate and is subject to change based on specific site conditions and detailed design.

Table 19: Capital Plan has been prepared to incorporate maintenance-related repairs identified in **Section 7**, and prioritize them for the Town to use in budget planning.

- To simplify cost-estimating given the variability in repair requirements, spot repairs were assumed to each take approximately one day, at a cost of $10,000.
- Repairs to remediate sags were assumed to be more intensive, and require on average two days to repair, at a cost of $20,000.
- Grade 5 and Grade 4 defects were not listed according to urgency, rather they were grouped into one section to be reviewed and addressed. To prioritize repairs, Grade 5 repairs should be performed followed by Grade 4 repairs. Repair order within the list of Grade 5 defects and Grade 4 defects should be performed to suit maintenance department operations.

An additional long-term task that is recommended is a complete CCTV assessment of the Town sanitary system. Based on a similar program performed in a community similar in size, the price per lineal meter has been assumed at $9, under the assumption that the Town is able to perform this work themselves and will not need to hire a contractor. Hiring a contractor would likely increase the cost of this work to approximately $12 per lineal meter.

Figure 18: Capital Plan Upgrade & Repair Schedule is a visual aid to indicate locations of repairs.

Town of Edson
Sanitary Condition Assessment
Class 'D' Cost Estimate

McElhanney

05-Jul-23

Item	Description	Unit	Estimated Rate	Estimate Quantity	Estimated Class 'D' Cost
	SECTION A - CONSTRUCTION COSTS				
PHASE 1					
A1 - 10th Avenue Sanitary Main					
1.1	Sanitary Sewer Main (300mm PVC) - Supply and Install	lm	$ 1,050.00	415	$ 435,750
B1 - 52nd Street / 54th Street / 13th Ave / 54th Street / 14th Avenue Sanitary Main					
1.2	Sanitary Sewer Main (300mm PVC) - Supply and Install	lm	$ 1,050.00	605	$ 635,250
A2 - 54th Street / 56th Street Sanitary Trunk					
1.3	Sanitary Sewer Main (450mm Concrete) - Supply and Install	lm	$ 1,575.00	465	$ 732,375
1.4	Sanitary Sewer Main (600mm Concrete) - Supply and Install	lm	$ 2,100.00	330	$ 693,000
1.5	Highway Crossing	each	$ 50,000.00	2	$ 100,000
A3 - 52nd Street Sanitary Main					
1.6	Sanitary Sewer Main (300mm PVC) - Supply and Install	lm	$ 1,050.00	765	$ 803,250
1.7	Highway Crossing	each	$ 50,000.00	2	$ 100,000
A4 - 50th Street Sanitary Main					
1.8	Sanitary Sewer Main (450mm Concrete) - Supply and Install	lm	$ 1,575.00	1,065	$ 1,677,375
1.9	Highway Crossing	each	$ 50,000.00	2	$ 100,000
A5 - 1st Avenue Sanitary Trunk					
1.10	Sanitary Sewer Main (450mm Concrete) - Supply and Install	lm	$ 1,575.00	350	$ 551,250
1.11	Sanitary Sewer Main (600mm Concrete) - Supply and Install	lm	$ 2,100.00	350	$ 735,000
1.12	Sanitary Sewer Main (750mm Concrete) - Supply and Install	lm	$ 1,125.00	1,000	$ 1,125,000
A6 - 48th Street Sanitary Main					
2.1	Sanitary Sewer Main (300mm PVC) - Supply and Install	lm	$ 1,050.00	1,085	$ 1,139,250
2.2	Sanitary Sewer Main (450mm PVC) - Supply and Install	lm	$ 1,575.00	525	$ 826,875
2.3	Highway Crossing	each	$ 50,000.00	2	$ 100,000
Future SW Development					
Southwest Lift Station					
3.1	New Lift Station	LS	$ 2,000,000.00	1	$ 2,000,000
Forcemain					
3.2	Forcemain (300mm HDPE) - Supply and Install	lm	$ 500.00	3,900	$ 1,950,000
	COST ESTIMATE - CONSTRUCTION SUBTOTAL			$	13,705,000
	CONTINGENCIES		35%	$	4,797,000
	COST ESTIMATE - CONSTRUCTION COSTS TOTAL			$	18,502,000

Notes & Assumptions:

1 Unit prices are based on regional averages, past experience, and some engineering judgement.

2 Prices include asphalt remove and replace.

Town of Edson
Sanitary Condition Assessment
Capital Plan

05-Jul-23

ID No.	Recommendation	Segment	Location	Description	Estimated Cost
High Priority - 5 Years					
CAPACITY					
A1	Capacity Upgrade		10th Avenue Sanitary Main	Pipe Size Upgrade	$ 435,750.00
B1	Capacity Upgrade		52nd Street / 54th Street / 13th Ave / 54th Street / 14th Avenue	Pipe Size Upgrade	$ 635,250.00
A2	Capacity Upgrade		54th Street / 56th Street Sanitary Trunk	Pipe Size Upgrade	$ 1,525,375.00
A3	Capacity Upgrade		52nd Street Sanitary Main	Pipe Size Upgrade	$ 903,250.00
A4	Capacity Upgrade		50th Street Sanitary Main	Pipe Size Upgrade	$ 1,777,375.00
A5	Capacity Upgrade		1st Avenue Sanitary Trunk	Pipe Size Upgrade	$ 2,411,250.00
GRADE 5 DEFECTS					
1.005	Spot Repair	S111- S112	4th Ave and 56th Street	Fractured Pipe	$ 10,000.00
1.006	Flush or Spot Repair	S26- S27	5th Ave and 70th Street	Rock Debris Obstruction	$ 3,000.00
1.007	Spot Repairs (2X)	S271- S272	12th Ave and 48th Street	Broken Pipe and Fracture	$ 10,000.00
1.008	Spot Repair	S392- S393	6th Ave and 49th Street	Broken Pipe	$ 10,000.00
1.009	Spot Repair	S398- S397	7th Ave and 49th Street	Void at Service Tie-in	$ 10,000.00
1.010	Spot Repair	S412- S411	9th Ave and 49th Street	Void at Service Tie-In	$ 10,000.00
1.011	Spot Repair	S412- S413	9th Ave and 49th Street	Void at Manhole	$ 10,000.00
1.012	Spot Repair	S417- S416	10th Ave and 49th Street	Void at Service Tie-In	$ 10,000.00
1.013	Spot Repair	S447- S446	9th Ave and 47th Street	Pipe Section	$ 10,000.00
1.014	Spot Repair	S450- S449	10th Ave and 47th Street	Multiple Fractures Pipe Deforming	$ 10,000.00
1.015	Spot Repair	S587- S588	4th Ave and 51st Street	Void Uninstalled Service in Cored Holes	$ 10,000.00
1.016	Spot Repair	S601- S602	5th Ave and 50th Street	Void at Service Tie-In and Service Tie-Ins Excessive Intrusion into Pipe	$ 10,000.00
1.017	Spot Repair	S602- S603	4th Ave and 50th Street	Broken Pipe, Multiple Fractures, and Deformation	$ 10,000.00
1.018	Spot Repair	S604- S609	1st Ave and 49th Street	Broken Pipe	$ 10,000.00
1.019	Remove Deposits	S618- S617	3rd Ave and 49th Street	Segment Blocking 40% of Pipe	$ 10,000.00
1.020	Spot Repair	S627- S635	4th Ave and 48th Street	Hole in Pipe (Camera Work Unclear)	$ 10,000.00
1.021	CIPP Repair	S55- S75	Highway 16 and 63rd Street	Hinge Cracking No Deformation	$ 10,000.00
1.022	Spot Repair	S528- S527	6th Ave and 42nd Street	Void at Service Tie-In	$ 10,000.00
1.023	Remove Blockage	S336- S337	7th Ave and 52nd Street	Root Ball 50% of Pipe	$ 3,000.00
1.024	Spot Repair	S645- S610	2nd Ave and 48th Street	Broken Pipe (Possible Exterior Repair)	$ 10,000.00
1.025	Spot Repair	S612B- S613B	2nd Ave and 46th Street	Missing Wall	$ 10,000.00
1.026	Include in Above Defect	S272- S271	12th Ave and 48th Street		
1.027	Include in Above Defect	S272- S271	12th Ave and 48th Street		
1.028	Flush or Spot Repair	S298- S299	18th Ave and 48th Street	Rock Debris Obstruction	$ 3,000.00
1.029	Remove Deposits	S330- S310	18th Ave and Edson Drive	Encrustation 35%	$ 3,000.00
1.030	Include in Above Defect	S310- S330	18th Ave and Edson Drive		
1.031	Remove Deposits	S331- S299	Edson Drive and 48th Street	Grease 40%	$ 3,000.00
GRADE 4 DEFECTS					
1.028	Spot Repair	S111- S110	4th Ave and 56th Street	Multiple Fractures and Deformation	$ 10,000.00
1.029	Spot Repair	S127- S129	3rd Ave and 55th Street	Joint Displacement Sealed with Fernco (Check Capacity)	$ 10,000.00
1.030	Re-Review Video – Lineup 50%	S146- S145	15th Ave and 65th Street		$ 10,000.00
1.031	Spot Repair	S231- S175	9th Ave and 61st Street	Sag and Unusual Fitting (Check Capacity and Re-Review Video)	$ 20,000.00
1.032	Spot Repair	S243- S244	13th Ave and 56th Street	Broken Pipe & Deformation	$ 10,000.00
1.033	Flush and Recheck – Possible Repl	S337- S336	10th Ave and 52nd Street	Camera Underwater	$ 10,000.00
1.034	Spot Repair – Likely Manhole Rep	S337- S338	10th Ave and 52nd Street	Sag at Manhole	$ 20,000.00
1.035	Replacement –Re-Camera to Veri	S363- S594	6th Ave and 52nd Street	Significant Sags Along Length and Several Cracked Pipe Sections	$ 20,000.00
1.036	Replacement –Re-Camera to Veri	S363- S366	6th Ave and 52nd Street	Significant Sags Along Length	$ 20,000.00
1.037	Spot Repair, Consider Rehabilitati	S367- S368	7th Ave and 51st Street	Roots Balls, Sag	$ 20,000.00
1.038	Segment Repair	S390- S601	6th Ave and 50th Street	25m Hinge, Cracking and Deformation	$ 20,000.00
1.039	Spot Repair (Check Capacity)	S392- S391	6th Ave and 49th Street	Large Displacement	$ 10,000.00
1.040	Replacement (Check Traffic Loadi	S394- S644	6th Ave and 48th Street	Sags and Hinge Crack	$ 10,000.00
1.041	Spot Repair (Check Capacity)	S398- S399	7th Ave and 49th Street	Large Joint Displacement	$ 10,000.00
1.042	Spot Repair (Check Capacity)	S417- S418	10th Ave and 49th Street	Large Joint Displacement	$ 10,000.00
1.043	Spot Repair (Check Capacity)	S423- S422	11th Ave and 49th Street	Multiple Fractures No Displacement & Large Joint Displacement	$ 10,000.00
1.044	Spot Repair Check Capacity)	S431- S644	6th Ave and 48th Street	Sag	$ 20,000.00
1.045	Spot Repair (Check Capacity)	S436- S435	6th Ave and 48th Street	Sag	$ 20,000.00
1.046	Spot Repair	S439- S437	7th Ave and 46th Street	Hinge Cracks With Displacement	$ 10,000.00
1.047	Spot Repair (Check Capacity)	S440- S439	7th Ave and 46th Street	Sag	$ 20,000.00
1.048	Replacement	S445- S442	9th Ave and 47th Street	Significant Sags Along Length (Re-Camera to Verify Low Flows)	$ 20,000.00
1.049	Spot Repair (Check Capacity)	S447- S448	9th Ave and 46th Street	Large Joint Displacement	$ 10,000.00
1.050	Spot Repair (Check Capacity)	S453- S438	8th Ave and 47th Street	Sag	$ 20,000.00
1.051	Spot Repair (Check Capacity)	S541- S540	5th Ave Cul-de-sac	Sag	$ 20,000.00
1.052	Spot Repair (Check Capacity)	S528- S686	6th Ave and 42nd Street	Sag	$ 20,000.00
1.053	Maintenance, Spot Repair (Check	S542- S539	5th Ave and 41st Street	Root Ball, Sag	$ 20,000.00
1.054	Replacement	S570- S575	1st Ave and 50th Street	Multiple Fractures	$ 10,000.00
1.055	Spot Repair (Check Capacity)	S565- S571	1st Ave and 52nd Street	Sag	$ 20,000.00
1.056	Maintenance (Check Capacity)	S577- S571	3rd Ave and 52nd Street	Grease Buildup	$ 3,000.00

ID No.	Recommendation	Segment	Location	Description	Estimated Cost
1.057	Spot Repair (Check Capacity)	S587- S586	4th Ave and 51st Street	Service Intrusion	$ 10,000.00
1.058	Spot Repair	S594- S593	5th Ave and 52nd Street	Fractured Pipe and Displacement	$ 10,000.00
1.059	Spot Repair	S603- S575	3rd Ave and 50th Street	Void at Service Tap	$ 10,000.00
1.060	Segment Repair	S603- S614	3rd Ave and 50th Street	Multiple Sags and 1 Broken Pipe	$ 10,000.00
1.061	Spot Repair (x2)	S615- S616	3rd Ave and 49th Street	Multiple Fractures No Displacement	$ 10,000.00
1.062	Spot Repair (x3)	S616- S609	3rd Ave and 49th Street	Significant Joint Displacement & Sag	$ 20,000.00
1.063	Monitor	S632- S601	5th Ave and 49th Street	Ovaled Pipe Causing Joint Displacement (Top of Pipe)	$ 10,000.00
1.064	Spot Repair (Check Capacity)	S635- S627	5th Ave and 48th Steet	Short Sag	$ 20,000.00
1.065	Spot Repair (Check Capacity), Mai	S636- S635	5th Ave and 48th Street	Short Sag, Sediment Buildup 30%	$ 20,000.00
1.066	Spot Repair (Check Capacity)	S638- S637	5th Ave and 47th Street	Short Sag	$ 20,000.00
1.067	Maintenance, Check Manhole Cor	S638- S639	5th Ave and 46th Street	Debris in Manhole	$ 3,000.00
1.068	Monitor	S644- S635	5th Ave and 48th Street	Small Broken Pipe at Joint @ 12 O'Clock	$ 10,000.00
1.069	Spot Repair (Check Capacity)	S65- S74	4th Ave and 63rd Street	Short Sag	$ 20,000.00
1.070	Spot Repair (Check Capacity)	S81- S82	1st Ave and 59th Street	Short Sag	$ 20,000.00
1.071	Maintenance	S82- S83	2nd Ave and 59th Street	Grease Buildup	$ 3,000.00
1.072	Spot Repair (Check Capacity)	S84- S83	2nd Ave and 58th Street	Short Sag	$ 20,000.00
1.073	Maintenance – I/I Repair	S87- S88	1st Ave and 57th Street	Encrustation and Ragging	$ 3,000.00
1.074	Spot Repair	S89- S88	1st Ave and 56th Street	Multiple Fracture & Deformation	$ 10,000.00
1.075	Replacement (Re-Camera to Verif	S442- S453	8th Ave and 47th Street	Significant Sags Along Length	$ 20,000.00
1.076	Spot Repair	S539- S536	In Front of 4023 41 Street	Hole in Pipe with Root Intrusion	$ 10,000.00
1.077	Spot Repair	S537- S534	4th Ave and 41st Street	Very Large Joint Displacement 50%	$ 10,000.00
1.078	Spot Repair	S537- S534	4th Ave and 41st Street	Very Large Joint Displacement 50%	$ 10,000.00
1.079	Spot Repair	S394- S431	6th Ave and 48th Street	Fracture and Joint Displacement, Potentially from Jacking Manhole	$ 10,000.00
1.080	Spot Repair (Check Capacity)	S478- S482	10th Ave and 43rd Street	Sag	$ 20,000.00
1.081	Spot Repair (Check Capacity)	S435- S431	6th Ave and 48th Street	Sag	$ 20,000.00
1.082	Spot Repair (Check Capacity)	S432- S431	6th Ave and 48th Street	Sag	$ 20,000.00
1.083	Spot Repair	S401- S394	7th Ave and 48th Street	Multiple Fracture But No Displacement	$ 10,000.00
1.084	Spot Repair	S434- S433	6th Ave and 46th Street	Broken Pipe at Joint	$ 10,000.00
1.085	Spot Repair (Check Capacity)	S442- S453	8th Ave and 47th Street	Sag	$ 20,000.00
1.086	Spot Repair (Check Capacity)	S627A- S645	1st Ave and 54th Street	Sag	$ 20,000.00
1.087	Spot Repair (X2)	S100- S91	1st Ave and 55th Street	Sag Location and Multiple Fractures	$ 20,000.00
1.088	Maintenance	S609- S610	2nd Ave and 48th Street	Encrustation 40%	$ 3,000.00
1.089	Maintenance	S610- S609	2nd Ave and 48th Street	Encrustation 40%	$ 3,000.00
1.090	Spot Repair, CIPP Candidate	S585- S577	4th Ave and 52nd Street	Multiple Cracks No Displacement	$ 10,000.00
1.091	Maintenance	S692- S693	Landfill Rd and 55th Street	Large Encrustation	$ 10,000.00
1.092	Maintenance – Flush and Re-Cam	S656- S657	South of Edson Lions Park	Debris in Pipe	$ 3,000.00
1.093	Maintenance, Spot Repair (Check	S355- S337	10th Ave and 52nd Street	Encrustation 25%, Short Sag	$ 20,000.00
1.094	Spot Repair	S286- S287	17th Ave and 48th Street	Broken Pipe at Joint	$ 10,000.00
1.095	Spot Repairs (x2)	S299- S298	18th Ave and 48th Street	Very Large Joint Displacement 50%, Multiple Fracture But No Displacement	$ 20,000.00
1.096	Spot Repairs (x4)	S445- S444	9th Ave and 47th Street	Broken, Multiple Fracture, Deformed Rigid, Fracture Hinge 4	$ 20,000.00
INFLOW & INFILTRATION					
1.100	Commercial Investigation		SW Commercial	Inflow and Infiltration Source Investigation	$ 30,000.00
Total Cost: High Priority - 5 Years					**$ 8,884,250.00**
Medium Priority - 10 Years					
CAPACITY					
A6	Capacity Upgrade		48th Street Sanitary Main	Pipe Size Upgrade	$ 2,067,000.00
2.001	*Service Area Increase*		*Highway 16, East Side of Town*	*New Lift Station and Forcemain*	*$ 3,950,000.00*
GRADE 3 DEFECTS					
2.002	Not included in Capital Plan, to be addressed by the Town as part of standard operation and maintenance				$ -
INFLOW & INFILTRATION					
2.100	Residential Investigation		Northwest, North-Central Residential Areas	Inflow and Infiltration Source Investigation	$ 30,000.00
Total Cost: Medium Priority - 10 Years					**$ 6,047,000.00**
Low Priority - 20 Years					
CAPACITY					
3.001	None identified				$ -
GRADE 2, 1 DEFECTS					
3.002	Not included in Capital Plan, to be addressed by the Town as part of standard operation and maintenance				$ -
TOWN-WIDE CCTV SUPPLEMENTARY INVESTIGATION					
3.100	Costs assumed based on lineal meters of Town sewer infrastructure				$ 350,000.00
Total Cost: Low Priority - 20 Years					**$ 350,000.00**
				CAPITAL PLAN - CONSTRUCTION SUBTOTAL	**15,281,250.00**
				CONTINGENCIES	35%
				CAPITAL PLAN - CONSTRUCTION COSTS TOTAL	**20,630,000.00**

Notes & Assumptions:

1 Unit prices are based on regional averages, past experience, and some engineering judgement.
2 Prices include asphalt remove and replace.
3 2.001 should be a developer cost and pricing included for Town knowledge
4 Pricing for 3.100 is based on a comparable project in a different community; the actual price may be different dependant on contractor rates and effort.

EDSON SANITARY SEWER CONDITION ASSESSMENT

DATE: 2023-07-25

LEGEND

CONDUITS

- VISIBLE
- FORCE MAIN
- UPGRADE 250 mm
- UPGRADE 300 mm
- UPGRADE 450 mm
- UPGRADE 600 mm
- UPGRADE 750 mm

McElhanney

0 1:20,000 1000

FIGURE 18: CAPITAL PLAN UPGRADE AND REPAIR SCHEDULE

SCALE 1:20000

APPENDICES

APPENDIX A CCTV REPORTS

APPENDIX B GRADE 4 & 5 PIPE ANALYSIS SUMMARY

Title: Edson Sanitary Sewer Condition Assessment
Client: City of Edson

File #: 2131-10590-00

From: Pipe Analysis Report

Prepared By: Jeff Amundson
Reviewed By: Michael Maltais
Date: 07/25/2023

System Name

Pipe Segment	Upstream MH	Downstream MH	Pipe Size (mm)	Material	Length (m)	Grade (%)	Video - Report	PACP Quick (Structural)	PACP Quick (O&M)	Structual Index	O&M Index	Overall Index
S111- S112	S111	S112	200	Vit. Clay	1.74	-	0	5143	0	4.25	0.00	4.25
S26- S27	S26	S27	200	Vit. Clay	71.42	-	0	4133	5141	2.27	2.56	2.40
S271- S272	S271	S272	200	Vit. Clay	47.5	-	0	4233	5100	2.63	5.00	2.89
S392- S393	S392	S393	200	Vit. Clay	11.63	-	0	5132	3123	2.60	2.25	2.44
S398- S397	S398	S397	200	Vit. Clay	25.16	-	0	5141	312A	2.50	2.09	2.29
S412- S411	S412	S411	200	Vit. Clay	27.34	-	0	5242	2A11	2.60	1.91	2.31
S412- S413	S412	S413	200	Vit. Clay	4.01	-	0	5142	5100	3.75	5.00	4.00
S417- S416	S417	S416	200	Vit. Clay	20.11	-	0	5132	3129	3.00	2.10	2.36
S447- S446	S447	S446	200	Vit. Clay	62.72	-	0	5148	2500	2.67	2.00	2.57
S450- S449	S450	S449	200	Vit. Clay	118.58	-	0	5144	2B00	3.17	2.00	2.62
S587- S588	S588	S587	200	Vit. Clay	104.75	-	0	5132	4232	3.00	2.35	2.50
S601- S602	S601	S602	200	Vit. Clay	111.86	-	0	5131	5241	3.33	3.09	3.14
S602- S603	S602	S603	200	Vit. Clay	110.33	-	0	5242	2200	3.25	2.00	3.00
S604- S609	S604	S609	200	Vit. Clay	47.93	-	0	5135	4216	3.00	2.50	2.75
S618- S617	S617	S618	200	Vit. Clay	64.04	-	0	4122	5142	2.67	2.64	2.65
S627- S635	S635	S627	200	Vit. Clay	18.4	-	0	5341	4122	4.20	2.67	3.63
S55- S75	S55	S75	200	Vit. Clay	77.6	-	36630-04	5141	312B	2.56	2.03	2.15
S528- S527	S528	S527	200	Vit. Clay	107.6	-	36630-09	5142	4123	4.00	2.50	3.25
S336- S337	S336	S337	200	Vit. Clay	75.8	-	36630-18	4133	5142	2.71	2.29	2.43
S645- S610	S645	S610	200	Concrete	114	-	36630-33	5241	4332	2.10	2.47	2.33
S612B- S613B	S621B	S613B	380	Concrete	76.1	-	36630-35	5112	3100	2.33	3.00	2.50
S272- S271	S272	S271	200	Vit. Clay	48.7	-	36630-46	3111	512A	2.00	2.23	2.20
S272- S271	S272	S271	200	Vit. Clay	24.7	-	36630-47	4131	5125	2.67	2.50	2.56
S298- S299	S298	S299	200	Vit. Clay	18.5	-	0	4335	5131	2.82	3.00	2.87
S330- S310	S310	S330	200	Vit. Clay	83.4	-	0	2300	5134	2.00	2.17	2.15
S310- S330	S310	S330	200	Vit. Clay	3.8	-	0	0	5121	0.00	3.50	3.50
S331- S299	S331	S299	200	AC	111	-	0	5141	312A	4.50	2.07	2.35

Title: Edson Sanitary Sewer Condition Assessment From: Pipe Analysis Report

Client: City of Edson

Prepared By: Jeff Amundson
Reviewed By: Michael Maltais
Date: 07/25/2023

File #: 3231-10590-00

System Name

Pipe Segment	Upstream MH	Downstream MH	Pipe Size (mm)	Material	Length (m)	Grade (%)	Video - Report	PACP Quick (Structural)	PACP Quick (O&M)	Structual Index	O&M Index	Overall Index	Rating per m	Defects per m
S111- S110	S111	S110	200	Vit. Clay	11.79	-	0	4232	4100	2.67	4.00	2.86	1.696	0.594
S127- S129	S127	S129	200	Vit. Clay	82.99	-	0	4321	322A	3.50	2.13	2.42	0.554	0.229
S146- S145	S145	S146	200	PVC	26.26	-	0	0	4124	0.00	2.40	2.40	0.457	0.190
S231- S175	S231	S175	200	PVC	77.42	-	0	0	4227	0.00	2.44	2.44	0.284	0.116
S243- S244	S243	S244	200	Vit. Clay	71.18	-	0	4131	2211	3.00	1.67	2.33	0.197	0.084
S337- S336	S337	S336	200	Vit. Clay	91.85	-	0	3123	4800	2.25	4.00	3.42	0.446	0.131
S337- S338	S338	S337	200	Vit. Clay	16.56	-	0	3222	4121	2.50	3.00	2.67	0.966	0.362
S363- S594	S363	S594	200	Vit. Clay	108.59	-	0	423A	4428	2.75	2.43	2.62	0.820	0.313
S363- S366	S366	S363	250	Vit. Clay	25.52	-	0	3123	4231	2.25	2.22	2.23	1.136	0.509
S367- S368	S368	S367	200	Vit. Clay	59.24	-	0	3121	4333	1.60	2.26	2.13	0.861	0.405
S390- S601	S390	S601	200	Vit. Clay	116.09	-	0	4434	2400	3.33	2.00	2.92	0.327	0.112
S392- S391	S392	S391	200	Vit. Clay	1.76	-	0	4133	2100	3.00	2.00	2.83	9.659	3.409
S394- S644	S394	S644	250	Vit. Clay	32.15	-	0	4233	4300	2.15	4.00	2.50	1.244	0.498
S398- S399	S398	S399	200	Vit. Clay	11.8	-	0	4133	2500	2.00	2.00	2.00	2.542	1.271
S417- S418	S417	S418	200	Vit. Clay	0.36	-	0	4100	4121	4.00	3.00	3.33	27.778	8.333
S423- S422	S423	S422	200	Vit. Clay	1.03	-	0	4231	3121	3.25	2.50	3.00	17.476	5.825
S431- S644	S431	S644	200	Vit. Clay	43.46	-	0	3722	4323	2.78	3.00	2.87	0.989	0.345
S436- S435	S436	S435	200	Vit. Clay	49.82	-	0	3322	4123	2.60	2.50	2.56	0.462	0.181
S439- S437	S439	S437	200	Vit. Clay	59.47	-	0	4237	2311	2.91	1.75	2.60	0.656	0.252
S440- S439	S440	S439	200	Vit. Clay	134.22	-	0	4134	4235	2.56	2.40	2.45	0.529	0.216
S445- S442	S445	S442	200	Vit. Clay	108.43	-	0	413C	4631	2.73	3.30	2.88	1.061	0.369
S447- S448	S448	S447	200	Vit. Clay	49.64	-	0	4237	2500	2.79	2.00	2.58	0.987	0.383
S453- S438	S453	S438	200	Vit. Clay	45.46	-	0	0	4100	0.00	4.00	4.00	0.088	0.022
S541- S540	S541	S540	200	Vit. Clay	10.57	-	0	3200	4122	3.00	2.67	2.80	1.325	0.473
S528- S686	S528	S686	200	Vit. Clay	56.24	-	0	0	4222	0.00	3.00	3.00	0.213	0.071
S542- S539	S542	S539	200	Vit. Clay	49.33	-	0	3221	4332	2.67	2.60	2.62	0.689	0.264
S570- S575	S570	S575	200	PVC	93.5	-	0	443A	4131	2.80	2.17	2.50	1.016	0.406
S565- S571	S571	S565	250	Vit. Clay	31.52	-	0	0	4221	0.00	3.33	3.33	0.317	0.095
S577- S571	S577	S571	250	Vit. Clay	111.59	-	0	0	4131	0.00	2.60	2.60	0.116	0.045
S587- S586	S587	S586	200	Vit. Clay	18.82	-	0	3A11	4125	2.82	2.33	2.65	2.391	0.903
S594- S593	S593	S594	200	Vit. Clay	94.48	-	0	4231	4126	2.50	2.29	2.38	0.328	0.138
S603- S575	S603	S575	200	Vit. Clay	107.31	-	0	4126	4135	2.13	2.50	2.36	0.485	0.205
S603- S614	S614	S603	200	Vit. Clay	53	-	0	4133	4331	2.71	3.17	2.92	0.717	0.245
S615- S616	S615	S616	200	Vit. Clay	100.12	-	0	433A	4134	2.61	2.25	2.43	1.139	0.469
S616- S609	S616	S609	200	Vit. Clay	109.66	-	0	4234	4123	2.21	2.50	2.26	0.474	0.210
S632- S601	S632	S601	200	PVC	73	-	0	4200	2800	4.00	2.00	2.40	0.329	0.137
S635- S627	S635	S627	200	PVC	106.55	-	0	2400	4225	2.00	2.57	2.36	0.244	0.103
S636- S635	S636	S635	200	PVC	116.09	-	0	0	4231	0.00	2.83	2.83	0.146	0.052
S638- S637	S638	S637	200	PVC	81.05	-	0	0	4227	0.00	2.44	2.44	0.271	0.111

Title: Edson Sanitary Sewer Condition Assessment
Client: City of Edson

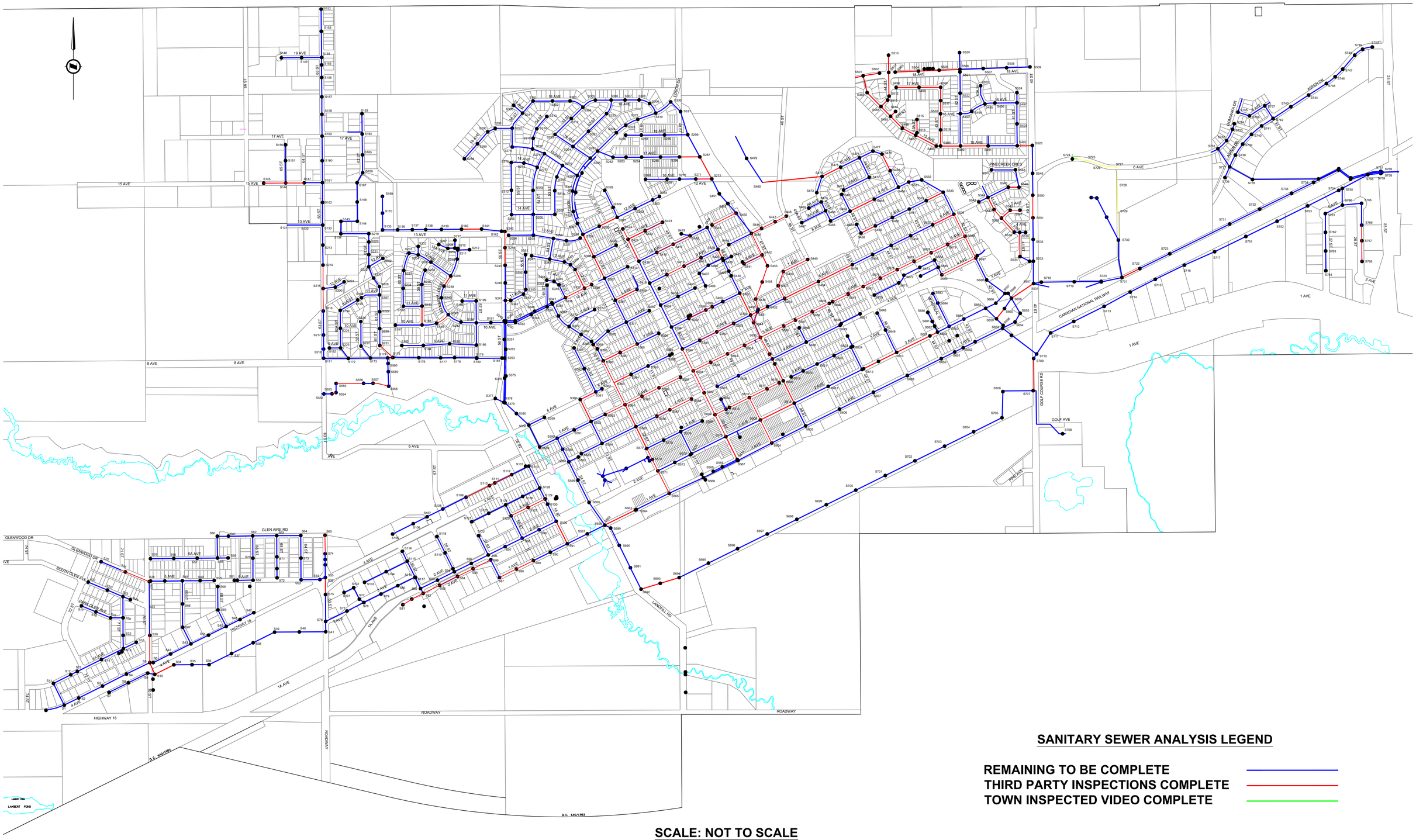
From: Pipe Analysis Report

Prepared By: Jeff Amundson
Reviewed By: Michael Maltais
Date: 07/25/2023

File #: 3231-10590-00

Pipe Segment	Upstream MH	Downstream MH	Pipe Size (mm)	Material	Length (m)	Grade (%)	Video - Report	PACP Quick (Structural)	PACP Quick (O&M)	Structual Index	O&M Index	Overall Index	Rating per m	Defects per m
S638- S639	S639	S638	200	PVC	83.41	-	0	0	4132	0.00	2.80	2.80	0.168	0.060
S644- S635	S644	S635	250	Vit. Clay	78.19	-	0	4234	2211	2.24	1.67	2.15	0.550	0.256
S65- S74	S65	S74	0	Vit. Clay	79.37	-	0	3823	412A	2.73	2.17	2.43	0.706	0.290
S81- S82	S81	S82	200	Vit. Clay	58.29	-	0	4231	4121	3.25	3.00	3.17	0.326	0.103
S82- S83	S82	S83	300	Vit. Clay	68.66	-	0	0	4221	0.00	3.33	3.33	0.146	0.044
S84- S83	S83	S84	300	Vit. Clay	51.03	-	0	0	4125	0.00	2.33	2.33	0.274	0.118
S87- S88	S87	S88	300	Vit. Clay	84.24	-	0	3121	4234	2.50	2.62	2.60	0.463	0.178
S89- S88	S88	S89	300	Vit. Clay	84.09	-	0	4100	3124	4.00	2.20	2.50	0.178	0.071
S442- S453	S442	S453	200	PVC	54.62	-	0	3923	4523	2.75	3.25	2.95	1.080	0.366
S539- S536	S539	S536	200	Vit. Clay	86.7	-	36630-10	4131	3212	2.50	2.00	2.30	0.265	0.115
S537- S534	S537	S534	200	Vit. Clay	2.7	-	36630-11	4100	2100	4.00	2.00	3.00	2.222	0.741
S537- S534	S537	S534	200	Vit. Clay	5.6	-	36630-12	0	4100	0.00	4.00	4.00	0.714	0.179
S394- S431	S394	S431	200	Vit. Clay	29.4	-	36630-22	4121	0	3.00	0.00	3.00	0.204	0.068
S478- S482	S478	S482	200	Vit. Clay	85.1	-	36630-14	2200	412A	2.00	2.17	2.14	0.353	0.165
S435- S431	S435	S431	200	Concrete	12.4	-	36630-20	4100	0	4.00	0.00	4.00	0.323	0.081
S432- S431	S432	S431	200	Vit. Clay	39.1	-	36630-21	4122	4100	2.67	4.00	3.00	0.307	0.102
S401- S394	S401	S394	200	Vit. Clay	85.7	-	36630-23	4222	2100	2.60	2.00	2.50	0.175	0.070
S434- S433	S434	S433	200	Vit. Clay	88.1	-	36630-24	4233	2100	2.20	2.00	2.18	0.272	0.125
S442- S453	S442	S453	200	Vit. Clay	55.7	-	36630-25	3111	4111	2.00	2.50	2.25	0.162	0.072
S627A- S645	S627A	S645	250	Concrete	86.6	-	36630-28	1300	4126	1.00	2.29	1.90	0.219	0.115
S100- S91	S100	S91	250	Concrete	114.9	-	36630-29	4124	412B	2.40	2.12	2.18	0.418	0.191
S609- S610	S609	S610	300	Concrete	23.5	-	36630-31	1100	4122	1.00	2.67	2.25	0.383	0.170
S610- S609	S609	S610	300	Concrete	149	-	36630-32	2200	412A	2.00	2.14	2.13	0.228	0.107
S585- S577	S585	S577	250	Vit. Clay	16.3	-	36630-40	4132	3100	2.60	3.00	2.67	0.982	0.368
S692- S693	S692	S693	900	Concrete	3.4	-	36630-41	0	4131	0.00	3.50	3.50	2.059	0.588
S656- S657	S656	S657	450	Concrete	38.7	-	36630-43	4121	4131	3.00	3.50	3.25	0.336	0.103
S355- S337	S355	S337	200	Vit. Clay	95.6	-	0	3122	4233	2.00	2.47	2.37	0.471	0.199
S286- S287	S286	S287	200	PVC	91.7	-	0	4133	312C	2.71	1.50	1.65	1.025	0.622
S299- S298	S298	S299	200	Vit. Clay	47.2	-	0	4431	312A	3.50	1.41	1.74	1.398	0.805
S445- S444	S444	S445	200	Vit. Clay	19.4	-	0	4532	3100	3.33	3.00	3.30	1.701	0.515

APPENDIX C CCTV MAP



SANITARY SEWER ANALYSIS LEGEND

REMAINING TO BE COMPLETE

THIRD PARTY INSPECTIONS COMPLETE

TOWN INSPECTED VIDEO COMPLETE

SCALE: NOT TO SCALE

Rev	Date	Description	Drawn	Design	App'd
3	2022-08-26	ISSUED FOR TOWN OF EDSON REVIEW	MH	AA	MM
2	2022-07-05	ISSUED FOR TOWN OF EDSON REVIEW	MH	AA	MM
1	2022-06-07	ISSUED FOR TOWN OF EDSON REVIEW	MH	AA	MM

ORIGINAL DWG SIZE: A1 (594 x 841mm)

McElhanney

Suite 200
858 Beatty Street
Vancouver BC
Canada V6B 1C1
T 604 683 8521

PRELIMINARY
NOT FOR
CONSTRUCTION

THIS DRAWING HAS NOT BEEN APPROVED AND MAY CONTAIN ERRORS AND OMISSIONS

Town of Edson
605 -50 Street, Edson, AB

Edson Sanitary Sewer Assessment Completed CCTV Inspections

Drawing No.
C100

Project Number	Rev.
3231-10590-00	3

DESTROY ALL PRINTS BEARING PREVIOUS REVISION

Contact
Jeff Amundson, P.Eng.
780-809-3257
jamundson@mcelhanney.com

McElhanney

CANADA BEST MANAGED COMPANIES