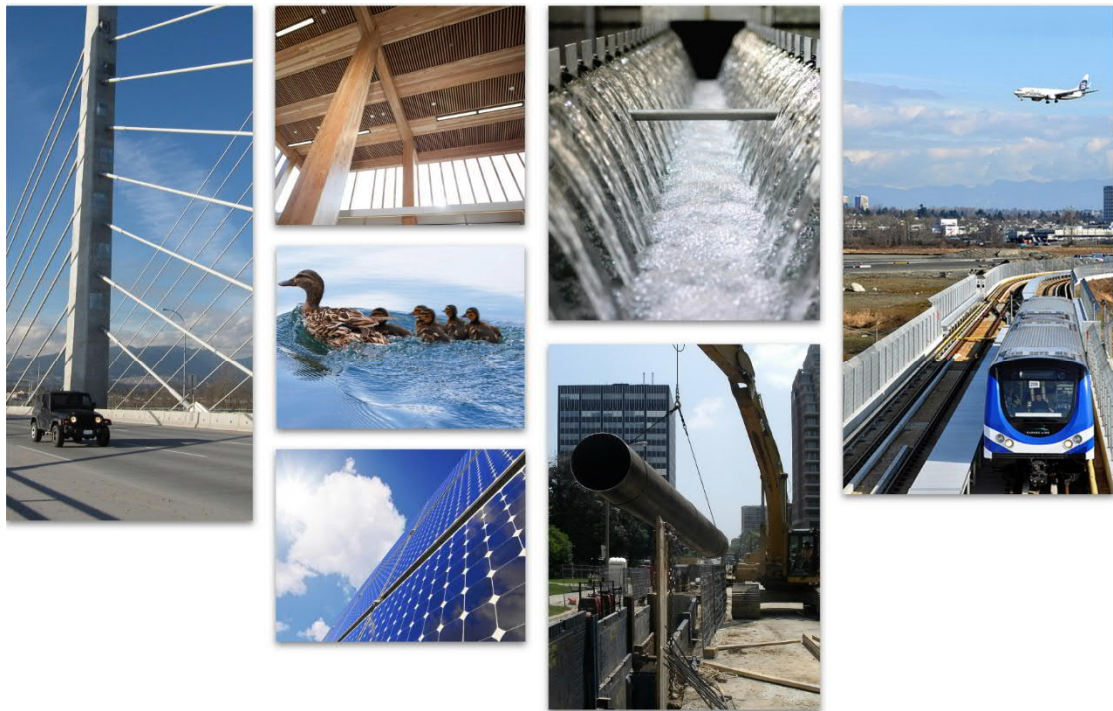


## REPORT

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### City of St. Albert

## Water Distribution System Master Plan 2020 Update



MARCH 2022

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## EXECUTIVE SUMMARY

### 1 BACKGROUND

The City of St. Albert (City) has engaged Associated Engineering to update their Water Distribution System Master Plan. Like many communities in Alberta, per capita water use in St. Albert has been declining. As such, previously projected water requirements are no longer applicable. The City now wishes to update the model to reflect the current distribution system. The goal is to identify proposed upgrades and future infrastructure requirements which will closer meet the City's projected needs.

The report objective is to provide the City with a comprehensive Water Master Plan Update which will outline recommended upgrades to the existing water distribution system and present servicing concepts for future development. To complete the scope, Associated Engineering has broken down this assignment into the following six primary objectives:

1. Provide the City with updated design criteria for system assessment.
2. Provide the City with updated and calibrated WaterCAD model.
3. Identify existing system deficiencies and constraints.
4. Identify opportunities for repairs and system improvements.
5. Provide a growth plan to aid the City in planning for future development and population increase.
6. Prepare a comprehensive 10 year Capital Plan to help guide City infrastructure spending.

### 2 ASSESSMENT

The existing WaterCAD model was updated and expanded to reflect current development and the adopted design criteria. The model was then validated/calibrated using multiple sources including:

- PRV Reading/Setpoint Data;
  - PRV Survey conducted to confirm elevations.
- Static Hydrant Pressure Data;
- Pump Station SCADA Data;
- Henday Booster Station Test Data; and
- Historical Pumped Flow Data.

Following model updating, the existing distribution system was analyzed to determine typical operating pressures and maximum day plus fire flow capabilities. The majority of locations experienced pressures within the recommended targets; however, a number of locations greatly exceeded recommendations.

The majority of locations within City property fully satisfied the maximum day plus fire flow criteria. Some areas which did not meet the criteria include:

- Cul-de-sacs;
- Dead end mains;

- Long blocks without intermediate looping; and
- High fire flow properties.

Most locations which did not meet the fire flow criteria are situated within private property and include hydrant leads and service lines.

There is ample surplus pumping capacity to meet the projected demands (while reserving some distribution pumps as backup). This is based on collective operation of the Sturgeon Heights, Oakmont and Lacombe Park Reservoir and Pump Stations. The Oakmont Pump Station was found to be the least capable of meeting the future projected demands.

Based on the storage assessment, there is sufficient storage capacity to meet the projected design demands to 2038, considering planned upgrades at the Sturgeon Heights Reservoir and Pump Station.

### 3 UPGRADES/EXPANSION

Relatively few upgrades to the distribution system have been recommended. These are primarily comprised of watermain upgrades; however, also include:

- Pressure zone modifications:
  - Two new proposed pressure zones; and
  - Existing PRV setpoint modifications.
- Removal of normally closed valves;
- Potential for select PRV removal;
- Grandin Booster Station decommissioning; and
- Potential Henday Booster Station decommissioning pending further testing.

Following recommended upgrades, some locations are not anticipated to fully meet the recommended fire flow. These may include cul-de-sacs, or dead ends, and other areas where fire flows may be improved due to future watermain extension or looping due to growth.

Upgrades are proposed at the Oakmont Pump Station to occur by 2034. Additional treated water storage will not be required until 2038, based on construction of the new Sturgeon Heights Reservoir and Pump Station.

Future water system concepts were developed for 3 Development Stages as well as the Ultimate System. The concepts outline major watermains anticipated through future staged growth areas, as well as identifying pumping, storage, and transmission main requirements. A comparative analysis was undertaken to assess three potential future reservoir locations/concepts.



## 4 COST ESTIMATES

A summary of capital cost estimates has been provided for upgrades which are recommended for the existing water system, as well as subsequent development stages where applicable. For future development scenarios, costs are generally presented for new facilities and offsite watermain and those onsite watermain over 300 mm in diameter. The estimates presented include an allowance for engineering (15%) and contingency (15%), but do not include GST.

**Table 1-1**  
**Summary of Capital Costs**

Upgrades to Existing System		
Watermains		\$3,890,000
Valve Removal		\$150,000
PRV Setpoint Adjustments		\$25,000
PRV Installation		\$3,000,000
PRV Removal		\$1,542,000
Sturgeon Reservoir and Pump Station		\$23,000,000
Grandin Booster Station Decommissioning		\$150,000
Henday Booster Station Decommissioning		\$150,000
<b>TOTAL UPGRADES TO EXISTING SYSTEM</b>		<b>\$31,907,000</b>
<b>Stage 1</b>		
Watermains		\$7,103,000
PRV Installation		\$1,500,000
Oakmont Pump Station Upgrades <sup>1</sup>		\$4,000,000
<b>TOTAL STAGE 1</b>		<b>\$12,603,000</b>
<b>Stage 2</b>		
Watermains		\$3,662,000
North Reservoir and Pump Station		\$20,000,000
<b>TOTAL STAGE 2</b>		<b>\$23,662,000</b>
<b>Stage 3</b>		
Watermains		\$1,400,000
North Reservoir Expansion		\$12,000,000
PRV Installation		\$1,000,000
<b>TOTAL STAGE 3</b>		<b>\$14,400,000</b>
<b>Ultimate Development Scenario</b>		
Watermains		\$27,973,000
PRV Installation		\$500,000
<b>TOTAL ULTIMATE</b>		<b>\$28,473,000</b>

Notes: 1 Cost for Oakmont Pump Station Upgrades taken from City of St. Albert Oakmont Reservoir and Pump Station Upgrades Predesign Report, Associated Engineering, August 2014. The costs include new pump installation as well as additional work. The estimated cost has been increased to account for inflation

Proposed upgrade locations were evaluated and prioritized using a priority ranking approach. The approach considered:

- Fire flow deficiency;
- People impacted;
- Criticality of infrastructure; and
- Cost-benefit ratio.

A comprehensive capital plan was developed which considered the upgrade priority rankings and included other identified distribution system upgrades.

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Closure

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# 1 INTRODUCTION

## 1.1 Background

The City of St. Albert (City) has engaged Associated Engineering to update their Water Distribution System Master Plan. The Master Plan identifies infrastructure needs which will be incorporated into a comprehensive 10 Year Capital Plan.

The previous Utility Master Plan (UMP) was undertaken in 2013 and included water distribution, wastewater collection and stormwater system assessments. In 2017, Associated Engineering converted the 2013 UMP Mike Urban water distribution model to a WaterCAD model. The model was updated to include new development areas and system upgrades and was validated using available hydrant flow testing data.

Like many communities in Alberta, per capita water use in St. Albert has been declining. As such, previously projected water requirements are no longer applicable. The City now wishes to update the model to reflect the current distribution system. This includes selecting appropriate design criteria which will provide a reasonable level of conservatism for existing system analysis as well as for future system planning purposes. The goal is to identify proposed upgrades and future infrastructure requirements which will closer meet the City's projected needs.

## 1.2 Study Area

The City of St. Albert is located immediately to the northwest of the City of Edmonton. The present corporate boundaries encompass approximately 49.7 square kilometres, which form the ultimate study area for the Water Distribution System Master Plan. Refer to **Figure 1-1** for a Location Plan.

The topography of the area generally falls toward the Sturgeon River, which flows through the centre of the City. The highest elevations are found on the southeast side of the river, within existing development areas.

## 1.3 Report Objectives and Scope

The City has identified the following report scope:

- Update to reflect the current status of development.
- Utilize appropriate design demands and evaluation criteria.
- Identify system shortfalls and propose upgrades to mitigate/correct the condition.
- Existing and future infrastructure capacity needs are to be identified and timing proposed for distribution expansion, transmission mains, reservoir, and pump stations.
- Staged growth scenarios are to be developed in consideration of risk and value engineering including opportunities for innovative construction methods.
- Proposed infrastructure costs are to be incorporated into a comprehensive 10 Year Capital Plan for implementation by the City.
- All findings are to be incorporated into a Water Distribution System Master Plan Update.

To complete the scope, Associated Engineering has broken down this assignment into the following six primary objectives:

1. Provide the City with updated design criteria for system assessment.
2. Provide the City with updated and calibrated WaterCAD model.
3. Identify existing system deficiencies and constraints.
4. Identify opportunities for repairs and system improvements.
5. Provide a growth plan to aid the City in planning for future development and population increase.
6. Prepare a comprehensive 10 year Capital Plan to help guide City infrastructure spending.

## **1.4 References**

The following information has been reviewed in preparation of this report:

1. City of St. Albert 2013 Utility Master Plan Update, Stantec Consulting Ltd.
2. City of St. Albert Utility Master Plan, Stantec Consulting Ltd., 2008
3. City of St. Albert Draft Municipal Development Plan, April 2020
4. City of St. Albert Municipal Development Plan Background Report, June 2019
5. Draft Municipal Engineering Standards
6. GIS data (including land use)
7. Water Records (2016-2019)
8. LIDAR Contour Data
9. Area Structure Plans
10. SCADA Data
11. Aggregate Water Meter Data
12. 2020 WaterCAD Model
13. Record Drawings
14. Pump Curves
15. Pump Station Operating Philosophy
16. PRV Data Table
17. Static Hydrant Tests (2017-2019)

We wish to take the opportunity to acknowledge the City of St. Albert staff, who provided assistance and collaboration on the project.

## **1.5 Background Reports**

### **1.5.1 City of St. Albert 2013 Utility Master Plan Update, Stantec Consulting Ltd., June 2014**

This report found that the water distribution system was providing an acceptable level of service, based on the modelled flow and pressure results. A per capita water consumption value of 350 L/c/d was utilized in the report, with Maximum Day and Peak Hour factors of 2 and 4 applied, respectively. The report identified two types of improvements: Required Deficiency Upgrades (RDUs) and Recommended System Improvements (RSIs), which were assessed and prioritized. Future servicing recommendations included: two new reservoirs with dedicated fill lines, a

transmission main from a proposed Southwestern Reservoir to service the north (and crossing the Sturgeon River) as well as watermain upgrades.

### 1.5.2 Flourish Growing to 100K City of St. Albert Municipal Development Plan Report (Draft), April 2020

This report was reviewed with respect to population growth, new development, re-development, and water servicing. The associated Draft Report figures were of primary relevance and provided direction on the City's future planning goals including future land use to the current City boundary and priority areas for growth.

### 1.5.3 Flourish Growing to 100K City of St. Albert Municipal Development Plan Background Report, June 2019

This plan provides an informative overview of both historical growth as well as the current conditions in St. Albert. This document was reviewed with respect to population growth, new development, re-development, and water servicing. The report references the Edmonton Metropolitan Region Growth Plan population projections of a low of 90,000 people and a high of 118,000 in 2044. It identifies a major future employment district to the West of the City, as the Lakeview Business District. The report references future water growth upgrades as presented in the 2013 UMP. The report was reviewed in conjunction with the Draft MDP Report.

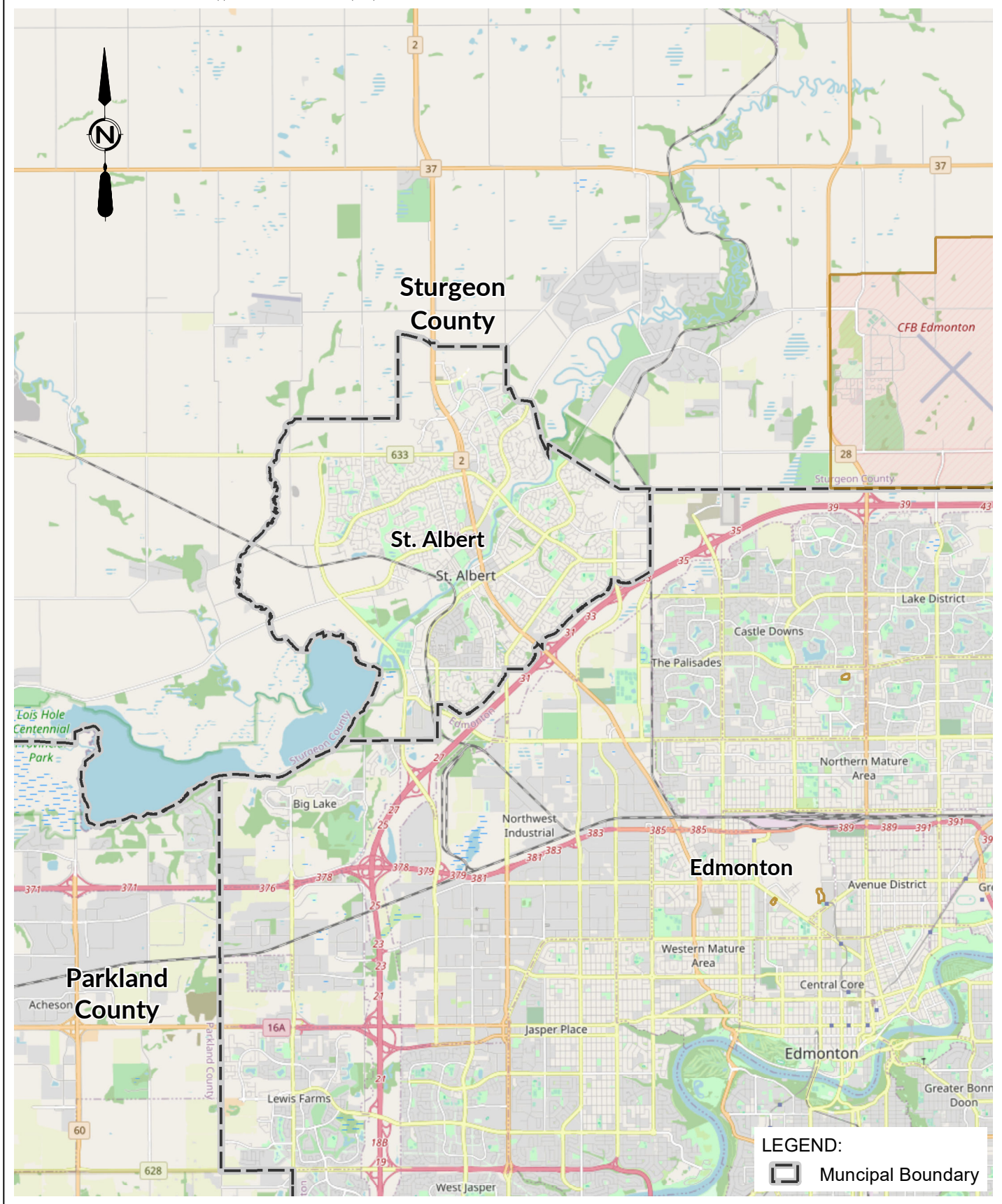
## 1.6 Abbreviations

Abbreviation	Phrase
AC	Asbestos Cement
CI	Cast Iron
fps	feet per second
ft <sup>3</sup> /s	cubic feet per second
ft <sup>3</sup>	cubic feet
ig	imperial gallons
igpcd	imperial gallons per capita day
igpm	imperial gallons per minute
km	Kilometre
L/s	Litres per second
L	Litre
L/c/d	Litres per capita day
m	Metre
m/s	metres per second
m <sup>3</sup> /s	cubic metres per second
m <sup>3</sup>	cubic metres
mig	million imperial gallons
mm	Millimetre
PRV	Pressure Reducing Valve
PVC	Polyvinyl Chloride
AEAL	Associated Engineering Alberta Ltd.
USGPM	United States Gallons per Minute

## 1.7 Metric Conversions

To Convert From	To	Multiple By
cubic metres (m <sup>3</sup> )	cubic feet (ft <sup>3</sup> )	35.31
cubic metres (m <sup>3</sup> )	imp gal (ig)	219.97
cubic metres/hour (m <sup>3</sup> /hr)	igpm	3.667
kilopascals (kPa)	psi	0.145
kilowatts (kw)	horsepower (hp)	1.341
litres/sec (L/s)	igpm	13.2
megalitres (ML)	imp gal (ig)	219974
metres (m)	ft	3.281
millimetres (mm)	inches	0.0394

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<b>SCALE</b>	1:120,000
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<b>DATE</b>	2021 JULY
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**FIGURE 1-1**

CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

LOCATION PLAN



## 2 DESIGN CRITERIA

### 2.1 General

#### 2.1.1 Population

One of the main variables in assessing a community's municipal servicing requirements is the population. The population provides a measure of the quantity of water required and has an impact on the distribution and collection systems based on population density.

**Table 2-1** presents the historical population for the City, from 2008 onward, obtained from municipal census data. Based on the data, the average annual growth rate was 1.30% from 2008 through 2018.

**Table 2-1**  
**Historical Population Statistics**

Year	Population	Average Annual Growth
2008	58,501	
2010	60,138	1.40%
2012	60,994	0.71%
2014	63,255	1.85%
2016	64,645	1.10%
2018	66,082	1.11%

Note: The information presented in **Table 2-1** was obtained from the 2018 St. Albert Census Report.

The Edmonton Metropolitan Region Growth Board (EMRB) published “Re-imagine. Plan. Build. Edmonton Metropolitan Region Growth Plan” in 2017. In this document, the EMRB projects that the City of St. Albert will have a population ranging from 90,100 to 118,000 by the year 2044. This results in an average annual growth rate ranging from 1.2% per year to 2.3% per year.

Based on the Draft Municipal Development Plan “Flourish: Growing to 100k” (April 20, 2020), the City envisions a future population of 100,000. To reach this future population by 2044, the average annual growth rate would need to increase to 1.6%. This growth rate exceeds recent historical data and has not been adopted for use in this report. It is instead proposed that a growth rate of 1.3% be applied, resulting in a population of 92,455 in 2044 (which is within the anticipated population range identified by the EMRB). A population of 100,000 is anticipated to be reached in 2050, based on a growth rate of 1.3%.

An annual growth rate of 1.3% has been adopted for this study.

#### 2.1.2 Population Density

Population densities are used to estimate the population, or equivalent population, for different land use areas. These values are used in conjunction with the per capita daily consumption rate to estimate the demands on the water system.



Water meter data was assessed for various land uses to establish current and proposed densities in St. Albert, as presented in **Table 2-2**. Water data was provided by the City and includes all Metered Consumer Water in 2018. It should be noted that there is a discrepancy of 9.9% when compared to all reservoir metered data which was provided separately.

Total area per land use has been estimated based on the GIS land use mapping provided by the City. This has been compared to recent aerial photography so that only land which is currently developed has been included. Assumptions have been made to best associate meter data to applicable land uses.

**Table 2-2**  
**2018 Metered Consumer Water Use Breakdown by Land Use**

	Land Use				
	Low Density Residential	Multi-Family Residential	Commercial /Industrial	Institutional	Other
Total Volume (m <sup>3</sup> )	3,325,584	851,194	620,241	232,065	129,208
Percent Volume (%)	64%	17%	12%	4%	3%
Area (ha)	1815.3	152.6	425.5	166.3	N/A
Average (m <sup>3</sup> /ha/day)	5.0	15.3	4.0	3.8	N/A
Average (L/ha/day)	5,019	15,279	3,993	3,822	N/A
Combined Residential Water Use (L/c/d)	173.2 <sup>1</sup>		N/A	N/A	N/A
Density (p/ha)	29.0	88.2	N/A	N/A	N/A
Equivalent Density (ep/ha)	N/A	N/A	23.1	22.1	N/A
Scaled Density <sup>2</sup>	32	97	25	24	

Note: 1 The calculated combined residential per capita consumption value equals 173.2 L/s. The total per capita water usage including non-residential water equals a combined 214 L/c/d. This is lower than the 2018 calculated per capita water consumption value of 237 L/s due to a discrepancy between Metered Consumer Water and Metered Pump Station Water of approximately 10%

2 Density has been increased by 10% to consider the water use discrepancy

Low Density Residential is assumed to include single family detached homes as well as duplexes. Multi Family Residential includes both medium and high density residential development. Commercial and Industrial land uses have been combined as there is a combined classification in the land use map, making it difficult to differentiate. Institutional land uses include schools, religious buildings, hospitals, and nursing homes. By-law exempt, City-owned, grant-in-lieu, lawn service, and other municipal land uses are all included in the "Other" category. These have not been assessed as the areas of such properties are not known and are not explicitly identified on the land use plan. It is not anticipated that this will have a significant effect on the assessment.



The table presents a combined per capita residential water usage of 173.2 L/c/d. The total water consumed equates to 214 L/c/d (included non-residential uses). This value is approximately 10% lower than the actual 2018 value of 237 L/c/d, in line with the overall water use discrepancy.

The table identifies calculated densities of 29.0 p/ha and 88.2 p/ha for the Low Density Residential and Multi Family Residential areas, respectively. Equivalent densities of 23.1 p/ha and 22.1 p/ha have been calculated for the Commercial/Industrial and Institutional areas respectively. All values have been scaled up by 10% to account for the water use discrepancy, as shown in the table.

The table also identifies the average water utilized per land use per day. As shown in the table, Commercial/Industrial and Institutional areas used somewhat less water than Low Density Residential areas (on a per hectare basis). It may be of interest that the Commercial/Industrial water usage of approximately 4,000 L/ha/day is significantly lower than the value identified in the Municipal Engineering Standards of 25,000 L/ha/day. On average, water usage in these areas is significantly lower than currently designed for.

Based on the information above, **Table 2-3** presents the population densities adopted for this study. These values are somewhat higher than actual and will be conservative for modelling and master planning purposes. These values also reflect our planning experience in other communities in Alberta.

A value of 60 p/ha future residential development has been adopted for this study. Although higher than many other communities in the area, the demand for future high density development may be greater in St. Albert due to its proximity to the City of Edmonton. This value will be applied to blended future residential development areas.

**Table 2-3**  
**Recommended Population Densities**

Land Use Type	Existing Developed Areas	Future Developed Areas
Single Family Residential	40 people/ha	60 people/ha <sup>4</sup>
Low Density Residential	40 people/ha	
Medium Density Residential	80 people/ha <sup>1</sup>	
High Density Residential	200 people/ha <sup>2</sup>	
Commercial/Institutional	37 ep/ha <sup>3</sup>	37 ep/ha
Industrial	30 ep/ha	30 ep/ha
Mixed Use (Intensification)		200 people/ha <sup>5</sup>

Notes:

<sup>1</sup> Medium Density Residential population density estimated to be 2 times Low Density Residential population density.

<sup>2</sup> High Density Residential population density estimated to be 5 times Low Density Residential population density.

<sup>3</sup> ep/ha = equivalent population per hectare.

<sup>4</sup> A blended population density is proposed for residential growth areas, including Mixed Use (other than Mixed Use Intensification).

<sup>5</sup> Mixed Use (Intensification) lands are located along St. Albert Trail and reflect the highest future population densities. As per the MDP, densities in these areas are anticipated to be between 100 du/ha (dwelling units/hectare) up to and exceeding 200 du/ha (assumed net). The applied population density of 200 p/ha considers a blend of medium and high density land use and will be applied based on the associated total lot area.

### 2.1.3 Land Use

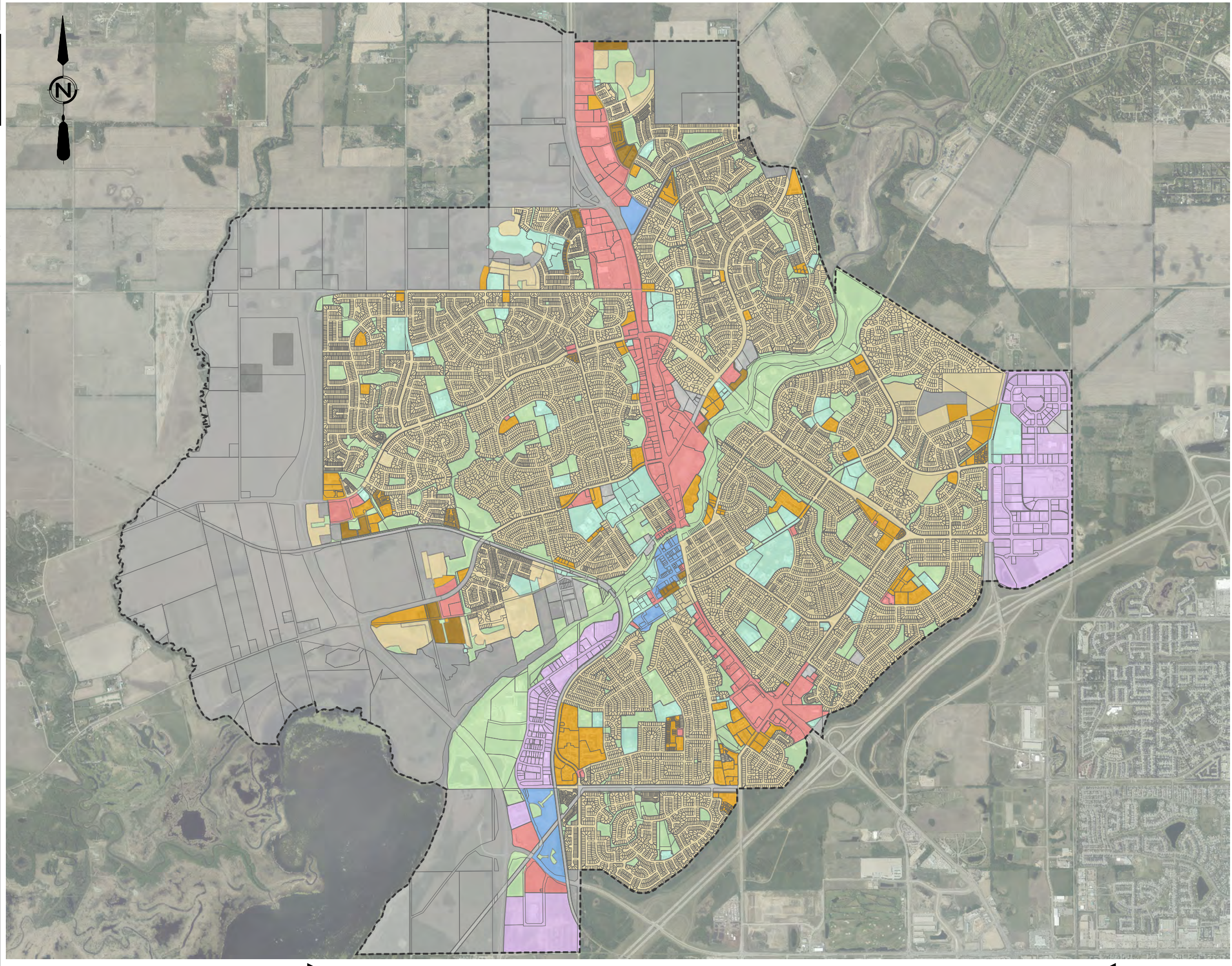
The February 18, 2020 land use district map provided by the City will be applied to establish contributing populations and resulting system demands/flows for existing developed areas. Land use district maps from the following planning documents will be used for future developed areas where applicable:

- Erin Ridge North ASP
- Range Road 260 ASP
- South Riel ASP
- Riverside ASP
- Jensen Lakes ASP
- Downtown Area Redevelopment Plan (DARP)
- Ville Giroux

ASP's for Erin Ridge, Inglewood, and North Ridge were also provided; however, these are believed to be fully built out.

Figure 2-1 presents a generalized land use plan.





**LEGEND:**

City of St. Albert Boundary

**Land Use**

- Single Family Residential
- Medium Density Residential
- High Density Residential
- Mixed Use
- Commercial
- Commercial/Industrial
- Institutional
- Park
- Direct Control
- Urban Reserve
- Special Development Control



**FIGURE 2-1**

**CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE**

**EXISTING WATER SYSTEM  
GENERALIZED LAND USE PLAN**

<b>AE PROJECT No.</b>	2020-3838-00
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2.1.4 Future Staged Growth Areas

Figure 2-2 presents the proposed future staged growth areas which were developed through review of the Municipal Development Plan and Area Structure Plans, and in consultation with the City.

Table 2-4 presents the population associated with each future development stage at full build out. Population projections are generally based on a blended density of 60 p/gross ha for residential and mixed development areas. A density of 100 p/gross ha has been applied to the South Riel area to reflect a higher population. A net population density of 200 p/ha has been applied to lots identified within the future intensification lands. All densities are based on the gross development area identified in Figure 2-2, unless otherwise noted.

Table 2-4  
Staged Population Growth

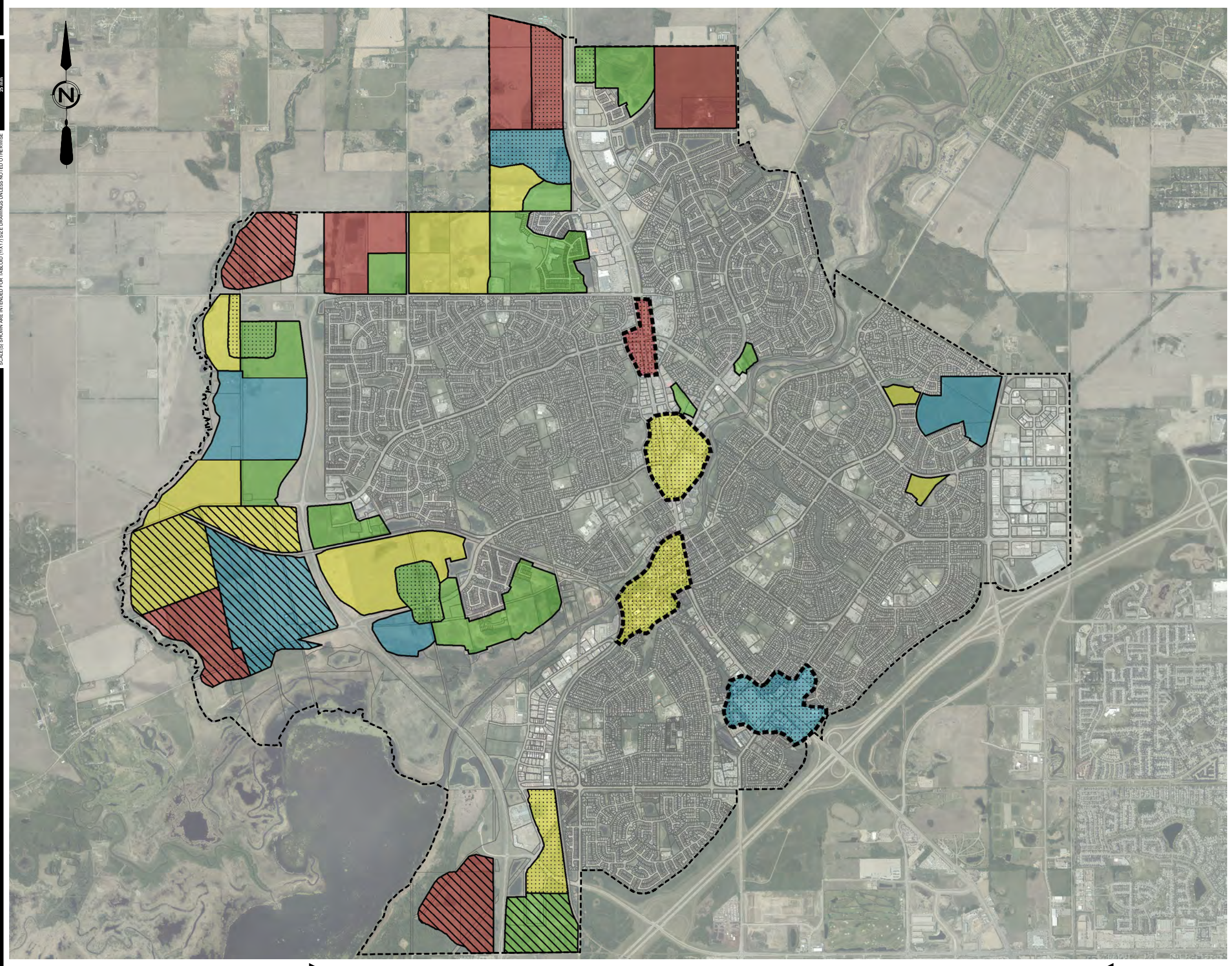
Stage	Population	Target Year (Based on 1.3% growth)
1	85,397	2036
2	110,939	2058
3	127,489	2069
Ultimate	141,091	2077

The design populations identified in Table 2-4 were assessed against those identified in the associated ASP's. With revisions to assumptions in the South Riel area, the values above were found to be 33% higher on average than those reported in the ASP's. This overage will provide a degree of conservatism in the design of the future water distribution system.



SAVE DATE: 4/12/2021 5:04:08 PM SAVED BY:  
DRAWING PATH: \\ae.ca\data\working\esfm\2020-3838-00\gis\model\wmp\_2-2\_Growth\_Areas.mxd  
DATA SOURCE: :

IF NOT 25 mm AS SHOWN ADJUST SCALES  
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE












- LEGEND:
-  City of St. Albert Boundary
  - Future Land Use**
    -  Residential
    -  Employment Lands
    -  Mixed Use
  - Intensification Land Use**
    -  Mixed Use
  - Development Stage**
    -  Stage 1
    -  Stage 2
    -  Stage 3
    -  Ultimate



FIGURE 2-2  
CITY OF ST. ALBERT

EXISTING WATER SYSTEM  
PROJECTED STAGED GROWTH AREAS

AE PROJECT No.	2021-0000
SCALE	1:36,000
APPROVED	
DATE	2021 JULY
REV	
DESCRIPTION	ISSUED FOR REPORT



## 2.2 Demand Design Criteria

Water demand is critical in determining the distribution network, pumping capability, and storage required for a water system. Three critical rates of demand are normally used: average day, maximum day, and peak hour demand. Fire flows, in conjunction with the maximum day flows are also used to test the water system's capability to deliver water and meet system demands.

The following sections briefly describe each of the critical flow conditions.

### 2.2.1 Average Day Demand

The average day demand (ADD) is determined by dividing the total annual consumption by 365 days. By dividing this rate by the population served, the per capita per day demand is derived. This rate is used primarily as a basis for the projection of the total water demand.

### 2.2.2 Maximum Day Demand

The maximum day demand (MDD) is determined by the single day of maximum consumption observed in the distribution system over one year. In using the single day of maximum flow, one must ensure that the record is not distorted by fire fighting demand, equipment malfunction, or watermain breaks. The peaking factor is determined by comparing the maximum day demand to the average day demand. The maximum day demand is used to determine the delivery capacity required of supply mains, treatment facilities, storage facilities, and pumping facilities. In conjunction with the fire flow, it is used to test the water system's capacity to supply the fire and maximum day demand.

### 2.2.3 Peak Hour Demand

The peak hour demand (PHD) is the expected maximum demand observed during a short period of the day. The peak hour rate is used in determining pumping requirements.

### 2.2.4 Historical Water Usage

The City of St. Albert has provided reservoir discharge data for 2016 – 2019. A summary is provided in [Table 2-5](#).

**Table 2-5**  
**Historical Water Usage**

	2016	2017	2018	2019
Population	64,645	65,359	66,082	66,941
Total Water Usage (m <sup>3</sup> /year)	5,803,736	5,664,093	5,725,070	5,472,877
Average Day (m <sup>3</sup> /day)	15,901	15,518	15,685	14,994
Average Day Per Capita (L/c/d)	246	237	237	224
Maximum Day (m <sup>3</sup> /day)	32,198	28,094	25,799	25,664
Peaking Factor	1.6	1.4	1.7	1.5

Note:

1. The 2017 population has been interpolated and the 2019 population has been projected based on the growth rate identified in Section 2.1.

As shown in the table above, per capita water consumption appears to be falling in recent years. This may be due in part to increased rainfall, resulting in less water being used to water lawns, etc. as well as education and water conservation efforts.

The maximum day factor was assessed based on actual recorded maximum day values, including flow out of the Lacombe Park Reservoir, and excluding flow supplied to the Reservoir. The average maximum day factor was 1.55 for the four year period.

### 2.2.5 Design Demands

Based on the recent water usage data, the following water demands have been applied in the model:

- Average Day Demand 250 L/c/d
- Maximum Day Demand 450 L/c/d (Peaking Factor of 1.8)
- Peak Hour Demand 750 L/c/d (Peaking Factor of 3.0)

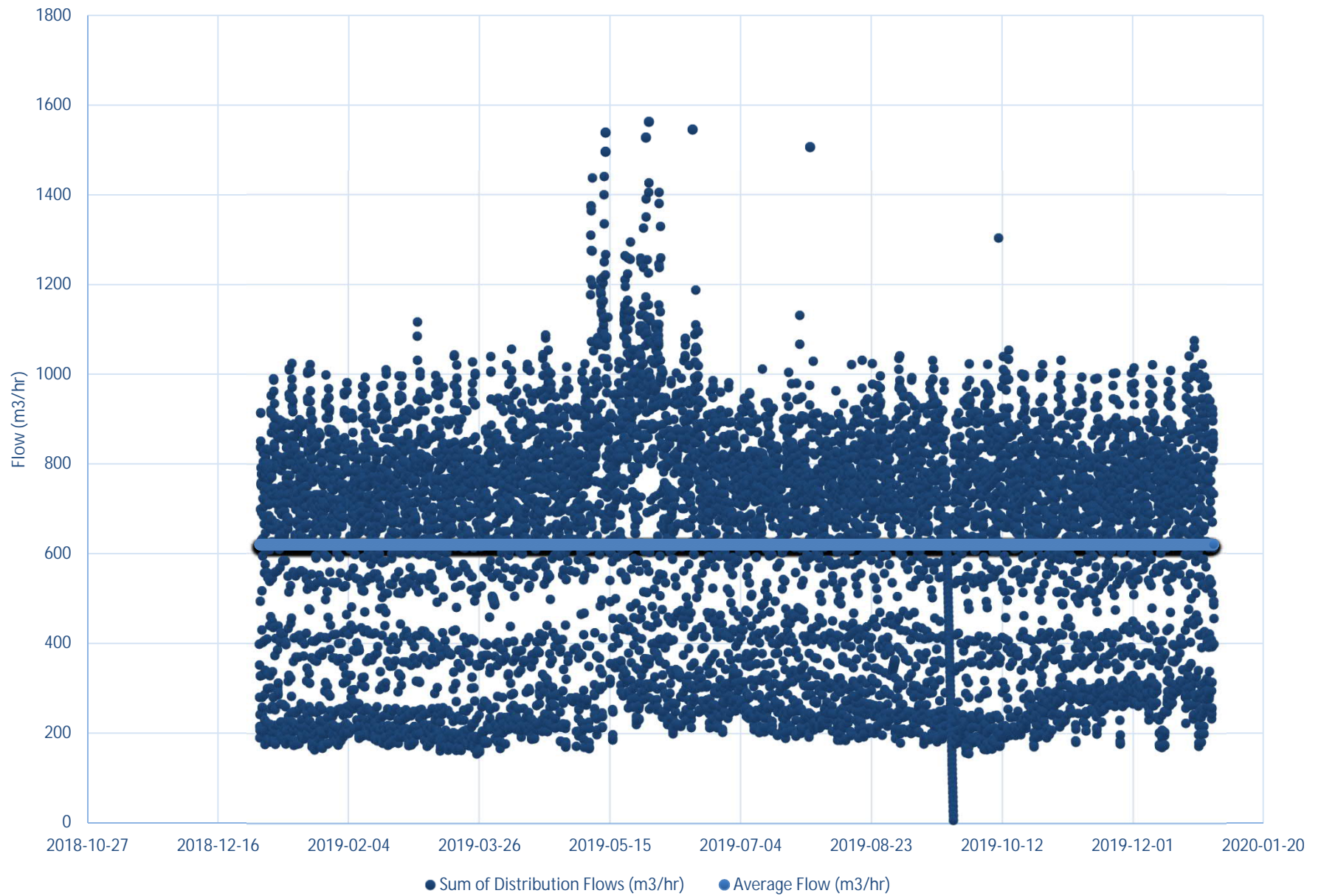
An average per capita water consumption of 250 L/c/d is recommended. This is approximately 6% higher than the 4 year average water consumption of 236 L/c/d. Although only marginally conservative, a design value of 250 L/c/d recognizes that water consumption is falling in the City.

A maximum day factor of 1.8 is recommended to allow for higher peak years, potentially due to dryer conditions. A factor of 1.8 will exceed individual peaking factors over recent years.

Existing facilities do not generally measure peak hour flows, and a peak hour factor of 3 times the average day demand is typically recommended. Fortunately, St. Albert does record appropriate information with which to assess peak hour flows. As such, SCADA data for 2019 was reviewed and is presented in [Figure 2-3](#). As shown on the figure, the average flowrate is in the order of 620 m<sup>3</sup>/hour (172 L/s) and the highest hourly flowrate is approximately 1,563 m<sup>3</sup>/hour (434 L/s), or 2.5 times higher.

Based on the above, a peak hour factor of 3 times the average day demand is appropriate and will be somewhat conservative.

Figure 2-3: 2019 Peak Hour Flow (m<sup>3</sup>/hr)





The design water demands for the next 25 years are outlined in [Table 2-6](#) below.

**Table 2-6**  
**Proposed Water Demands**

	2020	2025	2030	2035	2040	2045
Population	67,811	72,335	77,161	82,308	87,799	93,657
Average Day Per Capita (L/c/d)	250	250	250	250	250	250
Max Day Factor	1.8	1.8	1.8	1.8	1.8	1.8
Peak Hour Factor	3.0	3.0	3.0	3.0	3.0	3.0
Average Day Demand (L/s)	196.2	209.3	223.3	238.2	254.0	271.0
Average Day Demand (m <sup>3</sup> /day)	16,953	18,084	19,290	20,577	21,950	23,414
Max Day Demand (L/s)	353.2	376.7	401.9	428.7	457.3	487.8
Max Day Demand (m <sup>3</sup> /day)	30,515	32,551	34,722	37,039	39,510	42,146
Peak Hour Demand (L/s)	588.6	627.9	669.8	714.5	762.1	813.0

### 2.2.6 Future Staged Design Demand

The design demands for the future staged development is presented below in [Table 2-7](#).

**Table 2-7**  
**Future Design Demands (Staged Development)**

	Existing	Stage 1	Stage 2	Stage 3	Ultimate
Population	67,811	85,397	110,939	127,489	141,091
Average Day Demand (L/s)	196.2	247.1	321.0	368.9	408.2
Maximum Day Demand (L/s)	353.2	444.8	577.8	664.0	734.8
Peak Hour Demand (L/s)	588.6	741.3	963.0	1106.7	1224.7

Design demands for future development stages were established based on the target population and a water consumption value of 250 L/c/d. Peaking factors of 1.8 and 3.0 were applied to the Maximum Day and Peak Hour demand scenarios, respectively.

No additional demand was calculated based directly on the future Employment Lands. The design water consumption value of 250 L/c/d is a blended value based on existing land uses within the City, including commercial and industrial developments. Due to the increase in population density in future planned developments, the overall percentage of water consumed by the employment lands is anticipated to decrease in the ultimate system. Therefore, the future water demand has been based solely on the projected population. The demand was distributed throughout the future stages by applying the design densities outlined in [Table 2-7](#) and factored to meet the target demand in each Stage.

## 2.2.7 Fire Flows

Fire flows identified in [Table 2-8](#) have been adopted for this study.

**Table 2-8**  
**Recommended Fire Flows**

Land Use	Type of Development	Required Fire Flow
Residential	Single Family	100 L/s
	Multi-Family (row housing)	180 L/s
	High Density (walk-up and high rise apartments)	300 L/s
Commercial		300 L/s
Industrial		300 L/s
Institutional		300 L/s

It may not always be practical to meet the above fire flow targets and it is recommended that the City review on a case by case basis. The recommended fire flow targets may not be achievable in some existing areas of the City or in interim development areas. If fire flow target shortfalls can be improved through reasonable watermain upsizing, then it is likely warranted. Should minimal shortfalls require expensive pumping facilities or significant upgrades to the distribution system, then the City may want to review these situations more closely.

In general, the higher value of 300 L/s will be applied to future residential developments. This will accommodate the potential for high density neighbourhood development and will also provide for additional fire flow flexibility in these locations.

## 2.3 Hydraulic Design Criteria

### 2.3.1 Operating Pressures

The City of St. Albert Design Standards currently indicate the following operating system pressures:

- Normal operating pressure: 350 kPa – 700 kPa (50 psi to 100 psi).
- Minimum operating pressure during Peak Hour: 280 kPa (40 psi).
- Minimum operating pressure during MDD + Fire Flow: 140 kPa (20 psi).

It is recommended that the City of St. Albert consider a target maximum pressure of 550 kPa (80 psi) at services. This is in keeping with Alberta Environment and Parks (AEP) Design Guidelines, which recommends a pressure range of 350 kPa to 550 kPa (50-80 psi) for maximum user comfort. It is noted that this is a target maximum pressure and may not be practical in all areas.

The recommended target operating pressures are presented in [Table 2-9](#). It is acknowledged that it will not be possible to meet a target maximum pressure of 550 kPa (80 psi) in many existing locations within the City. The target is primarily intended to guide planning in new development areas.

**Table 2-9**  
**Recommended Operating Pressures**

Description	Pressure
Absolute minimum pressure at peak demand	280 kPa (40 psi)
Target minimum pressure	350 kPa (50 psi)
Target maximum pressure	550 kPa (80 psi)
Minimum pressure during MDD plus Fire Flow	140 kPa (20 psi)

### 2.3.2 Pipe Roughness Coefficient ("C" Value)

The current City of St. Albert Design Standards indicate the following for the Hazen Williams C Value:

- 100 for pipes equal to and smaller than 200 mm in diameter, and
- 120 for those pipes larger than 200 mm in diameter.

For modelling purposes, C-Values are more often associated by material types rather than pipe diameter. Pipe age can also be a consideration for some material types.

**Table 2-10** summarizes the pipe roughness coefficients recommended for this model update. The current City GIS data was found to be lacking reliable material data. As such, the City provided updated pipe material information such that existing material types could be included in the WaterCAD model for the purpose of applying material based C-Values.

**Table 2-10**  
**Recommended Pipe Roughness Coefficients**

Pipe Material	"C" Value
<b>Existing Watermains</b>	
PVC/HDPE	130
Asbestos Cement	120
Cast Iron	100
Ductile Iron	120
Steel	120
<b>Proposed Watermains</b>	
PVC	130

### 2.3.3 Minimum Pipe Size

The City of St. Albert Design Standards currently indicate minimum pipe sizes of 150 mm diameter for residential development and 300 mm for commercial development. It is recommended that the minimum pipe size in single family residential development be increased to 200 mm. This is appropriate for the existing fire flows in these areas and is in line with many other municipalities in the area.

Minimum pipe diameter should be selected based on the desired fire flow and level of service for each land use type. A minimum pipe diameter of 300 mm is appropriate for Commercial/Industrial and large institutional facilities which have associated large fire flows.

**Table 2-11** presents the recommended minimum pipe sizes to be considered in growth and redevelopment/rehabilitation areas.

**Table 2-11**  
**Recommended Minimum Pipe Sizes**

Land Use	Minimum Pipe Size
Single family residential (including semi-detached housing)	200 mm
Medium density residential (row housing)	250 mm
High density residential (walk-up apartment buildings)	300 mm
Commercial/industrial/institutional	300 mm

Proposed pipe sizes should be confirmed based on the results of a hydraulic network analysis when possible.

### 2.3.4 Velocity

It is recommended that the maximum velocity not exceed 1.5 m/s during normal system operation, increasing to a maximum of 3.0 m/s during fire flow scenarios.

## 2.4 Storage Design Criteria

It is good practice to provide adequate storage in a water system for operational needs (peak hour), supply interruption, and fire flow demand. There are two methods, described below, which are generally used to calculate water storage requirements. Alberta Environment and Parks (AEP) guidelines require:

### 2.4.1 Method 1

- Equalization Storage (peak hour demand): 25% of maximum day flow; and
- Fire Storage; and
- The greater of:
  - Emergency Storage (in the event of supply interruption): 15% of average day flow; or
  - Disinfection Contact Time ( $T_{10}$ ) storage.

Water storage requirements for systems with long supply lines, or where storage is located at long distances from the water source (i.e., regional pipelines) are at higher risk of supply interruption. In these cases, the recommended storage is calculated based on Method 2; however, specific situations could warrant even higher storage recommendations.

### 2.4.2 Method 2

- 2 Average Days; and
- Fire Storage

As the City of St. Albert is serviced via EPCOR, it is recommended that the second method of calculating storage requirements be applied.

## 3 EXISTING WATER DISTRIBUTION SYSTEM

### 3.1 Existing Facilities






The existing water system within the City of St. Albert consists of:

- Treated Water Supply from the City of Edmonton;
- Sturgeon Heights Reservoir and Pump Station;
- Oakmont Reservoir and Pump Station;
- Lacombe Park Reservoir and Pump Station;
- Grandin Booster Station
- Henday (South Riel) Booster Station
- Lacombe Park Fill Line;
- Pressure Reducing Valve (PRV) Stations;
- Normally Closed Valves; and
- Water Distribution System.

Figure 3-1 presents the locations of the key facilities.





-  Existing Reservoir & Pumphouse
-  Existing Booster Station
-  Supply Main
-  Lacombe Park Fill Line
-  City of St. Albert Boundary

## EXISTING WATER SYSTEM KEY FACILITY LOCATIONS

AE PROJECT No.	2020-3838-00
SCALE	1:32,500
APPROVED	
DATE	2021AUG05
REV	
DESCRIPTION	ISSUED FOR REPORT



## 3.2 Treated Water Supply

EPCOR supplies water from the City of Edmonton to the City of St. Albert through transmission mains feeding the Sturgeon Heights and Oakmont Reservoirs. The capacity of the supply system to the City of St. Albert is not within the current scope of work and has therefore not been assessed.

Fill rates are determined based on a peaking factor set by EPCOR. AE is working with the City of St. Albert to automate this calculation.

## 3.3 Reservoirs and Pump Stations

### 3.3.1 Sturgeon Heights Reservoir and Pump Station

The Sturgeon Heights Reservoir and Pump Station is located within south/central St. Albert and supplies the primary pressure zone (in conjunction with Oakmont and Lacombe Park Stations). It is understood that the pump station may be replaced in the next couple of years. The pump station contains 6 distribution pumps and one standby pump. Two of the distribution pumps are understood to be equipped with VFD's; however, are currently operating as constant speed pumps. **Table 3-1** summarizes the existing pumping capacity.

**Table 3-1**  
**Sturgeon Heights Pump Capacity**

Pump Designation	Pump Type	Pumping Capacity
P1	Dist. Pump (Electric) VFD Capable	132.5 L/s (2,100 USGPM) 42.7 m head
P2	Dist. Pump (Electric) VFD Capable	132.5 L/s (2,100 USGPM) 42.7 m head
P3	Dist. Pump (Electric) Constant Speed	151 L/s (2,393 USGPM) 42.7 m head
P4	Dist. Pump (Electric) Constant Speed	151 L/s (2,393 USGPM) 42.7 m head
P5	Dist. Pump (Electric) Constant Speed	107 L/s (1,696 USGPM) 42.7 m head
P6	Dist. Pump (Electric) Constant Speed	284 L/s (4,501 USGPM) 42.7 m head
P7	Standby Pump (Diesel) Constant Speed	453.6 L/s (7,000 USGPM) 42.7 m head

As indicated in the 2013 UMP, potable storage at Sturgeon Heights is comprised of 5 reservoirs with an active storage capacity of 16,700 m<sup>3</sup>, out of the total constructed storage capacity of 22,800 m<sup>3</sup>. The 2013 UMP references the City of St. Albert Sturgeon Heights Reservoir and Pump Station Study, UMA Engineering, 2007, indicating that there is some inactive storage capacity based on the reservoir piping design.

It is understood that the City is planning on constructing a new Sturgeon Heights Reservoir and Pump Station adjacent to the existing facility.

#### 3.3.1.1 Operating Philosophy – Sturgeon Heights

The pumps are understood to start based on minimum pressure setpoints and to shutdown based on minimum flow setpoints, as per the City of St. Albert 2004 Water and Wastewater Facilities Operations Manual. Normal pumping operating setpoints are presented in **Table 3-2** below.

**Table 3-2**  
**Sturgeon Heights Pumping Setpoints**

Pumping Setpoints	Value	Unit
Pumping High Pressure Setpoint	456.00	kPa
Pumping Low Pressure Setpoint	406.05	kPa
Pumping Start P1, P5 Flow Setpoint	115.05	L/s
Pumping Start P4, P5 Flow Setpoint	208.95	L/s
Pumping Start P1, P3, P4 Flow Setpoint	280.05	L/s
Pumping Start P1, P2, P6 Flow Setpoint	460.05	L/s
Pumping Stop P1, P3, P4 Flow Setpoint	390.00	L/s
Pumping Stop P4, P5 Flow Setpoint	250.05	L/s
Pumping Stop P1, P5 Flow Setpoint	160.05	L/s
Pumping Stop P5 Flow Setpoint	100.05	L/s
Pumping All Off Flow Setpoint	4.95	L/s

It is understood that the low pressure setpoint will turn on P5.

### 3.3.2 Oakmont Reservoir and Pump Station

The Oakmont Reservoir and Pump Station is located in the north portion of the City of St. Albert, near the city boundary. The pump station supports the primary pressure zone (Pressure Zone 105), Pressure Zone 102 (south Oakmont), as well as directly supplies the Lacombe Park Reservoir. The station contains 4 distribution pumps with 3 pumps operating on VFDs. There is an emergency backup generator which will operate the pump station should power be lost to the site.

**Table 3-3** summarizes the existing pumping capacity.

**Table 3-3**  
**Oakmont Pump Capacity**

Pump Designation	Pump Type	Pumping Capacity
P1	Dist. Pump (Electric) VFD	70 L/s (1,109 USGPM) 89.6 m head
P2	Dist. Pump (Electric) VFD	70 L/s (1,109 USGPM) 89.6 m head
P3	Dist. Pump (Electric) VFD (Standby)	70 L/s (1,109 USGPM) 89.6 m head
P4	Dist. Pump (Electric) Constant Speed	70 L/s (1,109 USGPM) 89.6 m head



Potable water storage at Oakmont is comprised of 2 reservoirs with a combined storage capacity of 10,000 m<sup>3</sup>. The City of St. Albert 2004 Water and Wastewater Facilities Operations Manual indicates that the reservoir was sized to provide emergency, peak hour, and fire storage to the year 2020. It does not appear that there is available land to expand the reservoir capacity at this site.

### 3.3.2.1 Operating Philosophy – Oakmont

The pumps are understood to start based on minimum pressure setpoints and to shutdown based on minimum flow setpoints, as per the City of St. Albert 2004 Water and Wastewater Facilities Operations Manual. Normal pumping operating setpoints are presented in **Table 3-4** below.

**Table 3-4**  
**Oakmont Pumping Setpoints**

Pumping Setpoints	Value	Unit
Pumping High Pressure Setpoint*	747.7	kPa
Pumping Low Pressure Setpoint	690.1	kPa
Pump Pressure Setpoint	757.9	kPa
Pump Stop CSP Flow Setpoint	120.00	L/s
Pump Stop Lag Flow Setpoint	50.00	L/s
Pump Stop Lead Flow Setpoint	138.00	L/s

\*Note: The Pumping High Pressure Setpoint is not identified in the January 2020 Submittal by the Vector Group.

### 3.3.3 Lacombe Park Reservoir and Pump Station

The Lacombe Park Reservoir and Pump Station is located within west/central St. Albert and is directly fed from the Oakmont Pump Station by a dedicated 500 mm transmission main. The pump station supplies the primary pressure zone (in conjunction with Oakmont and Sturgeon Heights Stations) and contains 4 distribution pumps with 2 pumps operating on VFDs. There is an emergency backup generator which will operate the pump station should power be lost to the site.

**Table 3-5** summarizes the existing pumping capacity. According to the 2013 UMP, the pump station has space to accommodate two additional pumps.

**Table 3-5**  
**Lacombe Park Pump Capacity**

Pump Designation	Pump Type	Pumping Capacity
P1	Dist. Pump (Electric) VFD	110 L/s (1,744 USGPM) 55 m head
P2	Dist. Pump (Electric) VFD	110 L/s (1,744 USGPM) 55 m head
P3	Dist. Pump (Electric) Constant Speed	110 L/s (1,744 USGPM) 55 m head
P4	Dist. Pump (Electric) Constant Speed	110 L/s (1,744 USGPM) 55 m head

Potable water storage at Lacombe is comprised of 2 reservoirs with a combined storage capacity of 23,000 m<sup>3</sup>. It does not appear that there is available land to expand the reservoir capacity at this site.

### 3.3.3.1 Operating Philosophy – Lacombe Park

The pumps are understood to start based on minimum pressure setpoints and to shutdown based on minimum flow setpoints, as per the City of St. Albert 2004 Water and Wastewater Facilities Operations Manual. Normal pumping operating setpoints are presented in **Table 3-6** below.

**Table 3-6**  
**Lacombe Park Pumping Setpoints**

Pumping Setpoints	Value	Unit
Pumping Pressure Setpoint*	420	kPa
Pumping Low Pressure Setpoint	375	kPa
Pumping Stop to P101, P102 Setpoint	210	L/s
Pumping Stop to Lead VFD Setpoint	100.1	L/s
Peak Pumping Lead VFD Stop Setpoint	37.9	L/s
Peak Pumping Lead VFD Speed Setpoint	82	%
Discharge Pressure High Setpoint	520	kPa
Discharge Pressure Low Setpoint	350	kPa

\*Note: the setpoint was adjusted from 405 kPa to 420 kPa on July 10, 2010.

### 3.3.4 Grandin Booster Station

The Grandin Booster Station is typically operated during the summer months to increase pressure during peak demand periods. The booster station is equipped with two distribution pumps and does not accommodate fire flow. Fire flow is provided through loop main connections from outside of the Grandin Pressure Zone.

**Table 3-7** summarizes the existing pumping capacity.

**Table 3-7**  
**Grandin Booster Station Pump Capacity**

Pump Designation	Pump Type	Pumping Capacity
P1	Dist. Pump (Electric) Constant Speed	12.6 L/s (200 USGPM) 12.2 m head
P2	Dist. Pump (Electric) Constant Speed	22.1 L/s (350 USGPM) 12.2 m head

Mainline valves are closed at Grange Drive/Gervais Road and Gervais Road/Levasseur Road. Check valves at these locations contains water to within the zone and allows water from outside the zone to enter due to low flow conditions (i.e. fire flow). There is an additional check valve on the waterline at Grange Drive/Gervais Road, which operates the same way year round.

### 3.3.4.1 Operating Philosophy – Grandin Booster Station

Detailed information regarding the operating pressure and pump curve are not available for the Grandin Pump Station.

### 3.3.5 Henday Booster Station

The Henday Booster Station (also known as the South Riel Booster Station) was constructed in 2016 in the Henday Industrial Park in Riel South Stage 4. There are three pumps within the station, all operating on VFDs. The booster station is primarily intended on meeting significant fire flows in the surrounding industrial area. The Operating and Maintenance Manual for the station indicates that the jockey pump is intended to maintain operating pressures during fire flow conditions in the upstream industrial areas (north of the booster station), while the fire pumps are intended to meet fire flows in the southern portion of the industrial development (south of the booster station).

**Table 3-8** summarizes the existing pumping capacity.

**Table 3-8**  
**Henday Booster Station Pump Capacity**

Pump Designation	Pump Type	Pumping Capacity
P1	Jockey Pump (Electric) VFD	50 L/s (793 USGPM) 6.1 m head
P2	Fire Pump (Electric) VFD	323 L/s (5,120 USGPM) 21.4 m head
P3	Fire Pump (Electric) VFD (Standby)	323 L/s (5,120 USGPM) 21.4 m head

A check valve is located west of the pump station which allows water to service the southerly distribution system during typical demand scenarios. This valve will close due to increased downstream pressure should the booster pumps operate.

#### 3.3.5.1 Operating Philosophy – Henday Booster Station

The pumps are set to operate based on minimum pressure setpoints. The operating pump will shut down when a maximum suction pressure is met. The jockey pump will turn off after pressure exceeds 285 kPa for 10 minutes, or if the fire pump has started. Normal pumping operating setpoints are presented in **Table 3-9** below.

**Table 3-9**  
**Henday Pumping Setpoints**

Pumping Setpoints	Value	Unit
Jockey Pump Start Pressure Setpoint	260	kPa
Jockey Pumping Pressure Setpoint	285	kPa
Fire Pumping Pressure Setpoint	350	kPa
Fire Pump Start Pressure Setpoint	180	kPa

As per the above table, the jockey pump VFD will operate to maintain a pressure of 285 kPa (41 psi) and the fire pump will operate to maintain a pressure of 350 kPa (51 psi).

### 3.4 Lacombe Park Fill Line

Water is supplied from the Oakmont Reservoir and Pump Station to the Lacombe Park Reservoir and Pump Station through a dedicated 500 mm diameter PVC transmission main. The supply main is serviced off the primary pressure zone (Zone 105) at the Oakmont Pump Station.

### 3.5 Pressure Reducing Valve Stations

The City of St. Albert currently operates 30 pressure reducing valve (PRV) stations, which reduce distribution system pressure in areas which would otherwise experience over-pressure. Newer PRV stations are equipped with two pressure reducing valves in each chamber. Typically, the small valve will operate during normal operating conditions while the second valve will open during high flow conditions. It is common for the large valve to be set to open at 35 – 69 kPa (5-10 psi) below the small valve.

The PRV Stations establish numerous pressure zones within the City (refer to [Figure 3-2](#)). The HGL for each zone is identified in [Table 3-10](#) below. The table presents the HGL's which have been established for the existing system, based on review of 2019 recorded data. Further discussion is provided in Section 3.8 Model Validation/Calibration.

**Table 3-10**  
**Existing Pressure Zones**

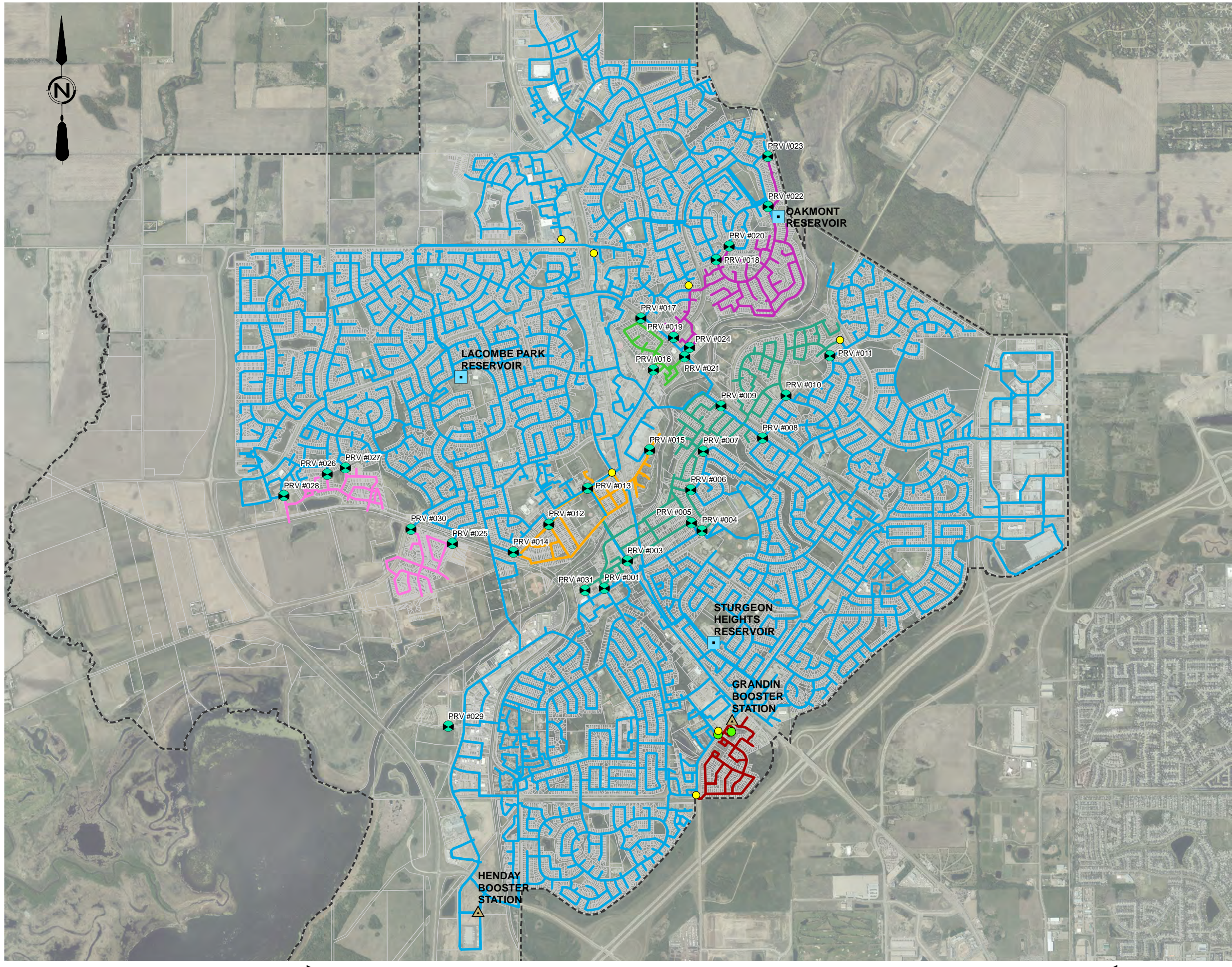
Zone	2019 Modelled HGL (m)
100	715.5
101	740
102	724.2
103	710.7
104	710.8
105	740
106 East	714.3
106 West	712.5

Zone 101 represents the Grandin Booster Station Zone, which is typically only operated during the summer months. For the purpose of this assessment, the Booster Station is assumed not to be operating. Zones 103 and 104 are connected by a 200 mm diameter waterline and are therefore not technically separate pressure zones. Zone 106 includes 5 PRV's in the Riverside and Ville Giroux neighbourhoods. These developments will be connected in the future via looped watermains and will form one pressure zone. An HGL of 740 m is shown for Zone 101 and 105, which is the approximate average high value leaving the pump stations. A broad range in discharge pressures occurs at the pump stations and therefore the HGL fluctuates regularly within these two zones.

### 3.6 Normally Closed Valves

There are 7 known locations of normally closed valves within the distribution system, as identified on [Figure 3-2](#). These valves operate to maintain a pressure break between different pressure zones. According to the 2013 UMP, there is also a check valve which operates to separate pressures zones.





**LEGEND:**

- City of St. Albert Boundary
- Reservoir & Pumphouse
- Booster Station
- PRV
- Check Valve
- Closed Valve

**Pressure Zone**

- Zone 100
- Zone 101
- Zone 102
- Zone 103
- Zone 104
- Zone 105
- Zone 106



**FIGURE 3-2**

**CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE**

**EXISTING WATER SYSTEM  
PRESSURE ZONE BOUNDARIES**

AE PROJECT No.	2020-3838-00
SCALE	1:32,500
APPROVED	
DATE	2021AUG05
REV	
DESCRIPTION	ISSUED FOR REPORT



### 3.7 Distribution System

The existing distribution system is comprised of asbestos cement pipe, steel pipe, HDPE pipe and PVC pipe (refer to **Figure 3-3**). Material types identified in the figure will require future confirmation, as the GIS system does not track material type within older areas of the City.

Pipe sizes range from 100 mm in diameter to 750 mm in diameter (leaving the Sturgeon Heights Pump Station). **Figure 3-4** indicates the pipe sizes of the existing water distribution system.

### 3.8 Existing Model Updates

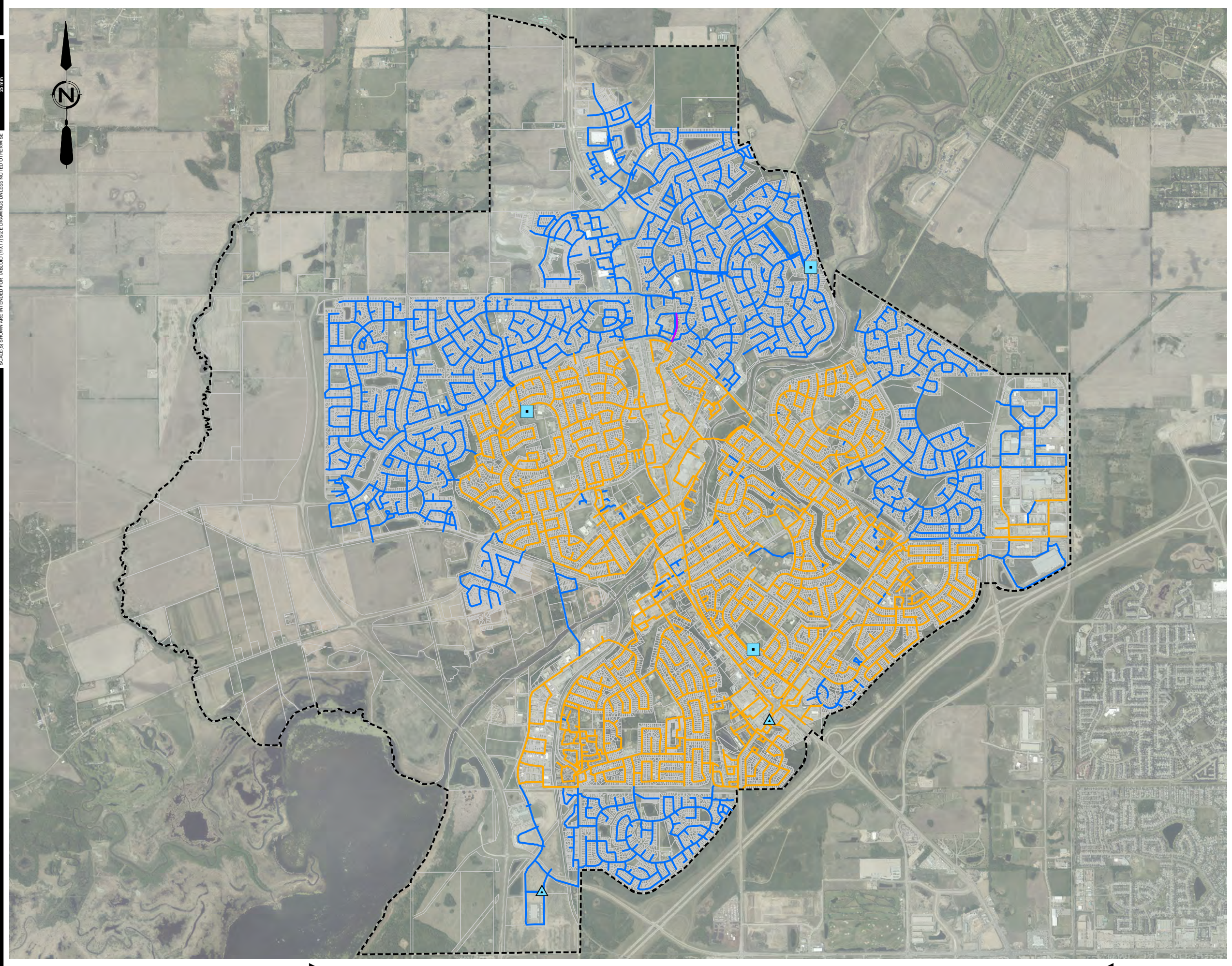
The existing model was updated to reflect the current distribution system. The following tasks were undertaken:

- The model was compared against existing GIS data.
- Input upgrades to piped distribution system.
- Input expansion to piped distribution system.
- Input Lidar ground elevations in new development areas.
- Update water demands to reflect current water use and land use.
- Update fire flow requirements to reflect current land use.
- Update the pumps and pump station setpoints.
- Update existing PRV setpoints.
- Validated model using SCADA data and existing static hydrant data.



SAVE DATE: 1/11/2021 9:53:12 PM SAVED BY:  
DRAWING PATH: \\ae.ca\data\working\esfm\2020-3838-00\gis\modelwmp\_3-3\_Existing\_Pipe\_Material.mxd  
DATA SOURCE: :

IF NOT 25 mm AS SHOWN ADJUST SCALES  
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE









- LEGEND:
-  City of St. Albert Boundary
  -  Reservoir & Pumphouse
  -  Booster Station
- Pipe Material
-  AC
  -  HDPE
  -  PVC

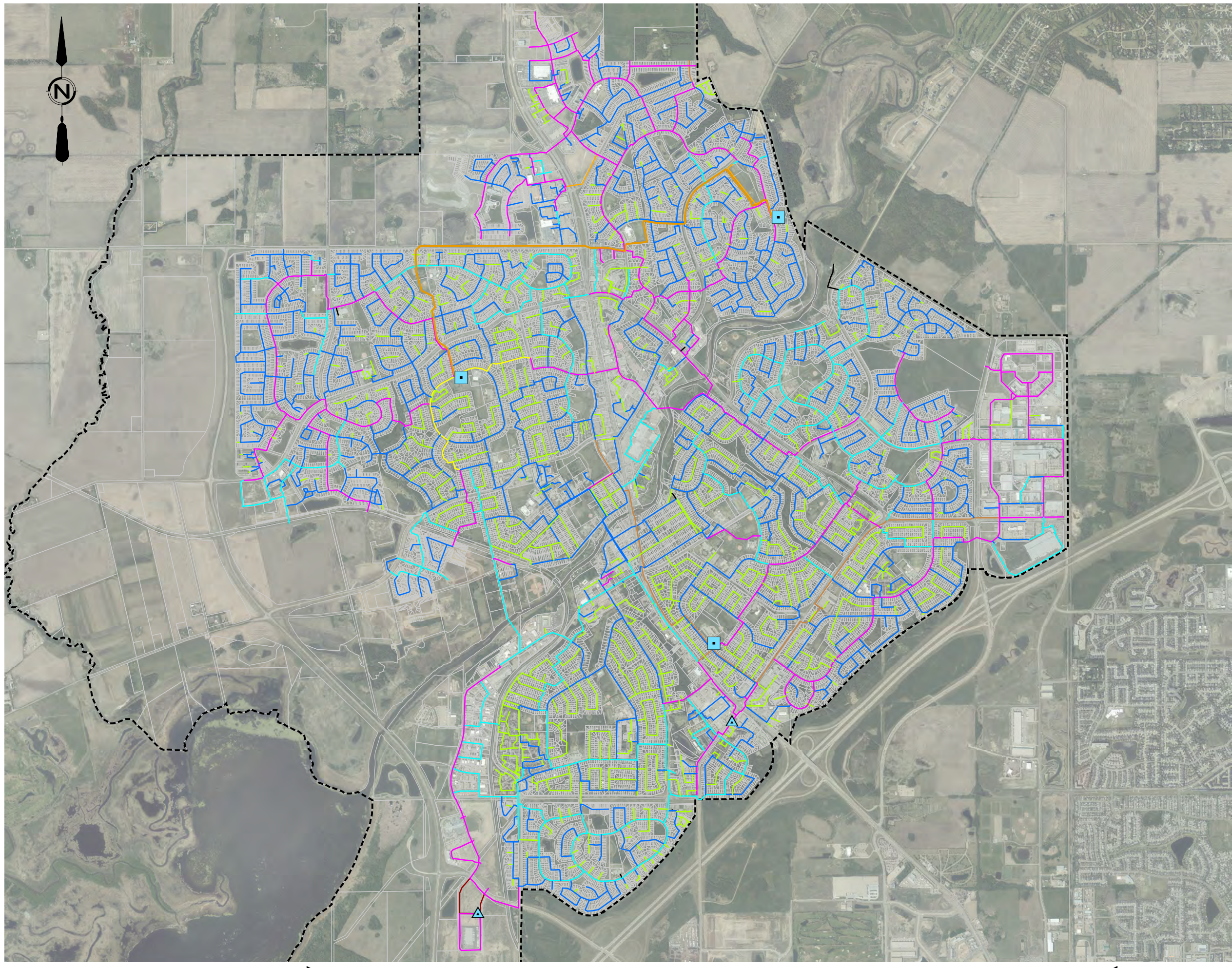


FIGURE 3-3	
CITY OF ST. ALBERT WATER DISTRIBUTION SYSTEM MASTER PLAN UPDATE	
EXISTING WATER SYSTEM PIPE MATERIAL	
AE PROJECT No.	2020-3838-00
SCALE	1:32,500
APPROVED	
DATE	2021JULY
REV	
DESCRIPTION	ISSUED FOR REPORT



SAVE DATE: 1/11/2021 9:52:21 PM SAVED BY:  
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DATA SOURCE: :

IF NOT 25 mm AS SHOWN ADJUST SCALES  
SCALE(S) SHOWN ARE INTENDED FOR TABL/CID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



**LEGEND:**

- City of St. Albert Boundary
- Existing Reservoir & Pumphouse
- Existing Booster Station

**Pipe Size**

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 350 mmø
- Existing 400 mmø
- Existing 450 mmø
- Existing 500 mmø
- Existing 600 mmø
- Lacombe Park Fill Line



**FIGURE 3-4**

**CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE**

**EXISTING WATER SYSTEM  
PIPE SIZE**

<b>AE PROJECT No.</b>	2020-3838-00
<b>SCALE</b>	1:32,500
<b>APPROVED</b>	
<b>DATE</b>	2021 JULY
<b>REV</b>	
<b>DESCRIPTION</b>	ISSUED FOR REPORT



### 3.9 Model Validation/Calibration

Multiple sources of data have been reviewed to validate/calibrate the existing WaterCAD model and to establish existing conditions. These include:

- PRV Reading/Setpoint Data;
- Static Hydrant Pressure Data;
- Pump Station SCADA Data;
- Henday Booster Station Test Data; and
- Historical Pumped Flow Data.

#### 3.9.1 PRV Reading/Setpoint Data

An assessment of the existing pressure zones has been undertaken. This includes establishing current pressure zone HGL's, identifying revisions to existing pressure zones where required, and reviewing areas of over-pressure which are currently outside the influence of existing PRV stations.

The City maintains a spreadsheet of existing PRV data, which includes pressure readings from 2019. Also included in the spreadsheet are PRV elevations, upstream pressure readings and adjacent hydrant pressure readings, etc. Following review of the table, a recommendation was made to survey all PRV stations as some record data was missing or conflicting. As such, the City authorized a survey of all PRV stations which occurred in mid October, 2020.

Upstream and downstream gauges as well as the top of pipe were surveyed at all PRV Stations. PRV 15 was unable to be surveyed as nothing was visible from the surface; however, all other stations were surveyed. Survey information has been incorporated with relevant data from the City PRV spreadsheet and is attached as [Table 3-11](#).

City of St. Albert - Water Distribution System Master Plan Update  
Table 3-11 - PRV Update Table

PRV #	Address	Pressure Zone	2020 Survey Guage 1 (m)	2020 Survey Guage 2 (m)	2020 Survey Top of Pipe (m)	Prior PRV Gauge Reading <sup>3</sup> (psi)	Prior PRV Gauge Reading <sup>2</sup> (m)	2019 PRV Gauge Reading (psi)	2019 PRV Gauge Reading <sup>2</sup> (m)	Modelled Setpoint <sup>2,4</sup> (m)	Proposed Setpoint <sup>2</sup> (m)	Proposed Setpoint (psi)
21	90 Boudreau Rd.	100	<b>655.21</b>	655.47	655.17	85.2	715.2	86	715.8	715.5	713	82.1
17	34 Ironwood	100	<b>673.95</b>	673.92	673.83	58.6	715.2	59	715.5	715.5	713	55.5
16	79 Bellerose - High	100	<b>662.62</b>			75.1	715.5	56	702.1	715.5	713	71.5
	79 Bellerose - Low									N/A	709.5	66.6
19	9 Evergreen Cl.	102	<b>659.42</b>	659.20	659.82	91.2	723.6	91	723.5	724.2	716.4	80.9
24	Old Holes Site - High	102	<b>659.87</b>		659.80	86.8	721.0	92	724.7	724.2	716.4	80.3
	Old Holes Site - Low									N/A	712.9	75.3
18	1 Odessa Place	102	<b>677.13</b>			66.9	724.2	66	723.6	724.2	716.4	55.8
20	1 Oakdale	102	<b>675.93</b>		675.70	68.7	724.3	70	725.2	724.2	716.4	57.5
22	48 Oak Vista Drive	102	<b>669.45</b>		669.60	77.4	724.0	82	727.2	724.2	716.4	66.7
23	28 Oakcrest Terrace	102	<b>669.24</b>		669.13	78.2	724.3	78	724.2	724.2	716.4	67.0
15	375 St.Albert Rd.	103	Not surveyed, could not see from surface <sup>1</sup>			89.7		90		710.7	711	TBD
13	1 Madonna Dr.	103	<b>668.55</b>	668.43	668.40	60	710.8	60	710.8	710.7	711	60.3
12	13 St. Vital Ave.	103	<b>668.90</b>	668.90	668.97	60.3	711.4	58	709.7	710.7	711	59.8
14	71 Mission Ave.	103	<b>660.96</b>	660.94	661.09	70.5	710.6	72	711.7	710.7	711	71.1
9	42 Butterfield	104			<b>653.82</b>	80	710.2	80	710.2	710.8	711	81.2
8	49 Bradburn	104	<b>666.82</b>		666.85	62.6	710.9	63	711.2	710.8	711	62.7
7	60 Burnham Ave.	104	<b>664.34</b>	664.29	664.43	66	710.8	66	710.8	710.8	711	66.3
6	18 Burnham Ave.	104	<b>668.09</b>	668.10	668.19	60.9	711.0	60	710.3	710.8	711	60.9
4	6 Bernard Dr	104	<b>679.80</b>	679.73	679.85	44.1	710.9	50	715.0	710.8	711	44.3
5	29 Bishop St.	104	<b>674.52</b>	674.42	674.33	51.9	711.1	64	719.6	710.8	711	51.8
3	5 Perron St.	104	<b>654.36</b>	654.25	654.17			95	721.3	710.8	711	80.4
1	27 Sir Winston Ave	104	<b>656.30</b>	656.26	656.35	78.1	711.3	80	712.6	710.8	711	77.7
2(31) <sup>5</sup>	7 Tache	104	<b>651.61</b>		651.86	84.7	711.3	90	715.0	710.8	711	84.3
10	60 Woodlands Rd.	104	<b>659.17</b>	659.14	659.15	72.4	710.2	72	709.9	710.8	711	73.6
11	2 Waverly Dr.	104	<b>658.35</b>	658.30	658.47	74.3	710.7	70	707.6	710.8	711	74.8
25	50 Royal St - High	106	<b>657.85</b>		657.69			78	712.8	714.3	710	74.1
	50 Royal St - Low	106									706.5	69.1
30	Riverside 8 - High	106	<b>659.44</b>	659.39	659.51			80	715.8	714.3	710	71.8
	Riverside 8 - Low	-						-			706.5	66.8
26	31 Leveque Way - High	106	<b>668.19</b>		668.03	60	710.4	82	725.9	712.5	710	59.4
	31 Leveque Way - Low	106									706.5	54.4
27	8 Lachance Drive - High	106	<b>670.31</b>		670.13	57.2	710.6	60	712.6	712.5	710	56.4
	8 Lachance Drive - Low	106									706.5	51.4
28	Villemagne Road - High	106	<b>666.51</b>		666.34			64	711.6	712.5	710	61.7
	Villemagne Road - Low	106									706.5	56.8
29	Rodeo Drive	Riel	<b>654.44</b>	654.42	654.65	-	-	-	-	-	703.7	70.0

Notes: 1. Rim for PRV 15 is 654.99 m  
2. Elevations shown in bold were used to establish setpoint in metres  
3. Prior PRV Gauge readings are suspect due to level of precision  
4. Existing setpoints within zones vary, as such the Modelled Setpoint has been averaged or assumed  
5. Identified as PRV 2 in the table provided and PRV 31 in the GIS

As shown in the table, a Prior PRV Gauge Reading has been included; however, the date of the reading is unknown. A gauge reading in 2019 has also been included. Both readings have been converted to HGL using the Gauge 1 survey data (where available). From this historical data, an approximate HGL has been established for each zone. This is approximate at best, as the gauge readings varied significantly within some zones.

### 3.9.2 Static Hydrant Pressure Data

The City provided static hydrant pressure readings for 2017 through 2019, to aid in validating the model. A review of the data quickly revealed that the recorded pressures varied significantly for individual hydrants. Some variability would be expected, as Zone 105 outgoing pump station pressures ranged from 733 m HGL to 741 m HGL on average, depending on the time of day and location. This is reflective of the pump station operation as described earlier in the report. Figures displaying the hydrant pressure data are included in [Appendix A](#).

Surprisingly, pressures in other zones (downstream of PRV stations) also showed great variability. This is unexpected, as well looped systems with multiple PRV stations would be expected to have relatively consistent pressure. This may substantiate the PRV readings in Table 3-11, which were shown to vary between the two recorded periods. This is puzzling and supports re-setting of the PRV's as well as calibration of all PRV gauges.

In the downstream zones, there was significant variability between yearly readings, with over 10 m (14 psi) difference in pressure at some locations. The most consistent location was in the Riverside area.

Due to the variability in the readings, it is unclear whether the hydrant data provides good data to compare against the model. The readings in the upper zone were found to be variable, which is not unexpected; however, so were the readings downstream of PRV stations (which was unexpected). The readings collected downstream of the PRV's could vary due to potential adjustments at PRV stations, poorly calibrated pressure gauges, or human error in reading or documenting the pressures.

### 3.9.3 SCADA Data Review

A review of 2019 SCADA data was undertaken for the three pump stations. The findings are outlined in the sections below. All figures related to the SCADA review are included in [Appendix B](#).

#### 3.9.3.1 Sturgeon Heights SCADA Review

SCADA data was reviewed for 2019 for the Sturgeon Heights Pump Station. Outgoing pressure for the entire year was assessed, in addition to the high volume and low volume months (May and November, respectively). [Figure B-1](#) presents the Average Hourly Discharge Pressure and also shows the results for the Oakmont and Lacombe Park Pump Stations. As shown in the figure, the average yearly outgoing pressure was in the order of 444.8 kPa (64.6 psi). When added to the gauge elevation on the header, this results in an average HGL in the order of 738.3 m. The highest pressure was typically 456 kPa, (66.2 psi, 739.4 m HGL), which coincides with the pumping high pressure (stop) pressure.

[Figure B-2](#) presents the pressure and flow data for the Sturgeon Heights Pump Station for May 2019. As shown in the figure, the outgoing pressure regularly exceeds the high pressure pump stop level during this period. The flow varies significantly, with the highest flows coinciding with the highest pressure. As the pumps are constant speed and are not controlled by a VFD, pressure can raise as high as the pressure relief valve setpoint within the station

**Figure B-3** presents the pressure and flow data for the Sturgeon Heights Pump Station for November 2019. As shown in this figure, the pressure generally stays within the pumping high pressure (stop) setpoint and the low pressure (start) setpoint. Interestingly, the flow leaving the station regularly drops to 0 L/s, indicating that flow is being provided to the area by the Oakmont or Lacombe Park pump stations during this period.

The current PRV setpoint is unknown and will be assumed at the typical high value of 739.4 m HGL (for modelling purposes). From the May data, the highest pressure was actually in the order of 746 m HGL; however, this did not appear to occur regularly. This would represent a very broad operating range and would further increase already high pressures in some locations.

### 3.9.3.2 Oakmont SCADA Review

SCADA data was reviewed for 2019 for the Oakmont Pump Station. Outgoing pressure for the entire year was assessed, in addition to the high volume and low volume months (July and February, respectively). **Figure B-1** presents the Average Hourly Discharge Pressure and also shows the results for the Sturgeon Heights and Lacombe Park Pump Stations. As shown in the figure, the average yearly outgoing pressure was in the order of 741.0 kPa (107.5 psi). When added to the gauge elevation on the header, this results in an average HGL in the order of 740.1 m. The highest pressure was typically around 757.7 kPa, (110 psi, 741.8 m HGL), which coincides with the pump pressure setpoint and is understood to be the VFD operating target.

**Figure B-4** presents the pressure and flow data for the Oakmont Pump Station for February 2019. As shown in the figure, the outgoing pressure regularly falls below the target pressure (VFD setpoint) and does not exceed it. The flow to the distribution system (combined high and low pressure zones) varies significantly over the month and falls to 0 L/s at times. The flow to the Lacombe Park Pump Station operates at approximately 64 L/s when filling.

**Figure B-5** presents the pressure and flow data for the Oakmont Pump Station for July 2019. Once again, the outgoing pressure regularly falls below the target pressure (VFD setpoint) and does not exceed it. As shown in the February results, the flow to the distribution system (combined high and low pressure zones) varies significantly over the month and falls to 0 L/s at times. The flow to the Lacombe Park Pump Station operates at a high fill rate of approximately 64 L/s and a low fill rate of approximately 50 L/s. There are only 4 periods within the month in which the reservoir is not filling.

### 3.9.3.3 Lacombe Park SCADA Review

SCADA data was reviewed for 2019 for the Lacombe Park Pump Station. Outgoing pressure for the entire year was assessed, in addition to the high volume and low volume months (November and February, respectively).

**Figure B-1** presents the Average Hourly Discharge Pressure and also shows the results for the Sturgeon Heights and Oakmont Pump Stations. As shown in the figure, the average yearly outgoing pressure was in the order of 467.4 kPa (67.8 psi). When added to the gauge elevation on the header, this results in an average HGL in the order of 738.3 m. The highest pressure was typically between 480 kPa and 490 kPa, (69.7 – 71.1 psi, 739.5 - 740.6 m HGL). This is well beyond the pumping pressure setpoint; however, is more in line with the operating pressure at both Sturgeon Heights and Oakmont.

The VFD target setpoint was adjusted in July to maintain 420 kPa (61 psi, 733.3 m HGL), rather than 405 kPa as indicated in the Operations Manual. A review of the data indicates that the VFD's generally sit at their minimum speed, which keeps the discharge pressure above the target setpoint and more in line with the Sturgeon Heights and

Oakmont Pump Stations. In light of the this and recognizing that the pumping pressure setpoint of 420 kPa is significantly lower than the operating pressures at Sturgeon Heights and Oakmont, a review of the target pressure setpoint of Lacombe may be warranted.

**Figure B-6** presents the pressure and flow data for the Lacombe Park Pump Station for February 2019. As shown in the figure, the outgoing pressure falls between 490 kPa and 405 kPa. The flow to the distribution system varies over the month; however, remains above zero flow. A flow of 64 L/s is delivered at the Lacombe Park Pump Station when filling.

**Figure B-7** presents the pressure and flow data for the Lacombe Park Pump Station for November 2019. Once again, the outgoing pressure regularly falls below the target pressure (VFD setpoint) and does not exceed it. As shown in the figure, the outgoing pressure falls between 488 kPa and 420 kPa. The flow to the distribution system varies over the month; however, remains well above zero flow. The filling rate to the Lacombe Park Reservoir varies between 64 and 70 L/s and is filling most of the time in this period.

#### 3.9.3.4 SCADA Review Summary

A review of the SCADA data has shown that discharge pressure to the distribution system can vary significantly at each reservoir. This is a direct result of the system demands, which can vary greatly based on the season and time of day and require different pumps to operate. The calculated average discharge HGL for each pump station is identified below in **Table 3-12**, Typical minimum and maximum HGL's are also identified; however, these values occasionally fall outside of those presented.

**Table 3-12**  
Existing Pump Station HGL Ranges

Pump Station	HGL (m)		
	Minimum	Average	Maximum
Sturgeon Heights	733.2	738.3	739.4
Oakmont	734.9	740.1	741.8
Lacombe Park	733.4	738.3	740.6

Although the target VFD setpoint is understood to be 741.8 m HGL at Oakmont and 733.3 m HGL at Lacombe Park, the average values presented above clearly show that the pumps spend much of their time well off of their setpoints.

For the purpose of the existing system model, the average HGL's will be applied where possible. As such, the VFD's at the Oakmont and Lacombe Park Pump Stations will be adjusted to 740.1 m and 738.3 m respectively. As there are no VFD's operating at the Sturgeon Heights Pump Station, the PRV will be set to limit the pressure to the maximum HGL of 739.4. The Oakmont PRV will be set at 741.8 m HGL and the Lacombe Park PRV will be set at 740.6 m HGL. These setpoints are for modelling purposes only.

#### 3.9.4 Henday Booster Station Test Data

Testing of the Henday Booster Station occurred on July 23, 2020. An aerial truck and engine truck were used to draw flow downstream of the booster station. From the data provided, it appears that flow was drawn through the booster station, but that the pressure did not fall sufficiently to cause the booster pumps to turn on.

The target fire flow of 300 L/s was not achieved during the test period. This may be attributed to the number of hydrants tested (2) and may have required that additional hydrants be operated to meet the target flows.

Pressure was recorded at 4 upstream hydrants throughout the test period. During the high flow test (maximum of 217 L/s) the modelled pressures were found to be lower than the recorded field pressures. This may reflect differences in water demands, which pumps were operating at the time, and the resulting outgoing pressure from each pump station; however, suggests that the model may be conservative during high flow periods.

The model results indicate that the full fire flow of 300 L/s can be provided to the area while maintaining a residual pressure of approximately 331 kPa (48 psi) at the booster station and 262 kPa (38 psi) at the flowing hydrant (assumed at the extreme south location within the Henday Industrial Park). As the booster fire pumps start at a low pressure of 180 kPa (26 psi), the booster station is unlikely to operate at this time.

### 3.9.5 Historical Pumped Flow Data

**Table 3-13** presents Historical Pumped Flow Data for 2017 and 2018 from each pump station. As shown in the table, the Sturgeon Heights Pump Station supplied approximately half of the total water consumed in 2017/2018, based on the current system operation. The Oakmont Pump Station also pumped approximately 50% of the total flow; however, approximately half of this was supplied to the distribution system (25-30% of the total), with the other half supplied directly to the Lacombe Park Reservoir. In turn, the Lacombe Park Pump Station supplied nearly a quarter of all water consumed in the distribution system.

**Table 3-13**  
**Historical Pumped Flow Data 2017/2018**

	% of Total Average Day Flow	Average Day (L/s)	Max Day (L/s)	Peaking Factor
<b>2017</b>				
Sturgeon Heights	50%	90.5	199.6	2.2
Lacombe Park	25%	44.3	90.2	2.0
Oakmont (distribution)	25%	44.8	77.4	1.7
Oakmont (Lacombe fill)	25%	44.3	79.3	1.8
Oakmont (total)	50%	89.1	132.4	1.5
<b>2018</b>				
Sturgeon Heights	48%	87.3	175.4	2.0
Lacombe Park	22%	40.3	46.7	1.2
Oakmont (distribution)	30%	53.9	78.9	1.5
Oakmont (Lacombe fill)	22%	40.3	65.5	1.6
Oakmont (total)	52%	94.2	128.6	1.4

The highest daily pumped flow from each pump station is also identified on the table (note that the peak days do not necessarily align and did not occur at the same time). The associated peaking factors are also presented. As shown on the table, the Sturgeon Heights Pump Station accounted for the highest maximum day flow and overall peaking factors, in addition to the highest proportion of average day flow. This indicates that the pump station contributes an even higher proportion of flow, as the total demand rises in the system.

### 3.10 Existing System Assessment

Following model updating, the existing distribution system was analyzed to determine the average day pressures, peak hour pressures and maximum day plus fire flow capabilities. Many locations experience pressures within the recommended targets; however, a number of locations exceeded the recommended maximum pressure. The following describes each scenario in detail.

#### 3.10.1 Average Day Scenario

The Average Day Demand scenario was run to assess typical distribution system pressures. **Table 3-14** presents the minimum and maximum pressures, assuming filling of the Lacombe Park Pump Station. The following pumps were assumed to be operating:

- Sturgeon Heights: Pump 5
- Oakmont: Pumps 1 and 4
- Lacombe Park: Pump 1

The resulting pressure leaving the Sturgeon Heights Pump Station is 738.2 m HGL under these conditions, quite close to the average pressure determined for the existing system.

**Table 3-14**  
**Average Day Pressure Results**

Zone	Minimum Pressure kPa (psi)	Maximum Pressure kPa (psi)
100	370 (53.7)	537 (78.0)
101	382 (55.4)	506 (73.5)
102	421 (61.1)	683 (99.2)
103	339 (49.2)	552 (80.1)
104	278 (40.3)	559 (81.2)
105	413 (59.9)	849 (123.2)
106	386 (56.0)	562 (81.6)

As shown in the above table, pressures within most zones generally fell within the recommended target pressure range of 350 to 550 kPa (50 to 80 psi). The exceptions are Zone 102, which remained within the City's current Design Standards maximum, and Zone 105, which greatly exceeded recommended pressures. Although a future maximum target pressure of 550 kPa (80 psi) has been adopted, it is recognized that this will not be attainable in many locations within the existing distribution system.



The velocity in the existing distribution system remains well below the normal operating target of 1.5 m/s in the average day demand scenario.

The City has requested that the Grandin Booster Station service area be reviewed to ascertain whether the booster station is still required and providing benefit. During the Average Day scenario, the model results indicate a minimum pressure of 379 kPa (55 psi) in the Grandin Area (Zone 101). This is based on an outgoing HGL of approximately 738 m at the Sturgeon Heights Pump Station. Should the pressure leaving the pump station fall to a lower HGL of around 733 m, the resulting minimum pressure in the Grandin Area would be in the order of 331 kPa (48 psi). Although slightly lower than the normal target operating pressure, there are few properties affected and this pressure is not anticipated to be sustained. As well, there is only a 3 m difference between the highest elevation located within the Grandin Booster Zone and the highest elevation located elsewhere in the system. As such, it appears that the Grandin Booster Station provides little benefit during the average day demand scenario.

The Henday Booster Station is not required to operate during the Average Day scenario.

It should be noted that the current average operating pressures have been applied at the pump stations where applicable. As such, pressures in Zone 105 and 101 (Grandin) will increase or decrease minimally during some operating periods.

### 3.10.2 Peak Hour Scenario

The Peak Hour Demand scenario is typically run to assess the minimum anticipated distribution system pressures. **Table 3-15** presents the minimum and maximum pressures, including filling of the Lacombe Park Pump Station. The following pumps were assumed to be operating:

- **Sturgeon Heights:** Pumps 1, 3 and 4
- **Oakmont:** Pumps 1, 2 and 4
- **Lacombe Park:** Pumps 1 and 2

The pressure leaving the Sturgeon Heights Pump Station is at 738 m HGL under these conditions, slightly lower than the average pressure determined for the existing system.

**Table 3-15**  
**Peak Hour Pressure Results**

Zone	Minimum Pressure kPa (psi)	Maximum Pressure kPa (psi)
100	370 (53.7)	537 (78.0)
101	362 (52.6)	487 (70.7)
102	421 (61.1)	683 (99.1)
103	338 (49.1)	551 (80.0)
104	278 (40.3)	559 (81.2)
105	395 (57.4)	834 (121.1)
106	386 (56.0)	562 (81.6)



Consistent with the average day scenario results, pressures within most zones generally fell within the recommended target pressure range of 350 to 550 kPa (50 to 80 psi). The exceptions are Zone 102, which remained within the City's current Design Standards Maximum, and Zone 105, which greatly exceeded recommended pressures. Although a future maximum target pressure of 550 kPa (80 psi) has been adopted, it is recognized that this will not be attainable in some locations of the existing distribution system.

The velocity in the existing distribution system remains below the normal operating target of 1.5 m/s in the peak hour demand scenario. The 250 mm watermain connection from the 500 mm waterline to Erin Ridge Drive has the highest velocity at 1.4 m/s.

Regarding the Grandin Booster Station, the model results indicate a minimum pressure of approximately 372 kPa (54 psi) in the Grandin Area (Zone 101). This is based on an outgoing HGL of approximately 738 m at the Sturgeon Heights Pump Stations. Should the pressure leaving the pump station fall to a lower HGL of around 733 m, the resulting minimum pressure in the Grandin Area would be in the order of 310 kPa (45 psi). This meets the minimum pressure requirements during peak demand scenarios. As such, it appears that the Grandin Booster Station provides little benefit during the peak hour demand scenario.

The Henday Booster Station is not required to operate during the Peak Hour scenario.

**Figure 3-5** presents the peak hour pressure results for the existing system, assuming that the Grandin Booster Station is not operating.

It should be noted that the outgoing pressure from the pump stations has been shown to vary. As such, pressures in Zone 105 and 101 (Grandin) will increase or decrease minimally during some operating periods.

### 3.10.3 Maximum Day Plus Fire Flow Scenario

Fire flow results are presented on **Figure 3-6**. Percent available fire flow is presented in consideration of land use specific fire flow targets. Nodes located within City roadways are shown larger than in private property. All other nodes are presented; however, are smaller as they are not key to the assessment.

The majority of locations within City property satisfied the Maximum Day plus Fire Flow scenario. Most locations which did not meet the fire flow criteria are situated within private property and include hydrant leads and service lines. Typically, fire flow capacity is assessed for those mains which are located within public roadways and right-of-ways. City fire flow requirements are generalized and are therefore often conservative. Fire demands for individual buildings may differ significantly, and depend on the floor area, building material, and contents (among others). As such, private systems may yield lower overall fire flow results and yet be adequate.

Some areas which did not meet the criteria include:

- Cul-de-sacs;
- Dead end mains;
- Long blocks without intermediate looping; and
- High fire flow properties.

Although these locations may not fully meet the target fire flow criteria due to a reduced flowrate, there will be water available for fighting fire.

Overall, there are relatively few fire flow deficiencies identified. The City has been actively addressing the recommended upgrades from the 2013 UMP as well as subsequent LOS (Level of Service) review and has constructed many of the upgrades proposed at that time.

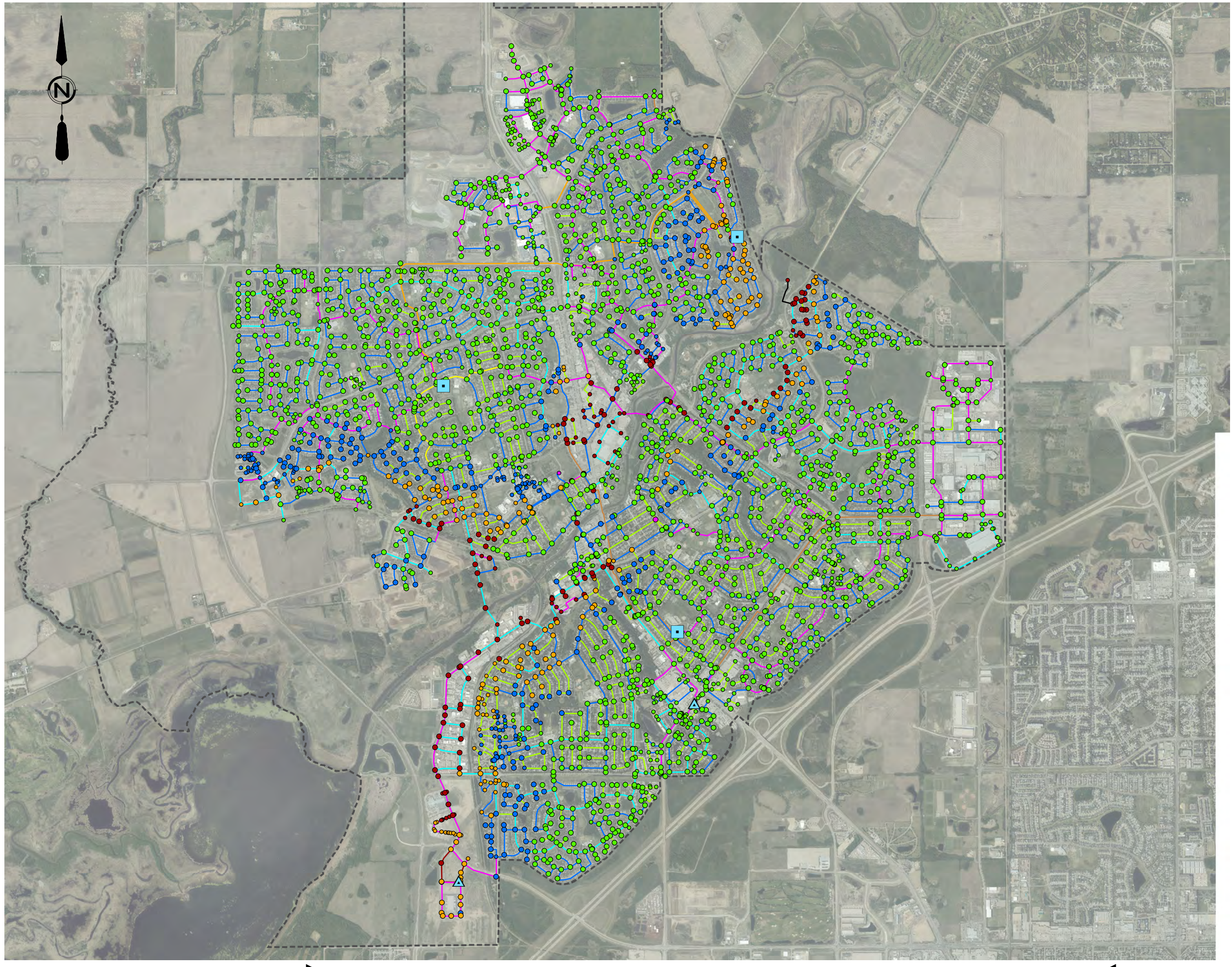
The model results indicate that the Henday Booster Station is not currently required to meet fire flows within the development area. The full fire flow of 300 L/s will be provided to the area, while maintaining the required minimum residual pressure, without operation of the booster station. It should be noted that there currently is minimum development in the area, so the local demands are anticipated to be quite small. A review of the Henday Booster Station Test indicated that the booster station is unlikely to operate under existing conditions.

The Grandin Booster Station is not sized to accommodate fire flows. Fire flow is provided from connections to neighbouring distribution systems.



SAVE DATE: 1/11/2021 1:02:16 PM SAVED BY:  
DRAWING PATH: Q:\2020-3838-00\gis\model\wmp\_3-5\_Existing\_Peak\_Hour\_Pressure.mxd  
DATA SOURCE: ;

IF NOT 25 mm AS SHOWN ADJUST SCALES  
SCALE(S) SHOWN ARE INTENDED FOR TABL/CID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



- LEGEND:**
- City of St. Albert Boundary
  - Existing Reservoir & Pumphouse
  - Existing Booster Station
- Peak Hour Pressure**
- 40 - 50 psi (280 kPa - 350 kPa)
  - 50 - 80 psi (350 kPa - 550 kPa)
  - 80 - 90 psi (550 kPa - 620 kPa)
  - 90 - 100 psi (620 kPa - 689 kPa)
  - >100 psi (>689 kPa)
- Distribution System**
- Existing ≤100 mmø
  - Existing 150 mmø
  - Existing 200 mmø
  - Existing 250 mmø
  - Existing 300 mmø
  - Existing 350 mmø
  - Existing 400 mmø
  - Existing 450 mmø
  - Existing 500 mmø
  - Existing 600 mmø



**FIGURE 3-5**  
CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

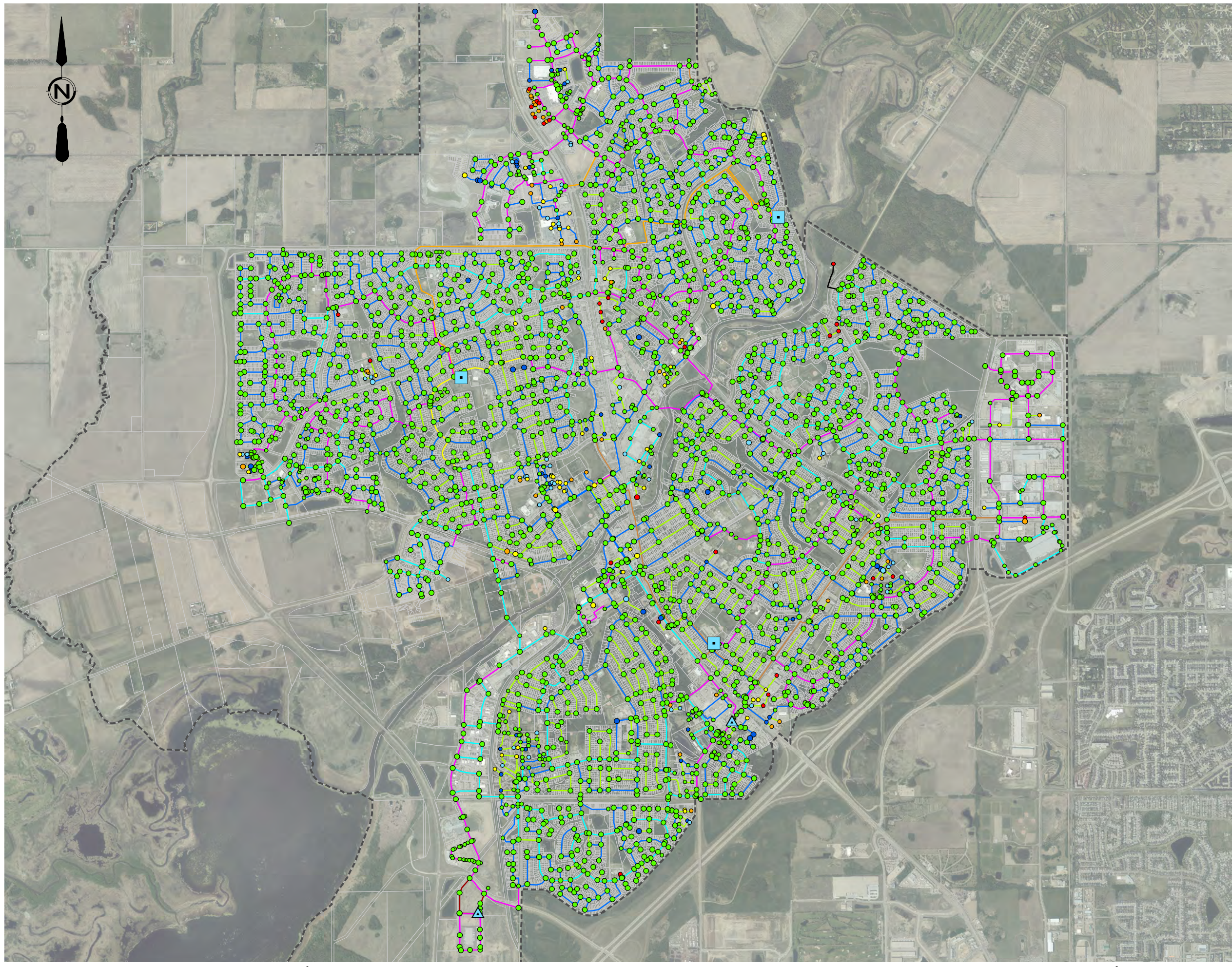
EXISTING WATER SYSTEM  
PEAK HOUR PRESSURE

AE PROJECT No.	2020-3838-00
SCALE	1:35,000
APPROVED	
DATE	2021 JULY
REV	
DESCRIPTION	ISSUED FOR REPORT



SAVE DATE: 3/17/2021 9:02:52 AM SAVED BY:  
DRAWING PATH: Q:\2020-3838-00\gis\model\wmp\_3-6\_Existing\_Max\_Day\_Plus\_Fire\_Flow.mxd  
DATA SOURCE: :

IF NOT 25 mm AS SHOWN ADJUST SCALES  
SCALE(S) SHOWN ARE INTENDED FOR TABL/CID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



**LEGEND:**

- City of St. Albert Boundary
- Existing Reservoir & Pumphouse
- Existing Booster Station

**Fire Flow Availability**

- Exceeds Fire Flow Requirements
- 90% - 99%
- 80% - 90%
- 60% - 80%
- 40% - 60%
- 0% - 40%

**Distribution System**

- Existing ≤100 mmø
- Existing 150 mmø
- Existing 200 mmø
- Existing 250 mmø
- Existing 300 mmø
- Existing 350 mmø
- Existing 400 mmø
- Existing 450 mmø
- Existing 500 mmø
- Existing 600 mmø



**FIGURE 3-6**

**CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE**

**EXISTING WATER SYSTEM  
MAXIMUM DAY PLUS FIRE FLOW**

<b>AE PROJECT No.</b>	2020-3838-00
<b>SCALE</b>	1:32,500
<b>APPROVED</b>	
<b>DATE</b>	2022MAR17
<b>REV</b>	
<b>DESCRIPTION</b>	ISSUED FOR DRAFT



### 3.10.4 Lacombe Park Fill Line Capacity

The maximum supply capacity has been determined for the 500 mm diameter PVC fill line to the Lacombe Park Reservoir. This waterline should have adequate capacity to meet the design Maximum Day Demand for the Lacombe Park Pump Station, such that operation of the pump station is not constrained due to supply capacity.

Based on a maximum allowable velocity of 1.5 m/s, the capacity of the fill line is approximately 300 L/s. At this flowrate, the incoming pressure would be in the order of 280 kPa (40 psi) at the Lacombe Park Reservoir should adequate pumping capacity be available at the Oakmont Pump Station. As this greatly exceeds both the actual and theoretical maximum day demands out of the Lacombe Park Pump Station, the fill line is considered to have ample capacity. The current supply rate of 64 L/s is far below the capacity of the waterline itself.

### 3.10.5 Pumping Capacity

**Table 3-16** presents the pumping capacity analysis. The analysis is based on the following assumptions:

- All pump stations operating (all pump into the same zone).
- The peak hour analysis considers the following pumps to be in operation:
  - Pumps P1, P2 and P6 at the Sturgeon Heights Pump Station;
  - Pumps P1, P2 and P4 at the Oakmont Pump Station; and
  - Pumps P1, P2 and P3 at the Lacombe Park Pump Station.
- Reserving Pumps P3, P4 and P5 at Sturgeon Heights, Pump P3 at Oakmont, and Pump P4 at Lacombe Park as backup.
- Maximum day plus fire flow capacity is based on utilizing P7 at Sturgeon Heights and the same distribution pumps outlined above at Oakmont and Lacombe Park.
  - The Sturgeon Heights Pump Station has a single dedicated standby pump, all other stations rely on backup power and it is assumed that all pumps can operate during emergency conditions (other than those retained as backup).
- A single fire flow of 300 L/s.

Ideally, there is full distribution pumping backup to allow for pump maintenance and repair so not to cause system disruption.

**Table 3-16**  
**Composite Pumping Capacity Assessment**

Year	2020	2025	2030	2035	2040	2045
Population	67,811	72,335	77,161	82,308	87,799	93,657
Average Day Demand (L/s)	196.2	209.3	223.3	238.2	254.0	271.0
Max Day Demand (L/s)	353.2	376.7	401.9	428.7	457.3	487.8
<b>Peak Hour Analysis</b>						
Peak Hour Demand (L/s)	588.6	627.9	669.8	714.5	762.1	813.0
Sturgeon Distribution Pumping Capacity (L/s)	549	549	549	549	549	549
Oakmont Distribution Pumping Capacity (L/s)	210	210	210	210	210	210
Lacombe Distribution Pumping Capacity (L/s)	330	330	330	330	330	330
<b>Total Distribution Pumping Capacity (L/s)</b>	<b>1089</b>	<b>1089</b>	<b>1089</b>	<b>1089</b>	<b>1089</b>	<b>1089</b>
<b>Surplus/Deficit (L/s)</b>	<b>500.4</b>	<b>461.1</b>	<b>419.2</b>	<b>374.5</b>	<b>326.9</b>	<b>276.0</b>
<b>Max Day + Fire Flow Analysis</b>						
Max Day plus Fire Flow Demand (L/s)	653.2	676.7	701.9	728.7	757.3	787.8
Sturgeon Standby Pump Capacity (L/s)	454.0	454.0	454.0	454.0	454.0	454.0
Oakmont Standby Pump Capacity (L/s)	210	210	210	210	210	210
Lacombe Standby Pump Capacity (L/s)	330	330	330	330	330	330
<b>Total Standby Pumping Capacity (L/s)</b>	<b>994.0</b>	<b>994.0</b>	<b>994.0</b>	<b>994.0</b>	<b>994.0</b>	<b>994.0</b>
<b>Surplus/Deficit (L/s)</b>	<b>340.8</b>	<b>317.3</b>	<b>292.1</b>	<b>265.3</b>	<b>236.7</b>	<b>206.2</b>

As shown in the table, there is ample surplus pumping capacity after meeting the 2045 peak hour demands, if reserving 5 pumps as backup (out of 14 total distribution pumps). This is based on the operation of the Sturgeon Heights, Oakmont, and Lacombe Park Pump Stations.

As well, there is sufficient fire/standby pump capacity to meet the anticipated 2045 maximum day plus fire flow demand. This is based on a single 300 L/s fire flow and assumes that all pump stations will operate.

Although there is significant collective surplus pumping capacity through 2045, the individual capacity of each pump station varies greatly. Individual assessments can be useful to illustrate comparative capacity and where future upgrades should be prioritized. It is acknowledged; however, that all pump stations pump into the same primary pressure zone, and that the pump stations do not effectively have individual service areas.

When assessing individual pumping capacities, it can be difficult to identify typical/required flowrates associated with each pumphouse. **Table 3-13** indicates that the portion of maximum day flow provided by the Lacombe Park Pump Station dropped off significantly in 2018 (over 2017), so clearly the operation of each pump station can vary year over year. For the purpose of this assessment, it has been assumed that the flow out of each pumphouse increases proportionately.



**Table 3-17** presents the distribution pumping assessment for the Sturgeon Heights, Oakmont and Lacombe Park pump stations for the average day, maximum day, and peak hour 2020 demand scenarios. The design flows associated with each pump station have been based on the 2017/2018 data presented in **Table 3-13**. A maximum day demand has been included for the Oakmont Pump Station to supply Lacombe Park in the maximum day and peak hour scenarios. An average day demand has been carried in the average day scenario.

**Table 3-17**  
**Distribution Pumping Capacity Assessment (2020 Demands)**

Location	Design Capacity (L/s)	Existing Design Demands			Flow/Capacity		
		Average Day (L/s)	Maximum Day (L/s)	Peak Hour (L/s)	Average Day (%)	Maximum Day (%)	Peak Hour (%)
Sturgeon	549	98.1	176.6	294.3	18%	32%	54%
Oakmont	210	49.1	88.3	147.2	23%	42%	70%
Oakmont (w/fill to Lacombe) <sup>1</sup>	210	98.1	176.6	235.5	47%	84%	112%
Lacombe	330	49.1	88.3	147.2	15%	27%	45%

Notes: 1. An allowance of the average day Lacombe demand has been applied in the average day scenario, and the maximum day Lacombe demands has been applied in the maximum day and peak hour scenario.

As shown in **Table 3-17**, there is sufficient pumping capacity at all pump stations to meet typical demands. The exception is at the Oakmont Pump Station if filling Lacombe Park during the peak hour demand. This is likely a conservative requirement; however, as filling of the Lacombe Park Reservoir can be suspended during peak demands periods, if necessary. The maximum day demand plus filling of the Lacombe Park reservoir is the most critical benchmark to be met by the Oakmont Pump Station. Although the pumping capacity of 210 L/s currently exceeds the calculated demand of 176.6 L/s, the demand will outpace pumping capacity by 2034, based on a projected growth rate of 1.3%.

**Table 3-18** presents the standby pumping assessment for the Sturgeon Heights, Oakmont, and Lacombe Park pump stations for the maximum day plus fire flow 2020 demand scenario. The table assumes that each pump station is required to contribute the full fire flow as well as the maximum day demand for their typical service area (based on 2017/2018 results). **This is highly conservative and is presented only to illustrate the range in capacity at each station.** It is not necessary to have full max day plus fire flow capacity at each individual station, as all pumping stations will contribute during high flow conditions.

**Table 3-18**  
**Standby Pumping Capacity Assessment (2020 Demands)**

Location	Design Capacity (L/s)	Existing Design Demand			Flow/Capacity (%)
		Maximum Day (L/s)	Fire Flow (L/s)	Total Flow (L/s)	
Sturgeon	454 <sup>1</sup>	176.6	300	476.6	105%
Oakmont	210	88.3	300	388.3	185%
Oakmont (w/fill to Lacombe) <sup>2</sup>	210	137.4	300	437.4	208%
Lacombe	330	88.3	300	388.3	118%

Notes: 1. Capacity of the diesel engine fire/standby pump

2. An allowance of the average day Lacombe demand has been applied during the maximum day plus fire flow scenario.

As shown in the above table, the design maximum day plus 300 L/s fire flow is somewhat higher than the pumping capacity at each of the Sturgeon Heights and Lacombe Park pump stations, if assessed individually. However, the design flow is over double the capacity at the Oakmont pump station (if considering average day filling of Lacombe). This is likely unnecessarily conservative, as filling of the Lacombe Park Reservoir can be suspended during peak demands periods. However, the Oakmont Pump Station remains the least capable in its capacity to meet the various design flows.

It should be noted that the average day Lacombe demand has been included in the Oakmont assessment for filling purposes (during the maximum day plus fire flow scenario). This is in keeping with the City of St. Albert Oakmont Reservoir and Pump Station Upgrades Predesign Report, Associated Engineering, August 2014.

The pumping analysis indicates that overall there is ample capacity to meet the distribution and fire flow demands; however, that the Oakmont Pump Station is the least equipped to contribute during peak flow periods. As growth continues, the Oakmont Pump Station may provide a smaller ratio of overall flow during peak demand periods.

It is recommended that pump upgrades occur at the Oakmont Pump Station by 2034, such that maximum day demands can be provided to both the distribution system and in filling the Lacombe Park Reservoir.

It is understood that a new Sturgeon Heights Reservoir and Pump Station will be designed and constructed within the next few years. This is not anticipated to affect the pumping assessment, as it is assumed that the new pump station will meet or exceed the current pumping capacity. Based on the City of St. Albert Sturgeon Heights Reservoir and Pump Station Study, UMA Engineering Ltd, March, 2008, it is understood that the new pump station may be equipped with a backup generator, as in the case of the Oakmont and Lacombe Park Pump Stations. This would allow the distribution pumps to operate during a power failure and would therefore not require a diesel engine fire/standby pump. The distribution and standby pump capacity would therefore be equivalent and total pump capacity would be based on the design maximum day plus fire flow demand.

### 3.10.6 Water Storage

**Table 3-19** presents the total treated water storage in St. Albert. As shown in the table, the total active storage volume is 49,700 m<sup>3</sup>.

**Table 3-19**  
**Existing Reservoir Water Storage Volume**

Reservoir	Year Built	Nominal Storage Volume (m3)	Active Storage Volume (m3)
<b>Sturgeon Heights Reservoir</b>			
Reservoir Cell 1	1966	2,100	1,100
Reservoir Cell 2	1957	2,200	1,200
Reservoir Cell 3	1957	2,200	1,200
Reservoir Cell 4	1972	8,300	6,700
Reservoir Cell 5	1973	8,000	6,500
<b>Sub-total – Sturgeon Heights</b>		<b>22,800</b>	<b>16,700</b>
<b>Oakmont Reservoir</b>			
Reservoir Cell A	1995	4,700	4,700
Reservoir Cell B	1995	5,300	5,300
<b>Sub-total – Oakmont</b>		<b>10,000</b>	<b>10,000</b>
<b>Lacombe Park Reservoir</b>			
Reservoir Cell 1	2005	11,500	11,500
Reservoir Cell 2	2005	11,500	11,500
<b>Sub-total – Lacombe Park</b>		<b>23,000</b>	<b>23,000</b>
<b>Total Reservoir Storage</b>		<b>55,800</b>	<b>49,700</b>

It is understood that a new Sturgeon Heights Reservoir and Pump Station will be designed and constructed within the next few years. Based on the City of St. Albert Sturgeon Heights Reservoir and Pump Station Study, UMA Engineering Ltd, March, 2008, a 23,000 m<sup>3</sup> two cell reservoir is proposed, similar to Lacombe Park. **Table 3-20** presents the updated treated water storage volumes, based on a new Sturgeon Heights Reservoir of this size.

**Table 3-20**  
**Reservoir Water Storage Volume – with Sturgeon Heights Upgrades**

Reservoir	Year Built	Active Storage Volume (m3)
<b>Sturgeon Heights Reservoir</b>		
New Reservoir Cell 1	TBD	11,500
New Reservoir Cell 2	TBD	11,500
<b>Sub-total – Sturgeon Heights</b>		<b>23,000</b>
<b>Oakmont Reservoir</b>		
Reservoir Cell A	1995	4,700
Reservoir Cell B	1995	5,300
<b>Sub-total – Oakmont</b>		<b>10,000</b>
<b>Lacombe Park Reservoir</b>		
Reservoir Cell 1	2005	11,500
Reservoir Cell 2	2005	11,500
<b>Sub-total – Lacombe Park</b>		<b>23,000</b>
<b>Total Reservoir Storage</b>		<b>56,000</b>

As outlined in [Section 2.4](#), the total storage requirement is assessed based on retaining two Average Day Demands plus Fire Flow. As all three existing reservoir/pump stations pump into the same primary pressure zone, there is no clearly defined service area for each facility. All reservoir/pump stations work together to satisfy the City's water demands. As such, storage needs can be assessed considering the combined total of all existing reservoirs.

For the purpose of this assessment, one full design fire flow has been assumed at each of the three reservoirs. Although typical to assign full fire flow storage to each active reservoir, this is likely a conservative approach. It should be noted that nearly 13,000 m<sup>3</sup> of storage volume will be retained for the purpose of fire fighting.

**Table 3-21** presents the storage capacity analysis.

**Table 3-21**  
**Storage Capacity Analysis**

	Total Existing Storage (m3)	Estimated Population	2 x Ave Day Flow (m3/day)	Fire Flow (300 L/s for 4 hours) (m3)	Total Fire Flow Storage (3 Reservoirs)	Total Required Storage (m3)	Remaining Storage (Surplus) (m3)
Existing (2020)	49,700	67,811	33,906	4,320	12,960	46,866	2,835
2025	56,000	72,335	36,168	4,320	12,960	49,128	6,873
2030	56,000	77,161	38,581	4,320	12,960	51,541	4,460
2035	56,000	82,308	41,154	4,320	12,960	54,114	1,886
2040	56,000	87,799	43,900	4,320	12,960	56,860	-860
2045	56,000	93,657	46,829	4,320	12,960	59,789	-3,789

Notes: 1. The new Sturgeon Heights Reservoir and Pump Station is assumed to be constructed and operating by 2025. It is assumed that a 23,000 m<sup>3</sup> reservoir will be constructed which will increase the total active volume from 49,700 m<sup>3</sup> to 56,000 m<sup>3</sup>.

The table indicates that there will be sufficient total storage volume to meet both the current and projected flowrates to approximately the year 2038. This assumes that a new 23,000 m<sup>3</sup> Sturgeon Heights Reservoir will be constructed in the short term, which has been confirmed by the City. The timing of required storage expansion is later than identified in the 2013 UMP. This can be attributed to a significant reduction in the design water consumption rate, which has been adjusted to better reflect current water usage. It also reflects planned upgrades (and active storage expansion) at the Sturgeon Heights Reservoir.

It should also be noted that the design fire flow volume has been based on the City's maximum fire flow criteria of 300 L/s (requiring a 4 hour flow duration), or 4,320 m<sup>3</sup>. Contrary to the 2013 UMP, individual fire flow requirements at each reservoir have not been considered (which varied from 230 L/s to 380 L/s). It is unnecessary to store fire flow volume in excess of the design fire flow within the distribution system.





## 4 UPGRADES TO EXISTING SYSTEM

### 4.1 Distribution System

Upgrades to the distribution system are presented on **Figure 4-1** and are recommended to satisfy fire flow criteria. The same operating criteria has been assumed as in the existing system analysis; however, the operating pressure has been reduced within the primary pressure zone to 736 m HGL, based on the Pressure Zone Modifications discussion in **Section 4.1.2**. It will be necessary to monitor and adjust the outgoing pressure as required and potentially operate the Oakmont Pump Station slightly higher (to maintain the current flow ratio between the Pump Stations).

As shown in the existing SCADA review, pressures leaving the pump stations would be expected to fall below this at times due to outgoing pressure fluctuations.

The proposed upgrades will be required regardless of whether the operating pressure is lowered as proposed. The proposed upgrades are as follows:

- New 300 mm watermains are recommended as shown:
  - Mission Avenue west of St. Vital Avenue (Upgrade 1)
  - Mission Avenue crossing St Albert Trail (Upgrade 2)
  - St. Thomas Street from Perron Street to St. Albert Trail (Upgrade 3)
  - Boudreau Road east of Carnegie Drive (Upgrade 4)
  - Alpine Place (Upgrade 5)
  - Giroux Road from Hogan Road to Bellerose High School (Upgrade 6)
  - Glenview Crescent east of Grandin Road (Upgrade 7)
    - As it is understood that upgrades were recently undertaken along Grandin Road, upgrading of the main up to the intersection of Grandin Road and Glenview Crescent is likely sufficient at this time.
  - Sir George Simpson Junior High (Upgrade 8) – will meet the threshold for upgrades should PRVs be installed along Riel Drive.

The upgrades shown on **Figure 4-1** are those required to meet the recommended fire flow criteria. However, it is recommended that mains be upsized to the minimum recommended diameter when the opportunity arises. It is recommended that a minimum of 200 mm diameter pipes be installed in all residential areas, a minimum of 250 mm in multi-family areas, and 300 mm in all high density residential, commercial, and industrial areas.

In addition to watermain upgrades, two additional pressure zones are proposed to address high pressure in the existing distribution system:

- Two PRV's to reduce pressure in the Kingswood neighbourhood (proposed HGL of 718 m)
  - Available fire flow would be expected to fall by a small amount based on this concept. Full fire flow may not be achieved at the end of two cul-de-sacs, similar to what currently occurs in other locations within the City.
- Four PRV's to reduce pressure along Riel Drive, including the Henday Industrial Park (proposed HGL of 715 m)
  - These PRV stations are proposed to be constructed with check valves on a bypass main such that water can flow from the proposed low pressure zone to the adjacent high pressure zone. This will be particularly important at the Rayborn Crescent connection, where the private development to the east is supported

by the municipal watermain. Available fire flow may fall by a small amount in some locations based on this concept (anticipated to be less than 10 L/s).

Further analysis is recommended to clarify any reduction in the level of service due to implementation of the two new pressure zones.

Following the proposed upgrades, there are a number of locations which are not anticipated to fully meet the recommended fire flow criteria. A brief discussion is provided below:

- Some dead ends will require future adjacent development and watermain looping to fully satisfy the fire flow criteria.
  - Jubilation Drive
  - Joyal Way
  - Joseph M. Demko School
  - Element Drive N.
- Some cul-de-sacs found to be deficient are not proposed for upgrading at this time, as it is assumed that fire will primarily be fought from the main roadway. It is recommended that this approach be reviewed with the fire department to ensure it is appropriate for St. Albert. When mains are replaced, the recommended minimum pipe size should be installed.
  - Harriot Court
  - Fallhaven Place
  - Burnham Place
  - Bocock Place
  - Dressler Court
  - Latimer Place
  - Lamoureux Place
- Some high value locations (commercial, institutional, and medium density residential) are minimally short of the fire flow targets (less than 10% short):
  - Galarneau Place
  - St. Joseph Place
  - Fountain Park Recreation Centre
  - Burnham Avenue/Bernard Drive
  - Sturgeon Road/Bishop Street
- There are two locations which do not meet the recommended fire flow targets; however, can be accommodated by nearby hydrants:
  - St. Vital Avenue
  - St. Vital Avenue/Muir Drive

Although all fire flow deficiencies are presented on **Figure 3-6**, upgrades are not proposed within private developments.

Table 4-1 presents locations with deficient fire flows following completion of the recommended upgrades.

**Table 4-1**  
**Remaining Fire Flow Deficiencies in City Land (Following Upgrades)**

Needed Fire Flow (L/s)	Available Fire Flow (L/s)	Available Fire Flow (%)	Land Use	Location
100	94	94%	SF Residential	Harriot Court
300	285	95%	Commercial	Galarneau Place
300	283	94%	Mixed Use	St. Joseph Street
300	117	39%	Mixed Use	Multi-lot service north of St. Thomas Street. No hydrant at location (so not relevant).
300	287	96%	HD Residential	Fountain Park Recreation Centre
100	78	78%	SF Residential	Fallhaven Place
100	94	94%	SF Residential	Burnham Place
300	272	91%	MD Residential	Burnham Avenue and Bernard Drive
100	91	91%	SF Residential	Bocock Place
300	285	95%	Commercial	Element Drive N.
300	299.8	100%	Institutional	Joseph M. Demko School
300	288	96%	Institutional	Joyal Way
300	183	61%	Institutional	Jubilation Drive - to be looped
100	95	95%	SF Residential	Dressler Court
100	93	93%	SF Residential	Latimer Place
100	91	91%	SF Residential	Lamoureux Place
300	222	74%	Institutional	St. Vital Avenue - hydrant nearby
300	291	97%	Commercial	St. Vital Avenue and Muir Drive
100	85	85%	SF Residential	Kingsbury Crescent (if PRVs installed)
100	97	97%	SF Residential	Knights Court (if PRVs installed)

Note: Water services and hydrant leads are not included in the above table

#### 4.1.1 Normally Closed Valves

Normally closed valves are located at 5 locations within the distribution system as identified in the 2013 UMP (refer to [Figure 3-2](#)) plus one additional location. Valves which are closed to maintain a pressure break between different pressure zones present a risk to the distribution system. Should the valve malfunction, the downstream pressure zone would be at risk of serious overpressure. It is recommended that physical separation be achieved at these locations, including removal of the valve and capping of the watermain. [Figure 4-1](#) presents the three locations requiring valve removal as described below:

- Evergreen Drive and Eden Court (separates Zone 102 from Zone 105).
- Walden Crescent and Waverly Drive (separates Zone 104 from Zone 105).
- St. Vital Avenue and Muir Drive (Zone 103 from Zone 105).
  - This location was not identified in the 2013 UMP and was not identifiable in the existing water model; however, was discovered in a review of recently constructed record drawings. The discovery of this location presents the possibility that other locations may exist in the distribution system where pressure zones are unknowingly separated by closed valves. It is recommended that the record drawings of pressure zone perimeters be closely examined in search of additional locations.

There are 2 locations where valves connect the Lacombe Park fill main with the distribution system. These are located along Villeneuve Road on either side of St. Albert Trail. It is assumed that these valves have been installed to assist with emergency water provision to the local areas should it be required. These valves are not considered to pose a risk to the distribution system as the transmission main and distribution system are within the same pressure zone in these locations. As such, it is unnecessary to physically disconnect these valves; however, they should remain fully closed during normal operation.

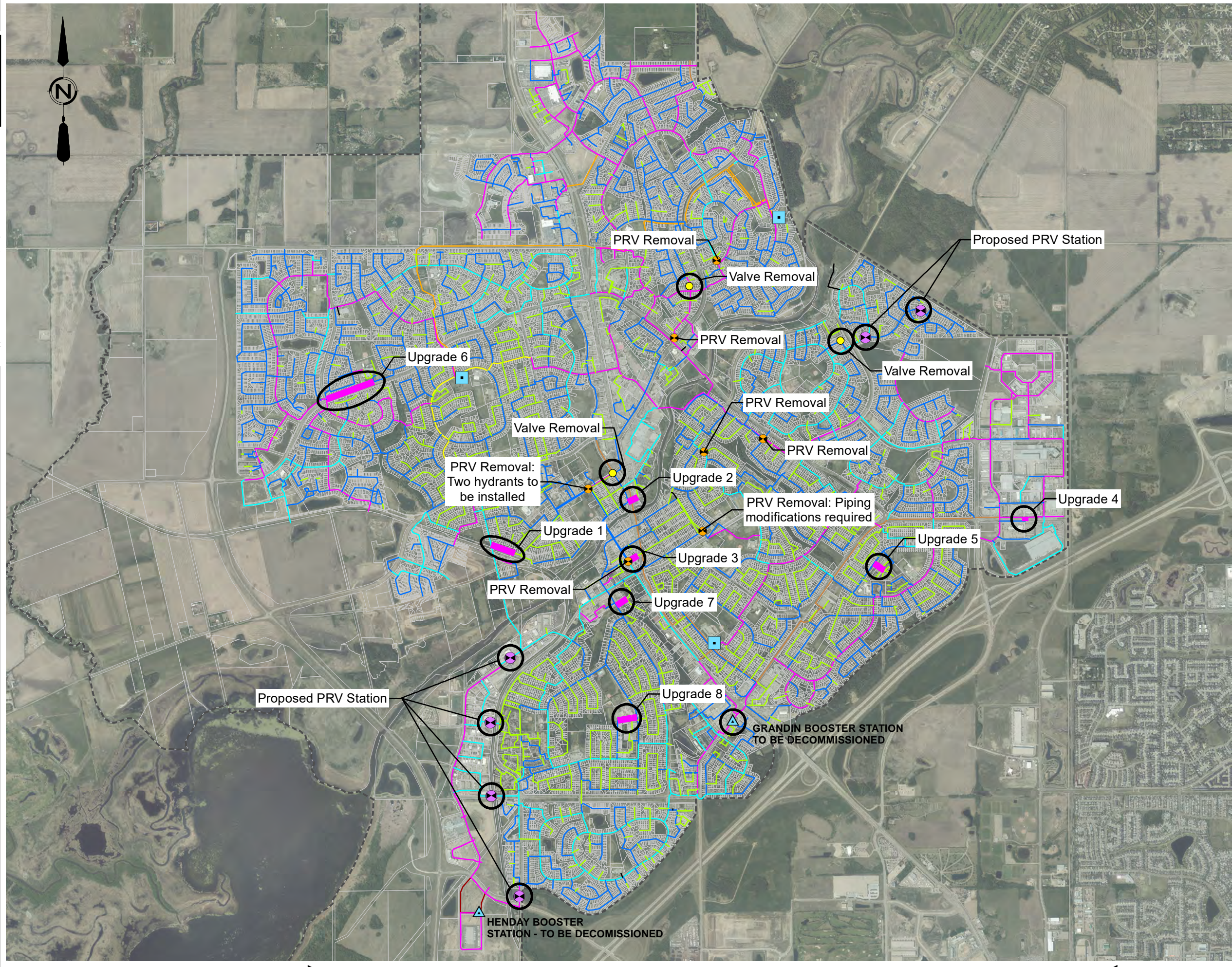
There are also two locations where valves are closed to isolate the Grandin Booster Station area (Zone 101). There is no risk to the distribution system in this situation. Two check valves also allow flow into the Grandin Booster Station Zone, one is located alongside the booster station, while the other is located at the intersection of Gloucester Drive and Gervais Road.

According to the 2013 UMP, a check valve also exists on the 250 mm watermain along Sturgeon Road between Sir Winston Churchill Avenue and Walden Park. This would separate Zone 104 and 105 and would only operate upon low pressure in Zone 105. Under normal conditions this valve would not pose a risk to the distribution system; however, it would overpressure Zone 104 should it malfunction. This valve is not necessary to support Zone 105 in this location and should be considered for removal.



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DATA SOURCE:

IF NOT 25 mm AS SHOWN, ADJUST SCALES  
SCALE(S) SHOWN ARE INTENDED FOR TABLID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



**LEGEND:**

- City of St. Albert Boundary
- Existing Reservoir & Pumphouse
- Existing Booster Station
- Closed Valve
- Proposed PRV
- Remove PRV

**Distribution System**

- Existing  $\leq 100$  mm $\varnothing$
- Existing 150 mm $\varnothing$
- Existing 200 mm $\varnothing$
- Existing 250 mm $\varnothing$
- Existing 300 mm $\varnothing$
- Existing 350 mm $\varnothing$
- Existing 400 mm $\varnothing$
- Existing 450 mm $\varnothing$
- Existing 500 mm $\varnothing$
- Existing 600 mm $\varnothing$
- Proposed 300 mm $\varnothing$



FIGURE 4-1

CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

EXISTING WATER SYSTEM WITH UPGRADES

AE PROJECT No.	2020-3838-00
SCALE	1:32,500
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DATE	2021AUG05
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## 4.1.2 Pressure Zone Modifications

### Main Pressure Zone (105)

Pressures in the main pressure Zone (Zone 105) significantly exceed maximum recommended distribution system pressure in some locations. Based on a current average high HGL of approximately 740 m, pressure as high as 868 kPa (126 psi) can occur in the system. Although this greatly exceeds the City's pressure criteria, there is little room to reduce the operating pressure at the pump stations due to relatively high elevations within the system.

A small reduction in operating pressure is proposed, based on the following:

- The highest elevation within the Grandin Booster Zone is 698.7 m.
  - A target operating HGL of 734 m would be required to meet a minimum Average Day pressure of 350 kPa (50 psi) at this location.
  - There is a very small area within this zone which has higher elevations than the remainder of the City system. It is located within the single family residential area and is comprised of three nodes within the model.
- The highest elevation elsewhere in the system is 695.8 m (roughly 3 m lower).
  - A target operating HGL of 731 m would be required to meet a minimum Average Day pressure of 350 kPa (50 psi) at this location.
- Some fluctuation in pressure currently occurs and should be assumed to continue in the future.

Based on the above, the average HGL can likely drop to 736 m and continue to maintain operating pressures (in consideration of anticipated discharge pressure fluctuation). Although this will not significantly reduce high pressures in those areas which significantly exceed recommended targets, it will provide a reduction in the order of 21 kPa (3 psi). It will also establish a target operating HGL which can be carried forward to future planned extension of the distribution system.

It will be necessary to review pump operation to confirm that they can operate effectively at the proposed lower discharge pressure. As well, the model indicates that the ratio of flow leaving Oakmont could reduce based on setting the HGL evenly at all facilities. It will be essential to monitor and adjust the outgoing pressure as necessary and potentially operate Oakmont at up to 1.8 m higher (as currently appears to occur). This is mainly due to the location of the Oakmont Pump Station, at the edge of the current development area.

Narrowing the pumphouse discharge pressure range may allow for an additional small pressure reduction.

### PRV Controlled Pressure Zones

Proposed PRV setpoints have been identified and are presented in **Table 4-2**, as well as in **Table 3-11**. These setpoints have been established based on resulting pressure ranges within each zone. It is recommended that the City verify and update the setpoints with all PRV Stations. It is also recommended that all pressure gauges within the stations be calibrated or replaced at that time. The range in recorded pressures suggests that there may be gauges that have been misread, mis-recorded, or that may require recalibration or replacement due to age.

**Table 4-2** also presents the expected pressures based on the proposed PRV setpoints and includes the proposed new pressure zones in Kingswood and servicing the Riel Drive area.

**Table 4-2**  
**Proposed Zone HGL**

Zone	Proposed HGL (m)	Minimum Pressure kPa (psi)	Maximum Pressure kPa (psi)
100	713	346 (50.2)	514 (74.6)
101	736	365 (53.0)	490 (71.1)
102	716.4	345 (50.0)	608 (88.2)
103	711	342 (49.6)	555 (80.5)
104	711	340 (49.4)	562 (81.6)
105	736	393 (57.1)	830 (120.4)
106	710	448 (65.1)	820 (75.5)
Proposed 107	718	343 (49.8)	628 (91.4)
Proposed 108	715	409 (59.4)	579 (84)

Recommended zone HGL's were reduced minimally for Zones 100 and 106 and more significantly for Zone 102. The recommended HGL for Zones 103 and 104 are virtually unchanged. Modifying the PRV setpoints will better meet the City's target operating pressures within the distribution system.

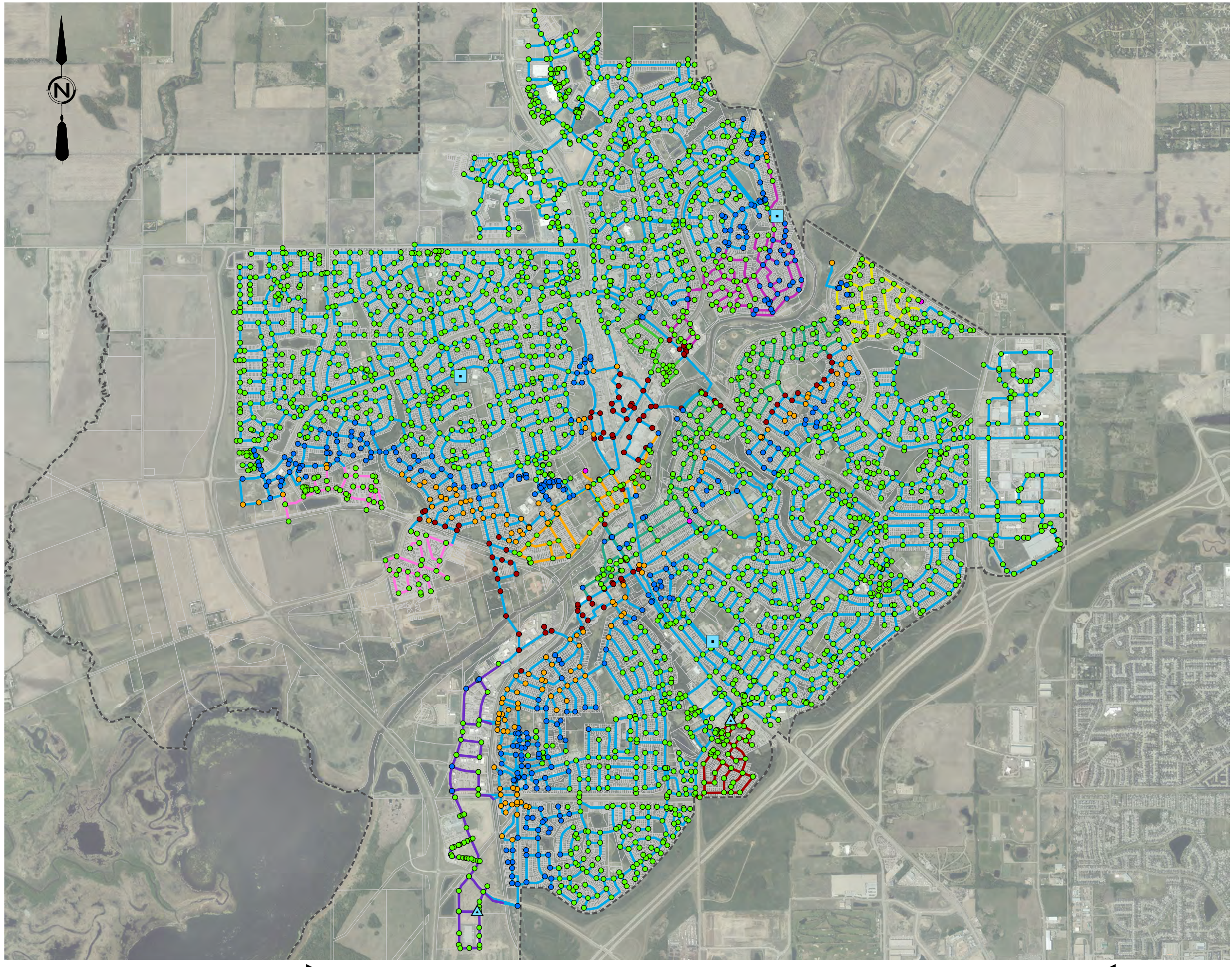
It will be necessary to isolate the PRV from the downstream distribution system such that the reading is not affected by downstream backpressure. This can be achieved by also isolating the nearest downstream hydrant and operating it to reduce pressure (to make an accurate reading/setpoint). Alternatively, the downstream piping can be isolated, and pressure reduced by draining through a gauge port and/or drain valve.

**Figure 4-2** presents the revised zone pressures based on the proposed PRV setpoints and a proposed pump station HGL of 736 m, as well as the two new proposed pressures zones. As shown in the figure, there are a number of locations where the maximum anticipated pressure will greatly exceed the recommended maximum. It is understood that the City is not interested in adding significant PRV stations within the existing distribution system. As such, individual lot PRV's are recommended on all properties where pressure is expected to exceed 690 kPa (100 psi).



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SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE  
IF NOT 25 mm ASJUST SCALES 25 mm



**LEGEND:**

- City of St. Albert Boundary
- Existing Reservoir & Pumphouse
- Existing Booster Station

**Static Pressure**

- 40 - 50 psi (280 kPa - 350 kPa)
- 50 - 80 psi (350 kPa - 550 kPa)
- 80 - 90 psi (550 kPa - 620 kPa)
- 90 - 100 psi (620 kPa - 689 kPa)
- >100 psi (>689 kPa)

**Distribution System (Pressure Zone)**

- Zone 100
- Zone 101
- Zone 102
- Zone 103
- Zone 104
- Zone 105
- Zone 106
- Zone 107 (Proposed)
- Zone 108 (Proposed)



**FIGURE 4-2**

CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

EXISTING WATER SYSTEM WITH UPGRADES  
MODIFIED ZONE PRESSURE

AE PROJECT No.	2020-3838-00
SCALE	1:32,500
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DATE	2021JULY
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### PRV Elimination

The City has indicated the desire to reduce the level of PRV redundancy if possible. As such, the following PRV locations have been identified for potential elimination. It is recommended that further review take place prior to removal of any PRV stations. This could include closing the PRVs and monitoring. Upon confirmation of system performance, the PRV stations identified below can be removed (refer to [Figure 4-1](#)).

**Table 4-3**  
**PRV Locations Identified for Potential Elimination**

PRV	Discussion
PRV 3	This station is located along St Thomas Street and is currently closed. This PRV station could potentially be removed; however, fire flows will fall slightly the area. Upgrades along Thomas Street will likely mitigate the small reduction in fire flow.
PRV 4	This PRV station is located on Bishop Street and Bernard Drive. A minor pipe cross connection could allow for PRV 5 to directly service the watermain downstream of PRV 4.
PRV 7	This PRV station is located on Burnham Avenue. The model results indicate that it can likely be removed; however, further review is recommended due to the size of the watermain.
PRV 8	This PRV station is located south of Bocock Place and can be removed. A small reduction in fire flow can be expected at the end of the Cul-de-sac.
PRV 18	This station is located on Oakmont Drive and Oakridge Drive S. This station is very close to PRV 20 and is redundant.
PRV 13	This station is located along St. Vital Avenue and is currently closed. The station can be removed; however, it is recommended that a hydrant be constructed in its place (connected to the 300 mm watermain). An additional hydrant along St. Vital Avenue will be required further east to accommodate a reduction in fire flow due to removal of the PRV station. All new hydrants should be connected to the existing 300 mm watermain.
PRV 19	This PRV station is located on Boudreau Road and Bellerose Drive. This station is located nearby PRV 24 and can likely be removed; however, further review is recommended due to the size of the watermain.

### Other Considerations

- Other locations could potentially be removed; however, watermain upsizing or looping would likely be required to fully satisfy fire flow.
- It is recommended that sufficient redundancy be maintained in order to account for potential PRV failures or repair closures, and in light of the large service area of some pressure zones.

#### 4.1.3 Grandin Booster Station

It does not appear that the Grandin Booster Station provides significant benefit to the downstream pressures zone, as the primary pressure zone can adequately meet the minimum system pressure.

City staff have confirmed that the booster station has not been operated for several years. As such, the station can be decommissioned.

#### 4.1.4 Henday Booster Station

It does not appear that the Henday Booster Station is required to operate at this time. The City may wish to undertake further testing to confirm the modelling results at full fire flow in the area. Further assessment could be undertaken to assess whether the station could provide some benefit during staged growth of the downstream development area. Additional field testing is recommended to confirm model results, and to see if enough demand can be placed on the system to engage the booster station. If the station cannot be engaged and the tests confirm the model results, we recommend decommissioning the booster station.

### 4.2 Pumping

The pumping analysis in **Table 3-16** indicates that there is ample combined capacity to meet the distribution and fire flow demands; however, that the Oakmont Pump Station is the least equipped to contribute during peak flow periods. It is recommended that the Oakmont Pump Station capacity be increased by 2034, such that the station can meet the projected maximum day demands (both distribution and Lacombe Park Reservoir supply).

It is understood that a new Sturgeon Heights Reservoir and Pump Station will be designed and constructed within the next few years. This will not affect the existing pumping assessment, as it is assumed that the new pump station will meet or exceed the current capacity. It is recommended that the new pump station be designed to maintain a more consistent delivery pressure than at the existing pump station. The addition of VFD's would allow the pumps to better target a consistent outgoing pressure and reduce pressure variation in the distribution system.

A slightly reduced target operating HGL of 636 m is recommended to be accommodated at all pump stations. It is anticipated that it may be necessary to operate the Oakmont Pump Station at slightly above this in order to maintain the current average flow contribution from each facility. Future pressure reduction may be possible if the system operating range can be reduced.

It is recommended that the City investigate installing a bypass at the Oakmont Pump Station which would allow for direct pumping to the Lacombe Park Reservoir, in case of emergency. The system currently operates with three Pump Stations; however, potential operational disruption at the Oakmont Pump Station would effectively also shutdown the Lacombe Park Pump Station due to a lack of supply. A review of the supply system would be required to identify the current capability of direct supply to the Lacombe Park Reservoir. This would be intended to operate on an emergency basis initially but could be investigated for potential long term permanent implementation (and may consider future supply to the proposed North Reservoir).

### 4.3 Storage

The storage analysis presented in **Table 3-21** indicates that there is sufficient storage to meet the 2038 design demands, following construction of the new 23,000 m<sup>3</sup> Sturgeon Heights Reservoir. As such, no additional storage is recommended at this time.

## 5 FUTURE WATER DISTRIBUTION SYSTEM

### 5.1 General

The future water system concept is presented in 4 phases, Stages 1 through 3 as well as Ultimate development. In general, a fire flow of 300 L/s has been assumed in each future residential area to allow for high density development. A fire flow of 300 L/s has also been allowed for in all future non-residential developments. ASP's were reviewed and are reflected in the future watermain concept where appropriate.

For all future development stages, it has been assumed that the proposed target HGL of 736 m will be adopted for the primary pressure zone (Zone 105).

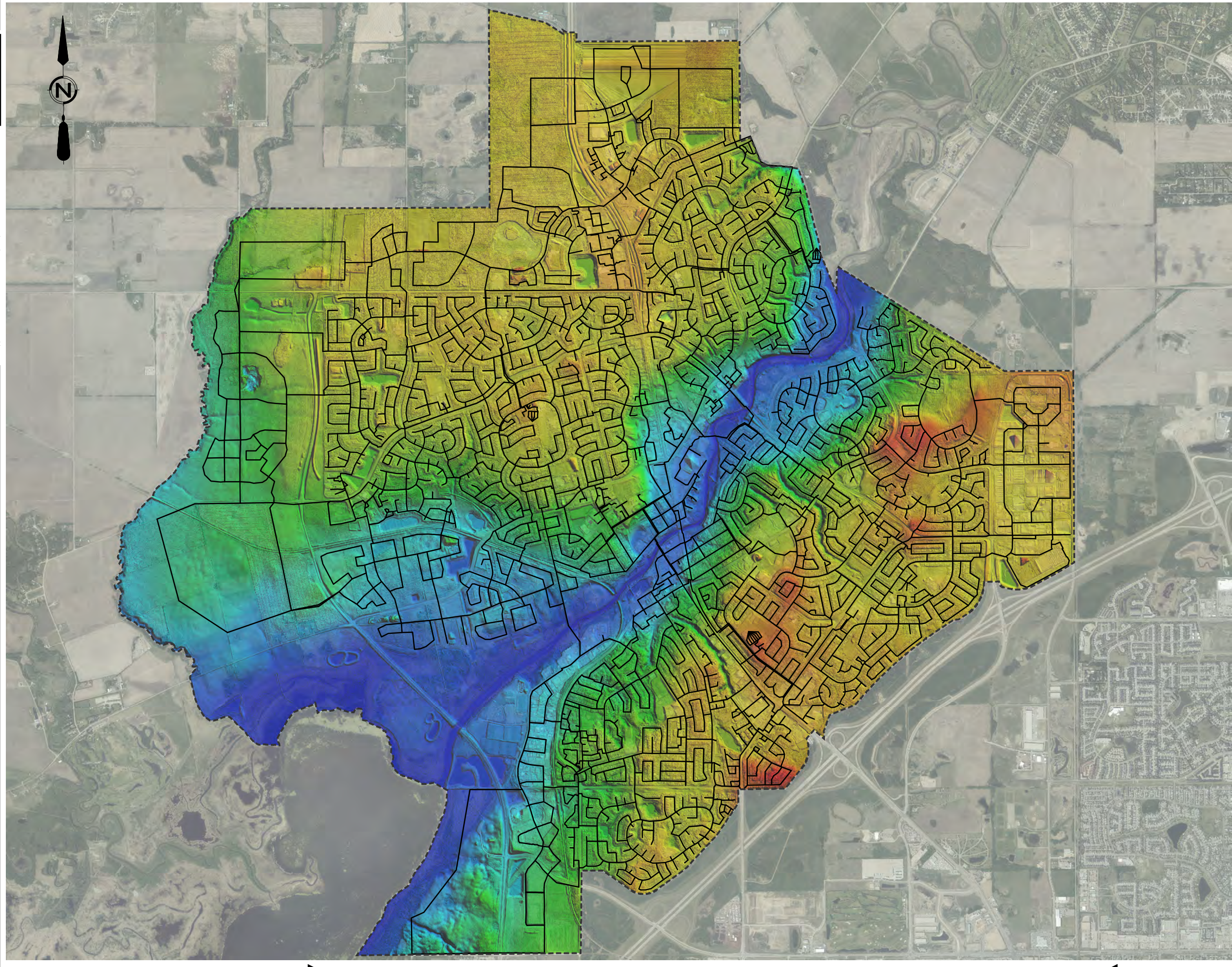
Watermain upgrades to support growth within the City Core at identified Intensification Areas, have not been assessed at this time. Local watermain capacity is recommended to be reviewed during redevelopment.

**Figure 5-1** presents the Ultimate Water System with Elevations. This figure shows the topographic relief to the City boundary and helps to demonstrate why PRV stations are critical to the St. Albert distribution system. As shown in the figure, future development west of the Henday Industrial Park and within the Riverside area will occur at some of the lowest elevations within the City. However, South Riel, Range Road 260, and the future employment lands west of Riverside will also be located in relatively low lying lands. Continued pressure zone management through PRV installation will be critical to addressing potential high pressures within future development areas.

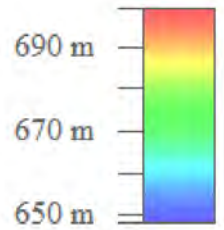


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DATA SOURCE: Imagery and Elevations from City of St. Albert;

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE  
IF NOT 25 mm ASJUST SCALES 25 mm



**LEGEND:**  
City of St. Albert Boundary  
Ultimate Water Network



**FIGURE 5-1**  
CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE  
ULTIMATE WATER SYSTEM WITH ELEVATION

AE PROJECT No.	2020-3838-00
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### 5.1.1 Comparative Analysis

Three potential options were considered to address future water storage needs. These include:

- New Southwest and North Reservoir and Pump Stations;
- New Southwest Reservoir and Pump Station; and
- New North Reservoir and Pump Station.

These options were compared in concept at a high level and were not modelled. The various options and related considerations are described below.

#### 5.1.1.1 New Southwest Reservoir and Pump Station and new North Reservoir and Pump Station

This option considers a new Southwest Reservoir and Pump Station located east of the Henday Industrial Park and a new North Reservoir and Pump Station located in the future north development area, west of Erin Ridge North. This option was originally proposed in the 2013 UMP.

New dedicated transmission mains would be installed to each of the new reservoirs. A large diameter watermain would be constructed from the Southwest Reservoir and Pump Station to Mission Avenue. This would convey water from the pump station to areas north of the Sturgeon River, upstream of the PRV zones.

#### Considerations:

- A long supply main would be required to service the North Reservoir and Pump Station. The supply main could be sized with consideration for potential additional reservoirs servicing the future annexation lands. A review of the upstream supply capacity would be required.
- A short supply main would be required to service the Southwest Reservoir and Pump Station.
- New facilities would be constructed both north and south of the river.
- A long distribution main would be required to convey water from the Southwest Reservoir and Pump Station to the north side of the river (upstream of the PRVs). A large diameter main of this length may be inefficient due to headloss associated with high flowrates.
- Fire flow storage would likely be accommodated at each new reservoir. Therefore, two reservoirs result in twice the fire flow storage to be constructed (at increased cost).
- The cost to construct two facilities is assumed to be higher than one larger facility (based on the same total storage volume).
- The Southwest Reservoir and Pump Station will provide little local benefit other than treated water storage:
  - It is located in a high pressure area – a pump station will not provide benefit in this location.
  - Additional fire flow capacity is not required nearby the Southwest Reservoir and Pump Station location, or at the end of the large diameter distribution main.
- There is limited new development nearby the Southwest Reservoir and Pump Station (to be supported by a new facility).
- The North Reservoir and Pump Station would be located within new development, bringing the storage to where it can be best utilized.



### 5.1.1.2 New Southwest Reservoir and Pump Station

This option would consolidate all required storage at a new Southwest Reservoir and Pump Station. A new dedicated transmission main would be installed to the new reservoir. A large diameter watermain would be constructed from the Southwest Reservoir and Pump Station to Mission Avenue. This would convey water from the pump station to areas north of the Sturgeon River, upstream of the PRV zones.

#### Considerations:

- A short supply main would be required to service the Southwest Reservoir and Pump Station.
- A new facility would be constructed south of the river (could support the Sturgeon Heights Reservoir and Pump Station).
- A long distribution main would be required to convey water from the Southwest Reservoir and Pump Station to the north side of the river (upstream of the PRVs). A large diameter main of this length may be inefficient due to headloss associated with high flowrates.
- One 32,000 m<sup>3</sup> storage reservoir would be constructed. Only one fire flow volume would be stored.
- The Southwest Reservoir and Pump Station will provide little local benefit other than treated water storage:
  - It is located in a high pressure area – a pump station will not provide benefit in this location.
  - Additional fire flow capacity is not required nearby the Southwest Reservoir and Pump Station location, or at the end of the large diameter distribution main.
- There is limited new development in the area (to be supported by a new facility).

### 5.1.1.3 New North Reservoir and Pump Station

This option would consolidate all required storage at a new North Reservoir and Pump Station. A new dedicated transmission main would be installed to the new reservoir.

#### Considerations:

- A long supply main would be required to service the North Reservoir and Pump Station. The supply main could be sized with consideration for potential additional reservoirs servicing the future annexation lands. A review of the upstream supply capacity would be required.
- A new facility would be constructed north of the river (would not provide additional support south of the river).
- One 32,000 m<sup>3</sup> storage reservoir would be constructed. Only one fire flow volume would be stored.
- The North Reservoir and Pump Station would be located within new development. bringing the storage to where it can be best utilized.

Based on the Comparative Analysis and discussions with City staff, future storage will be planned at the proposed North Reservoir and Pump Station. The location of the future facility may be revised in consideration of the annexation lands (not included at this time).

## 5.2 Stage 1

### 5.2.1 Distribution System

Figure 5-2 presents the proposed distribution system and model results for Stage 1.

As shown in the figure, much of the new growth will occur in areas which are currently partially developed (or not yet occupied). New development will occur in the Range Road 260 lands, west of current City footprint. Expansion into these lands will require that new PRV chambers be constructed to limit distribution pressure to the target maximum of 550 kPa (80 psi). An HGL of 720 m is proposed for the Range Road 260 area at this time. An additional PRV is also identified in Riverside, to allow for watermain connection to the east (as identified in the ASP).

During the average day and peak hour demand scenarios, pressures in the Stage 1 lands are anticipated to fall within the recommended range of 350 kPa to 550 kPa (50 to 80 psi) in new development areas. The exception is the Henday Industrial Park, where the pressure could near 690 kPa (100 psi) in some locations (if the proposed PRV stations are not constructed). On-lot PRVs may be required to reduce water pressure to buildings in this area.

Fire flows are met in the majority of new development lands. The exceptions are as follows:

- Some small diameter mains intended to service single family residential lands only, as per the ASP's. A future fire flow of 300 L/s was applied throughout, irrespective of the future land use. The figure presents locations of fire flow deficiency, other than along mains anticipated to service purely single family residential locations (located on 200 mm diameter watermain).
- New development areas without sufficient interim looping/supply. The two initial developments in the Range Road 260 are examples, as full fire flows will not be achieved until sufficient looping of watermain occurs.

Future growth in the Range Road 260 lands is projected to occur in the northeast and southeast portions of the development. As such, these initial pockets will each be serviced by a single watermain in Stages 1 and 2, which could present a risk to the local water supply should a break occur. It may be prudent to expedite development which will interconnect these areas, and therefore reinforce the water supply.

A pipe upgrade to a short section of watermain located immediately outside of the Lacombe Park Pump Station is proposed as the velocity will exceed 1.5 m/s during the Peak Hour Demand at the end of Stage 1. A 500 mm main is anticipated at this time. No additional upgrades to the existing water distribution system are anticipated to support development of Stage 1.

### 5.2.2 Pumping and Storage

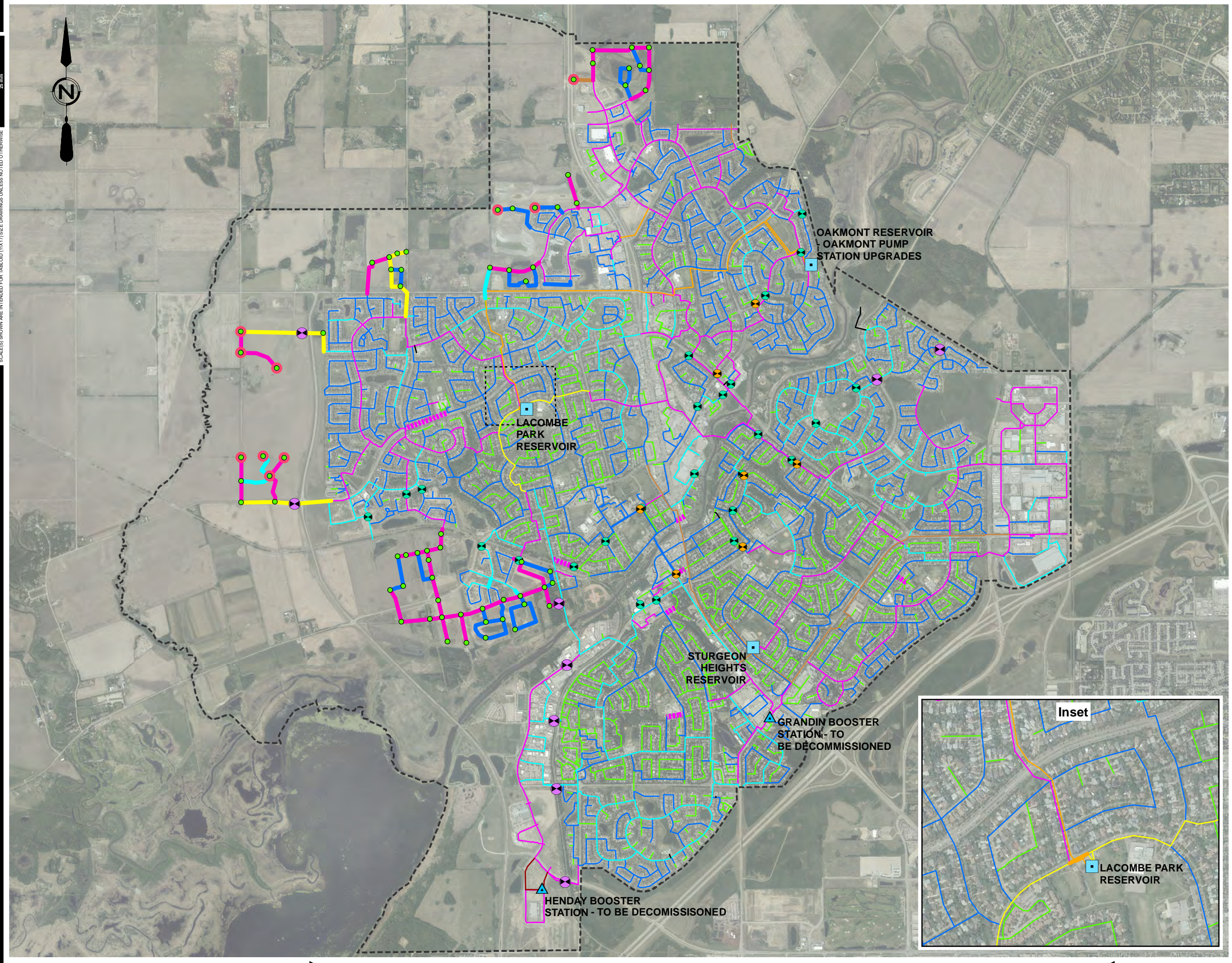
As previously identified, upgrades are proposed to the Oakmont Pump Station by 2034, which would fall within the Stage 1 timeline. As well, it is recommended that pumps be regularly inspected and maintained to prolong their lifespan. It should be anticipated that pumps may need to be replaced every 10-15 years with new and higher capacity pumps.

Based on constructing a new 23,000 m<sup>3</sup> Sturgeon Heights Reservoir by 2025, no additional storage capacity will be required in Stage 1.

### 5.2.3 Supply to Lacombe Park Reservoir and Pump Station

No upgrades are proposed for the Lacombe Park Fill Line, as the modelled Maximum Day flow leaving the Lacombe Park Pump Station in Stage 1 is anticipated to be less than the fill line capacity (at 300 L/s).





LEGEND:

- City of St. Albert Boundary
- Existing Reservoir & Pumphouse
- Existing Booster Station
- Existing PRV
- Remove PRV
- Proposed PRV
- Fire Flow less than 300 L/s (non-residential locations)

**Stage 1 Peak Hour Pressure**  
50 - 80 psi (350 kPa - 550 kPa)

**Stage 1 Distribution System**

- Existing  $\leq 100$  mm $\varnothing$
- Existing 150 mm $\varnothing$
- Existing 200 mm $\varnothing$
- Existing 250 mm $\varnothing$
- Existing 300 mm $\varnothing$
- Existing 350 mm $\varnothing$
- Existing 400 mm $\varnothing$
- Existing 450 mm $\varnothing$
- Existing 500 mm $\varnothing$
- Existing 600 mm $\varnothing$
- Proposed 200 mm $\varnothing$
- Proposed 250 mm $\varnothing$
- Proposed 300 mm $\varnothing$
- Proposed 350 mm $\varnothing$
- Proposed 400 mm $\varnothing$
- Proposed 500 mm $\varnothing$

Note: Pipes proposed in previous stages are identified by a dashed linetype.



FIGURE 5-2

CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

FUTURE WATER SYSTEM  
STAGE 1

AE PROJECT No.	2020-3838-00
SCALE	1:36,000
APPROVED	
DATE	2021AUG05
REV	
DESCRIPTION	ISSUED FOR REPORT



## 5.3 Stage 2

### 5.3.1 Distribution System

Figure 5-3 presents the proposed distribution system and model results for Stage 2.

As shown in the figure, new growth will continue to occur around the perimeter of the City but will also include areas of infill and intensification. The proposed North Reservoir and Pump Station is anticipated to be required early into Stage 2.

During the average day and peak hour demand scenarios, pressures in the Stage 2 lands are anticipated to fall within the recommended range of 350 kPa to 550 kPa (50 to 80 psi) in new development areas. The exception is the South Riel development, where the pressure will approach 690 kPa (100 psi) in some locations (should the proposed PRV stations not be constructed). On-lot PRVs may be required to reduce water pressure to buildings in this area.

Some areas of the DARP (Downtown Area Redevelopment Plan) intensification lands will exceed the target maximum pressure based on the location within the existing distribution system. The intensification lands north of the river are also located in an area which currently experiences higher than the target maximum pressure and is outside the influence of PRV stations.

Fire flows are met in the majority of new development lands. The exceptions are as follows:

- Some small diameter mains intended to service single family residential lands only, as per the associated ASP's. A future fire flow of 300 L/s was applied throughout, irrespective of the future land use. The figure presents locations of fire flow deficiency, other than along mains anticipated to service purely single family residential locations (on 200 mm diameter watermains).
- New development areas without sufficient interim looping/supply. The two initial developments in the Range Road 260 are examples as full fire flows will not be achieved until sufficient looping of watermains occur. This is also anticipated to occur in the future employment lands located west of the City.

Looping of watermains between the initial two developments in the Range Road 260 lands is not anticipated in Stage 2 based on the Projected Staged Growth Plan. However, without looping the entirety of the Range Road 260 and Southwest Employment Lands (Lakeview Business District) would fail to meet the target fire flows. As such, it may be prudent to expedite development and/or infrastructure which will interconnect these areas, and therefore reinforce the water supply. The watermain concept and model results reflect a watermain connection between the north and south growth nodes in the area.

The twin 350 mm mains leaving the Lacombe Park Pump Station will require upgrading by the end of Stage 2 as the velocity will exceed 1.5 m/s during the Peak Hour Demand. The mains are proposed to be upsized to 450 mm each; however, a single large main could also be constructed. No additional upgrades to the existing water distribution system are anticipated in order to support development of Stage 2.

### 5.3.2 Pumping and Storage

Pumping requirements have not been identified beyond 2045. It is recommended that pumps be regularly inspected and maintained to prolong their lifespan. It should be anticipated that pumps may need to be replaced every 10-15 years with new and higher capacity pumps.



Additional storage is anticipated to be required by 2038, early into Stage 2. For the purpose of this assessment, all future storage requirements are assumed to be accommodated at the future North Reservoir. To meet the ultimate storage requirements, 32,000 m<sup>3</sup> of storage would be required at the site (including fire flow storage). Rather than sizing the facility for nearly 40 years worth of demand (ultimate build out projected in 2077), the City may wish to construct the storage reservoir in phases. As such, it is assumed that a 20,000 m<sup>3</sup> storage reservoir would be constructed in Stage 2 with a reservoir expansion to occur in the future. This would accommodate approximately 25 years worth of projected growth.

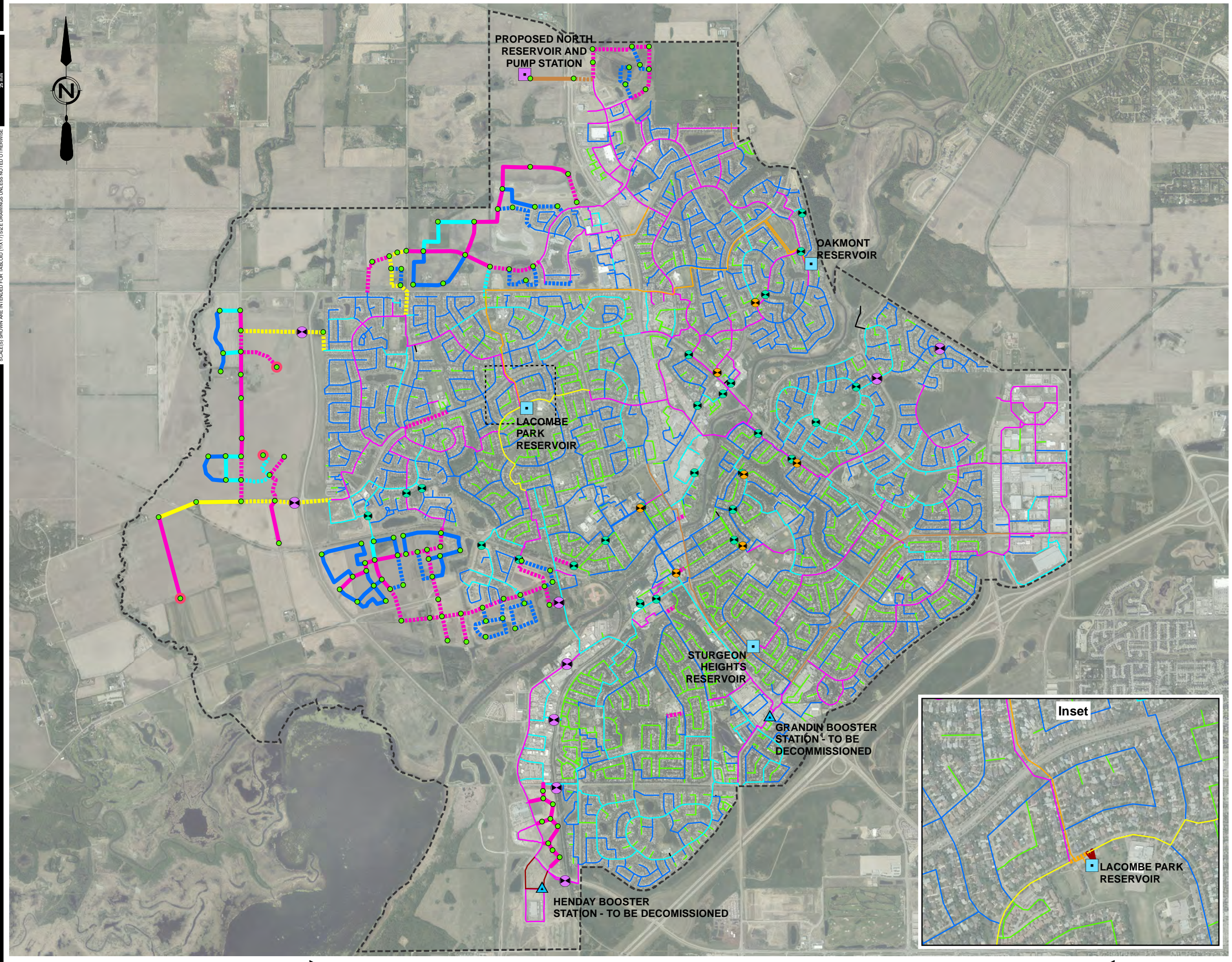
It is recommended that this concept be revisited to include the annexation lands. This may result in relocating the future reservoir to better service adjacent lands not currently considered. The estimated storage volume may also change based on potential additional reservoirs (due to annexation) and the optimal service area.

### **5.3.3 Supply to Lacombe Park Reservoir and Pump Station and the Proposed North Reservoir and Pump Station**

No upgrades are proposed for the Lacombe Park Fill Line, as the modelled Maximum Day flow leaving the Lacombe Park Pump Station in Stage 2 is less than the fill line capacity (at 300 L/s)

Ultimately, a dedicated transmission main may be required to convey water from the supply system to the North Reservoir. It would be to the City's benefit to bypass the Oakmont Reservoir and Pump Station and eliminate the need for re-pumping. In interim years, the reservoir could be filled from the distribution system during off-peak hours, as the reservoir will not be required to operate continuously to maintain system pressure and the outflow will be relatively low initially. It may also be possible to use the existing Lacombe Park Fill Main and construct an extension to the proposed North Reservoir until the fill main capacity is exceeded. For the purpose of this assessment, a new fill line is assumed to be constructed in the Ultimate System.





- LEGEND:**
- City of St. Albert Boundary
  - Existing Reservoir & Pumphouse
  - Existing Booster Station
  - Existing PRV
  - Remove PRV
  - Proposed PRV
  - Proposed Reservoir
  - Fire Flow less than 300 L/s (non-residential locations)
- Stage 2 Peak Hour Pressure**
- 50 - 80 psi (350 kPa - 550 kPa)
- Stage 2 Distribution System**
- Existing ≤100 mmø
  - Existing 150 mmø
  - Existing 200 mmø
  - Existing 250 mmø
  - Existing 300 mmø
  - Existing 350 mmø
  - Existing 400 mmø
  - Existing 450 mmø
  - Existing 500 mmø
  - Existing 600 mmø
  - Proposed 200 mmø
  - Proposed 250 mmø
  - Proposed 300 mmø
  - Proposed 350 mmø
  - Proposed 400 mmø
  - Proposed 450 mmø
  - Proposed 500 mmø
  - Proposed 600 mmø

Note: Pipes proposed in previous stages are identified by a dashed linetype.



**FIGURE 5-3**  
CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

FUTURE WATER SYSTEM  
STAGE 2

AE PROJECT No.	2020-3838-00
SCALE	1:36,000
APPROVED	
DATE	2021AUG05
REV	
DESCRIPTION	ISSUED FOR REPORT



## 5.4 Stage 3

### 5.4.1 Distribution System

Figure 5-4 presents the proposed distribution system and model results for Stage 3.

As shown in the figure, new growth will continue to occur around the perimeter of the City and will include additional areas of infill and intensification. During the average day and peak hour demand scenarios, pressures in the Stage 3 lands are anticipated to fall within the recommended range of 350 kPa to 550 kPa (50 to 80 psi) in new development areas. The exception is in the Southwest Employment Lands (Lakeview Business District) where the maximum pressure will approach 586 kPa (85 psi).

Fire flows are met in the majority of new development lands. The exceptions are as follows:

- Some small diameter mains intended to service single family residential lands only, as per the associated ASP's. A future fire flow of 300 L/s was applied throughout, irrespective of the future land use. The figure presents locations of fire flow deficiency, other than along mains anticipated to service purely single family residential locations (on 200 mm diameter watermain).
- New development areas without sufficient interim looping/supply. Full fire flow in the southwest employment lands will not be achieved until sufficient looping of watermain occurs.

Full fire flow will be achieved in the Range Road 260 lands as the south and north developments will be interconnected in Stage 3 (recommended to be expedited in Stage 2). Upgrades are proposed to the existing 200 mm which will connect to the central Range Road 260 watermain. This will provide some improvement to system performance and increased connectivity of large diameter watermain to the west. This upgrade is not critical and should be undertaken when other works are required in the area.

Velocity in the 350 mm watermain located west of the Lacombe Park Pump Station will approach 1.5 m/s at the end of Stage 3; however, upgrades are not likely required until the Ultimate Development Stage. No additional upgrades to the existing water distribution system are anticipated to support development of Stage 3.

### 5.4.2 Pumping and Storage

Pumping requirements have not been identified beyond 2045. It is recommended that pumps be regularly inspected and maintained to prolong their lifespan. It should be anticipated that pumps may need to be replaced every 10-15 years with new and higher capacity pumps.

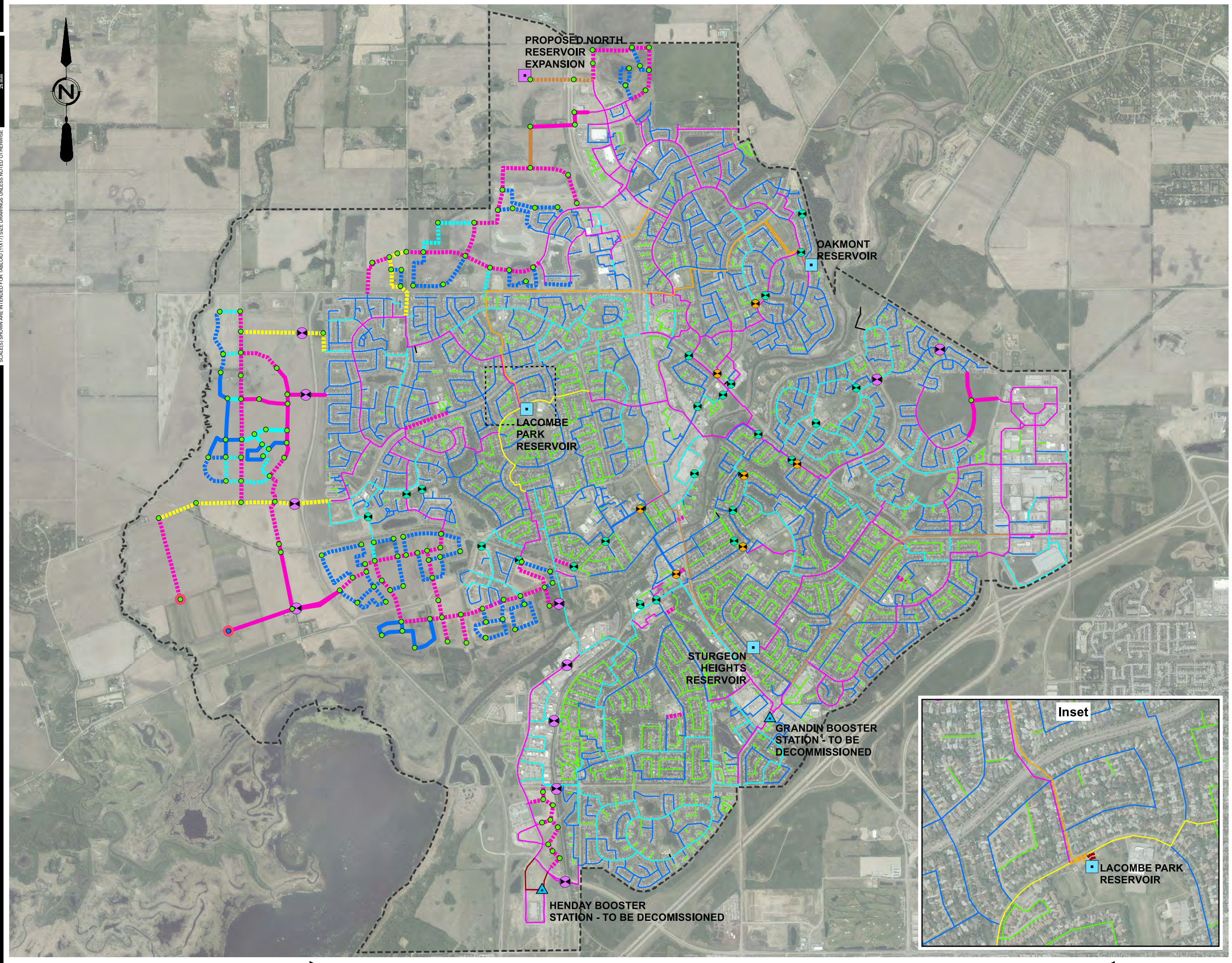
For the purpose of this assessment, it is assumed that a 12,000 m<sup>3</sup> storage expansion will occur at the future North Reservoir and Pump Station in Stage 3, should a 20,000 m<sup>3</sup> storage reservoir be constructed in Stage 2. This will meet both the Stage 3 and Ultimate system requirements.

### 5.4.3 Supply to Lacombe Park Reservoir and Pump Station and the Proposed North Reservoir and Pump Station

No upgrades are proposed for the Lacombe Park Fill Line, as the modelled Maximum Day flow leaving the Lacombe Park Pump Station in Stage 3 is less than the fill line capacity (at 300 L/s).

A dedicated fill line to the proposed North Reservoir and Pump Station is assumed to be constructed early in the Ultimate System.





**LEGEND:**

- City of St. Albert Boundary
- Existing Reservoir & Pumphouse
- Existing Booster Station
- Existing PRV
- Removed PRV
- Proposed PRV
- Proposed Reservoir
- Fire Flow less than 300 L/s (non-residential locations)

**Stage 3 Peak Hour Pressure**

- 50 - 80 psi (350 kPa - 550 kPa)
- 80 - 90 psi (550 kPa - 620 kPa)

**Stage 3 Distribution System**

- Existing  $\leq 100$  mm $\varnothing$
- Existing 150 mm $\varnothing$
- Existing 200 mm $\varnothing$
- Existing 250 mm $\varnothing$
- Existing 300 mm $\varnothing$
- Existing 350 mm $\varnothing$
- Existing 400 mm $\varnothing$
- Existing 450 mm $\varnothing$
- Existing 500 mm $\varnothing$
- Existing 600 mm $\varnothing$
- Proposed 200 mm $\varnothing$
- Proposed 250 mm $\varnothing$
- Proposed 300 mm $\varnothing$
- Proposed 350 mm $\varnothing$
- Proposed 400 mm $\varnothing$
- Proposed 450 mm $\varnothing$
- Proposed 500 mm $\varnothing$
- Proposed 600 mm $\varnothing$

Note: Pipes proposed in previous stages are identified by a dashed linetype.



**FIGURE 5-4**

**CITY OF ST. ALBERT WATER DISTRIBUTION SYSTEM MASTER PLAN UPDATE**

**FUTURE WATER SYSTEM  
STAGE 3**

AE PROJECT No.	2020-3838-00
SCALE	1:36,000
APPROVED	
DATE	2021AUG05
REV	
DESCRIPTION	ISSUED FOR REPORT



## 5.5 Ultimate System

### 5.5.1 Distribution System

**Figure 5-5** presents the proposed distribution system and model results for the Ultimate Development Stage.

As shown in the figure, new growth will continue to occur around the perimeter of the City and will include additional areas of intensification. During the average day and peak hour demand scenarios, pressures in the Ultimate System lands are anticipated to fall within the recommended range of 350 kPa to 550 kPa (50 to 80 psi) in new development areas. The exception is in the southwest employment lands (Lakeview Business District) and the employment lands west of the Henday Industrial Park, where pressures will exceed 550 kPa (80 psi); however, remain below 620 kPa (90 psi) should the proposed PRVs be installed.

Fire flows are met in the majority of new development lands. The exceptions are as follows:

- Some small diameter mains intended to service single family residential lands only, as per the associated ASP's. A future fire flow of 300 L/s was applied throughout, irrespective of the future land use.

Full fire flow will be achieved in all Ultimate Development areas as full looping will be achieved.

Velocity in the 350 mm watermain located west of the Lacombe Park Pump Station will exceed 1.5 m/s in the Ultimate Development. Proposed upgrades include replacing the existing 300 mm main north of the Lacombe Park Pump Station with a 450 mm main. A new 350 mm watermain is proposed along Giroux Road, as well as replacement of the existing 200 mm main with a 300 mm watermain. It is also recommended that the existing 200 mm watermain which supports the Stage 3 connection to Range Road 260, be upsized to a 300 mm watermain.

No additional upgrades to the existing water distribution system are anticipated to support the Ultimate Development

The 2013 UMP identified a new watermain extending from the 500 mm distribution main north of the Oakmont Pumphouse. Due to the timing of the proposed North Pump Station, this main does not appear necessary to support the distribution system (to the study limits). The necessity of this main should be re-evaluated following inclusion of the annexation lands into the Master Plan and may consider re-supply of the North Reservoir and Pump Station (through the distribution system).

### 5.5.2 Pumping and Storage

Pumping requirements have not been identified beyond 2045. It is recommended that pumps be regularly inspected and maintained to prolong their lifespan. It should be anticipated that pumps may need to be replaced every 10-15 years with new and higher capacity pumps.

No additional storage will be required in the Ultimate System, should the full storage needs be accommodated in earlier development stages.

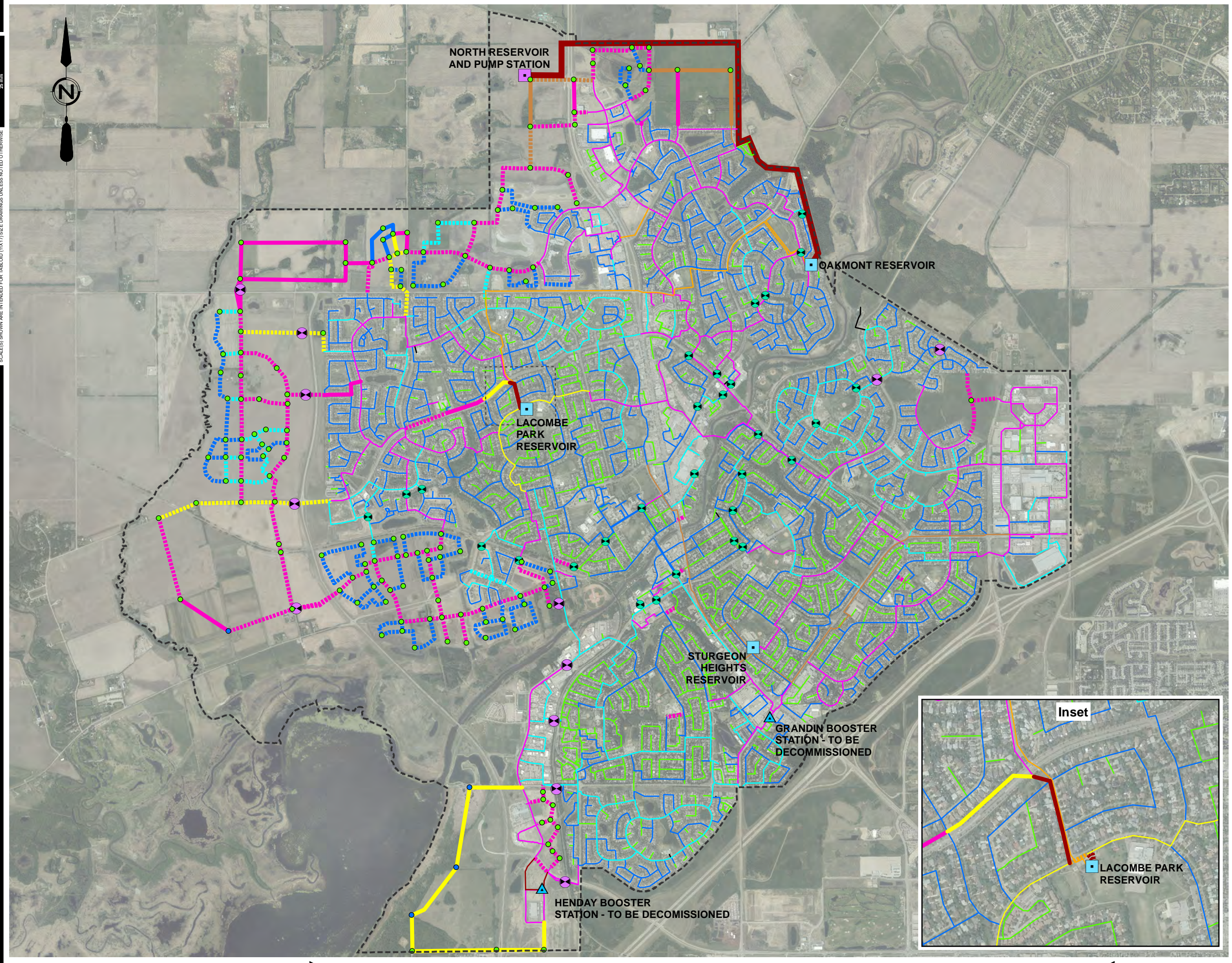
### **5.5.3 Supply to Lacombe Park Reservoir and Pump Station and the Proposed North Reservoir and Pump Station**

No upgrades are proposed for the Lacombe Park Fill Line, as the modelled Maximum Day flow leaving the Lacombe Park Pump Station in the Ultimate stage is less than the fill line capacity (at 300 L/s). A 450 mm dedicated fill line to the proposed North Reservoir and Pump Station is assumed to be constructed early in the Ultimate System.



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DATA SOURCE: Imagery and Elevations from City of St. Albert

IF NOT 25 mm AS SHOWN, ADJUST SCALES  
SCALE(S) SHOWN ARE INTENDED FOR TABL/CID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



- LEGEND:**
- City of St. Albert Boundary
  - Existing Reservoir & Pumphouse
  - Existing Booster Station
  - Existing PRV
  - Remove PRV
  - Proposed PRV
  - Proposed Reservoir
- Ultimate Peak Hour Pressure**
- 50 - 80 psi (350 kPa - 550 kPa)
  - 80 - 90 psi (550 kPa - 620 kPa)
- Ultimate Distribution System**
- Existing ≤100 mmø
  - Existing 150 mmø
  - Existing 200 mmø
  - Existing 250 mmø
  - Existing 300 mmø
  - Existing 350 mmø
  - Existing 400 mmø
  - Existing 450 mmø
  - Existing 500 mmø
  - Existing 600 mmø
  - Proposed 200 mmø
  - Proposed 250 mmø
  - Proposed 300 mmø
  - Proposed 350 mmø
  - Proposed 400 mmø
  - Proposed 450 mmø
  - Proposed 500 mmø
  - Proposed 600 mmø
  - Proposed 450 mmø North Reservoir Supply Main

**Note:** Pipes proposed in previous stages are identified by a dashed linetype.



**FIGURE 5-5**  
CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

**FUTURE WATER SYSTEM  
ULTIMATE**

AE PROJECT No.	2020-3838-00
SCALE	1:36,000
APPROVED	
DATE	2021AUG05
REV	
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## 6 COST ESTIMATES AND CAPITAL IMPROVEMENT PLAN

### 6.1 Capital Costs

A summary of capital cost estimates is provided in **Table 6-1** for upgrades which are recommended for the existing water system, as well as subsequent development stages where applicable. For future development scenarios, costs are generally presented for new facilities and offsite watermain and those onsite watermain over 300 mm in diameter. The estimates presented include an allowance for engineering (15%) and contingency (15%), but do not include GST. The costs are based on 2021 construction dollars. Unit costs and detailed estimates are provided in **Appendix C**.

**Table 6-1**  
**Summary of Capital Costs**

Upgrades to Existing System		
Watermains		\$3,890,000
Valve Removal		\$150,000
PRV Setpoint Adjustments		\$25,000
PRV Installation		\$3,000,000
PRV Removal		\$1,542,000
Sturgeon Reservoir and Pump Station		\$23,000,000
Grandin Booster Station Decommissioning		\$150,000
Henday Booster Station Decommissioning		\$150,000
<b>TOTAL UPGRADES TO EXISTING SYSTEM</b>		<b>\$31,907,000</b>
<b>Stage 1</b>		
Watermains		\$7,103,000
PRV Installation		\$1,500,000
Oakmont Pump Station Upgrades <sup>1</sup>		\$4,000,000
<b>TOTAL STAGE 1</b>		<b>\$12,603,000</b>
<b>Stage 2</b>		
Watermains		\$3,662,000
North Reservoir and Pump Station		\$20,000,000
<b>TOTAL STAGE 2</b>		<b>\$23,662,000</b>
<b>Stage 3</b>		
Watermains		\$1,400,000
North Reservoir Expansion		\$12,000,000
PRV Installation		\$1,000,000
<b>TOTAL STAGE 3</b>		<b>\$14,400,000</b>



Upgrades to Existing System	
Ultimate Development Scenario	
Watermains	\$27,973,000
PRV Installation	\$500,000
	<b>TOTAL ULTIMATE</b>
	<b>\$28,473,000</b>
Notes: 1. Cost for Oakmont Pump Station Upgrades taken from City of St. Albert Oakmont Reservoir and Pump Station Upgrades Predesign Report, Associated Engineering, August 2014. The costs include new pump installation as well as additional work. The estimated cost has been increased to account for inflation	

## 6.2 Priority Ranking

The 8 proposed upgrade locations were evaluated and prioritized. The watermain upgrades have been prioritized based on fire flow deficiencies, number of people impacted, criticality of the infrastructure, and a cost benefit ratio. The following discussion describes the criteria used and how each location ranked within that criteria. Based on the criteria, a score of between five and one was provided; five demonstrating the highest ranked upgrade location based on that criteria, and one being the lowest priority.

### Fire Flow Deficiency

This criterion evaluates the percent fire flow deficiency of nodes at each location. Each node identified, failed to meet the required fire flow under maximum day demand conditions based on the City of St. Albert standards. The nodes were compared based on the percentage of current available fire flow to the required fire flow. Percent of available fire flows of less than 50% are ranked highest, followed by a lower ranking as the available fire flow increased.

Table 6-2 identifies each location with a corresponding score.

**Table 6-2**  
**Fire Flow Deficiency per Location**

Location	Land Use Type	Fire Flow Target	Available Fire Flow	Available Fire Flow (%)	Score*
Mission Avenue East	Commercial	300	107	36%	5
Mission Avenue West	Apartment	300	127	42%	5
Boudreau Road	Commercial	300	173	58%	4
St. Thomas Street	Apartment	300	229	76%	3
Giroux Road - Bellerose School	School	300	257	86%	2
Alpine Place	Apartment	300	262	87%	2
Glenview Crescent	Commercial	300	260	87%	2
Sir George Simpson Junior High	School	300	282	94%	1

\*5 is the highest ranked upgrade location based on the criteria, and 1 is the lowest priority

### People Impacted

This criterion identifies the population that would be impacted if facilities in the service area were no longer available. The criterion is based on numerical values that reflect how many people would be impacted from improvements or lack of improvements to the current water system. This criterion was based strictly on a quantitative measure; the higher number of people impacted, the higher the score value, as summarized in [Table 6-3](#).

**Table 6-3**  
**People Impacted from Deficient Fire Flow**

Location	Land Use Type	Number of People Impacted	Score*
Mission Avenue East	Commercial	<50	1
Mission Avenue West	Apartment	<50	1
Boudreau Road	Commercial	500-1000	4
St. Thomas Street	Apartment	100-500	3
Giroux Road - Bellerose School	School	>1000	5
Alpine Place	Apartment	100-500	3
Glenview Crescent	Commercial	<50	1
Sir George Simpson Junior High	School	>1000	5

\*5 is the highest ranked upgrade location based on the criteria, and 1 is the lowest priority



### Criticality of Infrastructure

This criterion evaluates the criticality of specific infrastructure (property and buildings) in sustaining a community and maintaining a continuity of services. Factors considered include facilities that provide day to day services; businesses that provide income for individuals/families, and the public who utilize the services provided by those businesses; population dependence on facilities. **Table 6-4** summarized the level of dependency of the infrastructure, and the resulting score.

**Table 6-4**  
**Dependence on Infrastructure**

Location	Land Use Type	Dependence on Infrastructure (Property/Buildings)	Score*
Mission Avenue East	Commercial	Low	1
Mission Avenue West	Apartment	Medium	3
Boudreau Road	Commercial	Low	1
St. Thomas Street	Apartment	Medium	3
Giroux Road - Bellerose School	School	High	5
Alpine Place	Apartment	Medium	3
Glenview Crescent	Commercial	Low	1
Sir George Simpson Junior High	School	High	5

\*5 is the highest ranked upgrade location based on the criteria, and 1 is the lowest priority

### Cost – Benefit Ratio

By taking the property value of the area impacted by the deficient fire flow and dividing it by the estimated cost of the proposed upgrade, a numerical value is created to identify the ratio between replacement cost of the infrastructure (property/buildings), and the watermain upgrade cost. The higher the ratio value, the higher the cost impact if the property/buildings were to be destroyed versus if the water network portion was replaced.

Existing property values, combined with the 2020 property tax assessment, and updated construction costs of similar infrastructure were used to estimate the Infrastructure Replacement Cost for the property/buildings. The ratio was found using the following formula:

$$\text{Ratio} = \frac{\text{Infrastructure Replacement Cost}}{\text{Watermain Upgrade Cost}}$$

**Table 6-5** lists the Infrastructure Replacement Costs, Watermain Upgrade Costs and Ratios for the 8 locations.

**Table 6-5**  
Replacement Cost vs. Option Cost

Project	Infrastructure Replacement Cost (Property/Buildings)	Watermain Upgrade Cost	Ratio	Score*
Mission Avenue West	1,954,000	662,000	3.0	1
Mission Avenue East	7,470,000	304,000	24.6	3
St. Thomas Street	3,000,000	274,000	10.9	2
Boudreau Road	15,000,000	105,000	142.9	5
Alpine Place	7,500,000	331,000	22.7	3
Giroux Road - Bellerose School	20,000,000	1,355,000	14.8	2
Glenview Crescent	1,300,000	340,000	3.8	1
Sir George Simpson Junior High	20,000,000	519,000	38.5	3

\*5 is the highest ranked upgrade location based on the criteria, and 1 is the lowest priority

### Priority Ranking

Watermain upgrades have been prioritized based on their scores from the evaluated criteria. **Table 6-6** presents the Priority Ranking.

**Table 6-6**  
Watermain Priority Ranking

Location	Total Score	Priority Ranking
Boudreau Road	14	1
Giroux Road - Bellerose School	14	2
St. Thomas Street	11	3
Alpine Place	11	4
Mission Avenue West	10	5
Mission Avenue East	10	6
Sir George Simpson Junior High	9	7
Glenview Crescent	5	8



### 6.3 Capital Plan

For budgetary purposes, the capital plan is based on the allocation of approximately \$1,000,000 annually for the next ten years toward required system upgrades. Due to budget allocations being complete for the next three years, the ten-year capital plan begins in 2024. Locations are based on the prioritized upgrades from [Section 6.2](#) and the planned development from the ASP's for the Stage 1 growth. Should the value of upgrade be less than one million dollars, the subsequent upgrade would be added to that annual program. To maximize the effectiveness of the budget, any remaining amounts will be utilized by the addition of other appurtenances such as valve removals and PRV installations and removals. The capital plan has been developed to cover all upgrades and Stage 1 costs. [Table 6-7](#) outlines the capital plan for the next decade.

**Table 6-7**  
**10 Year Capital Plan**

Year	Upgrades	Budget
2021 <sup>1</sup>	Stage 1 – Range Road 260 North Stage 1 – Range Road 260 North Stage 1 – PRV Installation x 1 (Range Road 260)	2,876,000
2022 <sup>2</sup>	Upgrades – Grandin Booster Station Decommissioning Stage 1 – Range Road 260 South Stage 1 – Range Road 260 South Stage 1 – PRV Installation x 1 (Range Road 260)	2,943,000
2023 <sup>3</sup>	Sturgeon Reservoir and Pump Station	23,000,000
2024	Upgrades – Boudreau Road Upgrades – St. Thomas Street, Upgrades – PRV Setpoint Adjustment Upgrades – Alpine Place Upgrades – PRV Removal – St. Vital (with 2 x hydrant install) Upgrades – PRV Removal – Bernard (with 8m piping install)	1,277,000
2025	Upgrades – Giroux Road (Bellerose School)	1,355,000
2026	Upgrades – PRV Installation x 2 (Kingswood Area) Upgrades – PRV Removal x 1	1,200,000
2027	Upgrades – Mission Avenue West Upgrades – Mission Avenue East Upgrades – Henday Booster Station Decommissioning	1,116,000
2028	Upgrades – PRV Installation x 2 (Riel Park) Upgrades – PRV Removal x 1	1,200,000
2029	Upgrades – PRV Installation x 2 (Riel Park) Upgrades – PRV Removal x 1	1,200,000
2030	Upgrades – Sr. George Simpson Junior High Upgrades – Glenview Crescent Upgrades – Valve Removal x 3	1,009,000
2031	Stage 1 – West of Jensen Lakes (Niagara)	948,000
2032	Stage 1 – West of Jensen Lakes	1,264,400

Year	Upgrades	Budget
2033	Stage 1 – Oakmont Pump Station Upgrades	4,000,000
2034 <sup>4</sup>	Stage 1 – PRV Installation x 1 (Riverside) Stage 1 – Larose Drive Upgrades – PRV Removal x 2	1,122,000

<sup>1</sup> Budget exceeds one million target amount; based on City's current project schedule.

<sup>2</sup> Budget exceeds one million target amount; based on City's current project schedule.

<sup>3</sup> Budget exceeds one million target amount; due to the replacement of the Sturgeon Heights Reservoir and Pump Station, currently scheduled for 2023.

<sup>4</sup> Schedule may change; PRV installation to be based on when developer would like to connect into existing system.





## 7 CONCLUSIONS AND RECOMMENDATIONS

### 7.1 Conclusions

- An average per capita consumption value of 250 L/c/d is appropriate for use in this assessment. This is a reduction from 350 L/c/d as applied in the 2013 UMP.
- A maximum day factor of 1.8 times the average day demand and a peak hour factor of 3.0 times the average day demand are appropriate for use in this assessment. This is a reduction from 2.0 and 4.0 respectively, as applied in the 2013 UMP.
- A number of locations fall outside of the recommended pressure range of 350 to 550 kPa (50 to 80 psi).
- The majority of locations satisfy the Maximum Day plus Fire Flow criteria.
- Current PRV setpoints require confirmation and/or adjustments
- In 2017 and 2018 respectively, the following average breakdown in pump station outflow was as follows:
  - Sturgeon Heights Pump Station: 50%/48%;
  - Oakmont Pump Station (distribution): 25%/30%; and
  - Lacombe Park Pump Station: 25%/22%.
- The average outgoing HGL at each pump station is as follows:
  - Sturgeon Heights Pump Station: 738.3 m;
  - Oakmont Pump Station (distribution): 740.1 m; and
  - Lacombe Park Pump Station: 738.3 m.
- There is a wide operating band in terms of outgoing pressure from the pump stations.
- The maximum pressure leaving the Sturgeon Heights Pump Station in 2019 was 746 m HGL (522 kPa, 76 psi).
- There is sufficient combined pumping capacity to meet the existing system requirements.
- The Oakmont Pump Station will require pumping upgrades by 2034 to meet the projected maximum day demands at the current overall ratio (both distribution and Lacombe supply).
- There is sufficient storage capacity to meet the existing system requirements.
- Following construction of the new Sturgeon Heights Reservoir (at 23,000 m<sup>3</sup>), there will be sufficient capacity to meet the projected 2038 year needs.
- The Lacombe Park Fill Line has a capacity of 300 L/s at 1.5 m/s velocity.
- The Lacombe Park pumps appear to operate well above the target VFD setpoint and more in line with the outgoing pressure from the Sturgeon Heights and Oakmont Pump Stations, based on a review of the 2019 SCADA Data.
- Minimum distribution system pressures can be met without operation of the Grandin Booster Station. The station has not been in operation for the past several years.
- The Henday (South Riel) Booster Station is not required to meet fire flow or pressure requirements and is not anticipated to operate under future conditions.
- There are three known locations where downstream pressure zones are separated by closed valves in the distribution system. This may put the downstream system at risk of overpressure, should these valves be accidentally opened.



- Following upgrading of the distribution system, some locations will continue to fall short of the target fire flows. These areas include:
  - Dead ends due to interim development scenarios;
  - Residential cul-de-sacs; and
  - High value land uses within 10% of the target fire flow.
- Private development areas have not been assessed. As such, upgrades are not proposed for these areas.
- Watermain upgrades to support intensification within the City core have not been identified at this time, as these will be dependent upon the proposed redevelopments.
- The supply system to City reservoirs has not been assessed as is out of scope.

## 7.2 Recommendations

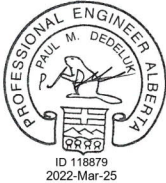
- Proceed with watermain upgrading recommendations as shown in [Figure 4-1](#).
- Undertake the PRV setpoint adjustments as identified in [Table 3-11](#).
  - Calibrate or replace pressure gauges within PRV stations.
- Lower the target operating HGL to 736 m at pump stations (although it is anticipated that the Oakmont Pump Station may require a higher operating HGL). Monitor and adjust as required to maintain target flow rates/ratios.
- Proceed with removal of 3 valves and physically separate mains between pressure zones as shown in [Figure 4- 1](#).
  - Review record drawings and GIS for other possible closed valve zone connections and disconnect as necessary.
- Remove identified PRV stations and install identified associated system improvements as required (watermain/hydrants).
- Install 2 new PRV stations to reduce high pressures in the Kingswood neighbourhood.
- Install 4 new PRV stations to reduce high pressures along Riel Drive.
- Construct the new Sturgeon Heights Pump Station and Reservoir with 23,000 m<sup>3</sup> of storage.
- Install VFDs at the new Sturgeon Heights Pump House to better maintain the target discharge pressure.
- Increase pumping capacity at the Oakmont Pump Station by 2034.
- Narrow the discharge operating pressure band at all pump stations, where possible.
- Decommission the Grandin Booster Station.
- Potential Henday Booster Station decommissioning pending further testing
- Upgrade distribution mains to the minimum recommended pipe size during local system improvement opportunities.
- Require that on-lot PRVs be installed in areas where the pressure exceeds 690 kPa (100 psi).
- Plan for staged expansion of the water system as presented in [Figures 5-2](#) through [Figure 5-5](#).
- Construct a new North Reservoir and Pump Station with a total of 32,000 m<sup>3</sup> storage capacity. To be constructed in Stage 2 with a reservoir expansion in Stage 3.
- Plan for a target maximum pressure of 550 kPa (80 psi) in new development areas.
- Assess the capacity of the supply system and its ability to meet the future design flows including supply to a proposed future North Reservoir.

## CLOSURE

This report was prepared for the City of St. Albert to provide an update of the Water Distribution System Master Plan.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

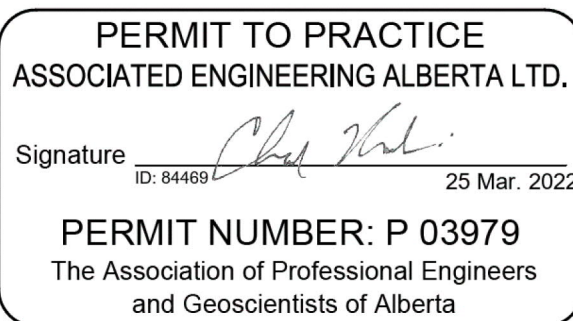
Respectfully submitted,  
Associated Engineering Alberta Ltd.



Paul Dedeluk, P.Eng.  
Project Manager



Candice Gottstein, P.Eng.  
Project Engineer







## APPENDIX A – HYDRANT PRESSURE DATA

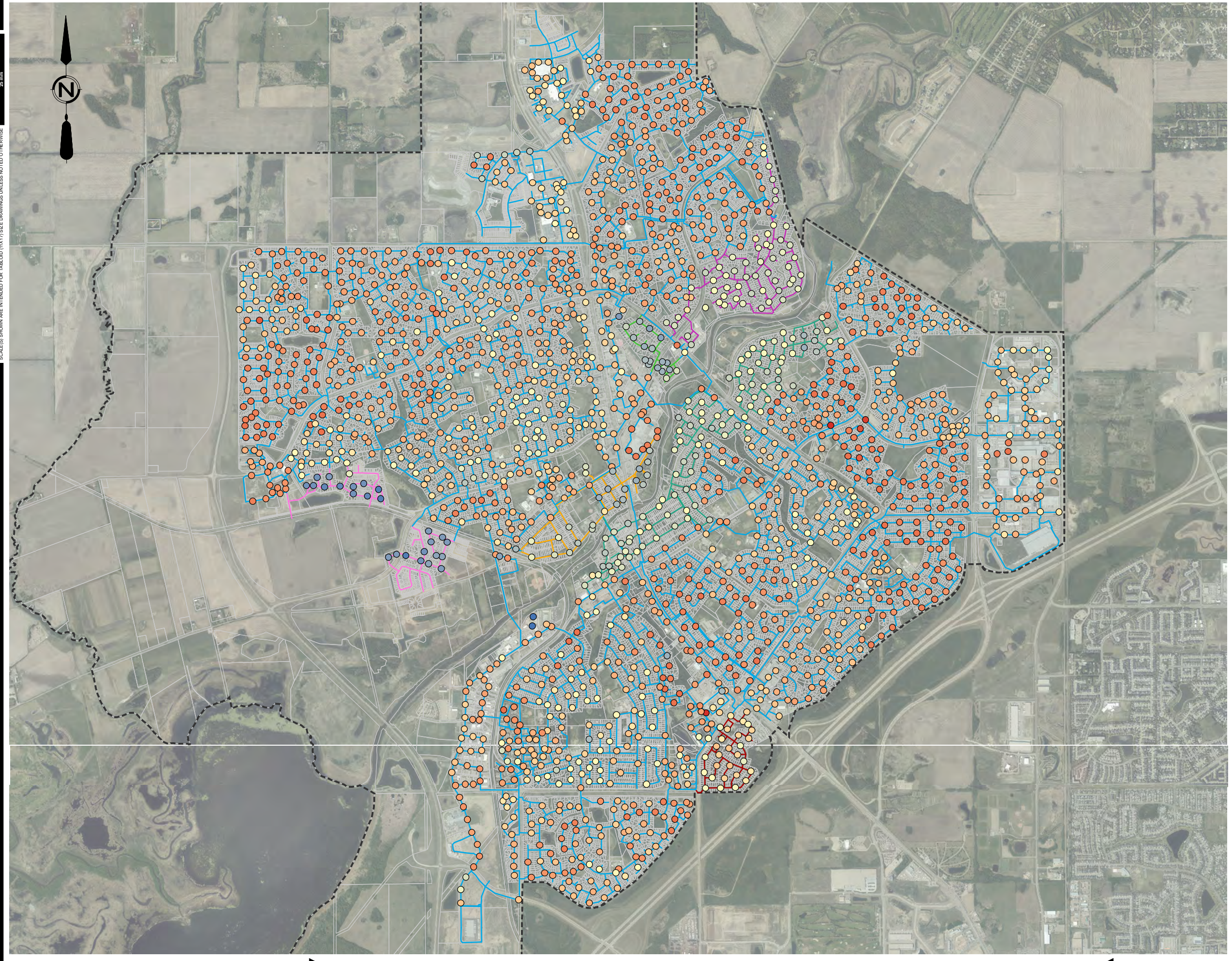






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DATA SOURCE: :

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE  
IF NOT 25 mm AS JUST SCALES 25 mm



LEGEND:

Hydrant HGL 2017	Pressure Zone
● >752	— Zone 100
● 751 - 752	— Zone 101
● 749 - 750	— Zone 102
● 747 - 748	— Zone 103
● 745 - 746	— Zone 104
● 743 - 744	— Zone 105
● 741 - 742	— Zone 106
● 739 - 740	
● 737 - 738	
● 735 - 736	
● 733 - 734	
● 731 - 732	
● 729 - 730	
● 727 - 728	
● 725 - 726	
● 723 - 724	
● 721 - 722	
● 719 - 720	
● 717 - 718	
● 715 - 716	
● 713 - 714	
● 711 - 712	
● 709 - 710	
● 707 - 708	
● 705 - 706	
● <705	

Note: Extreme, outlier, and '0' value hydrants were excluded from classification.



FIGURE A-1  
CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

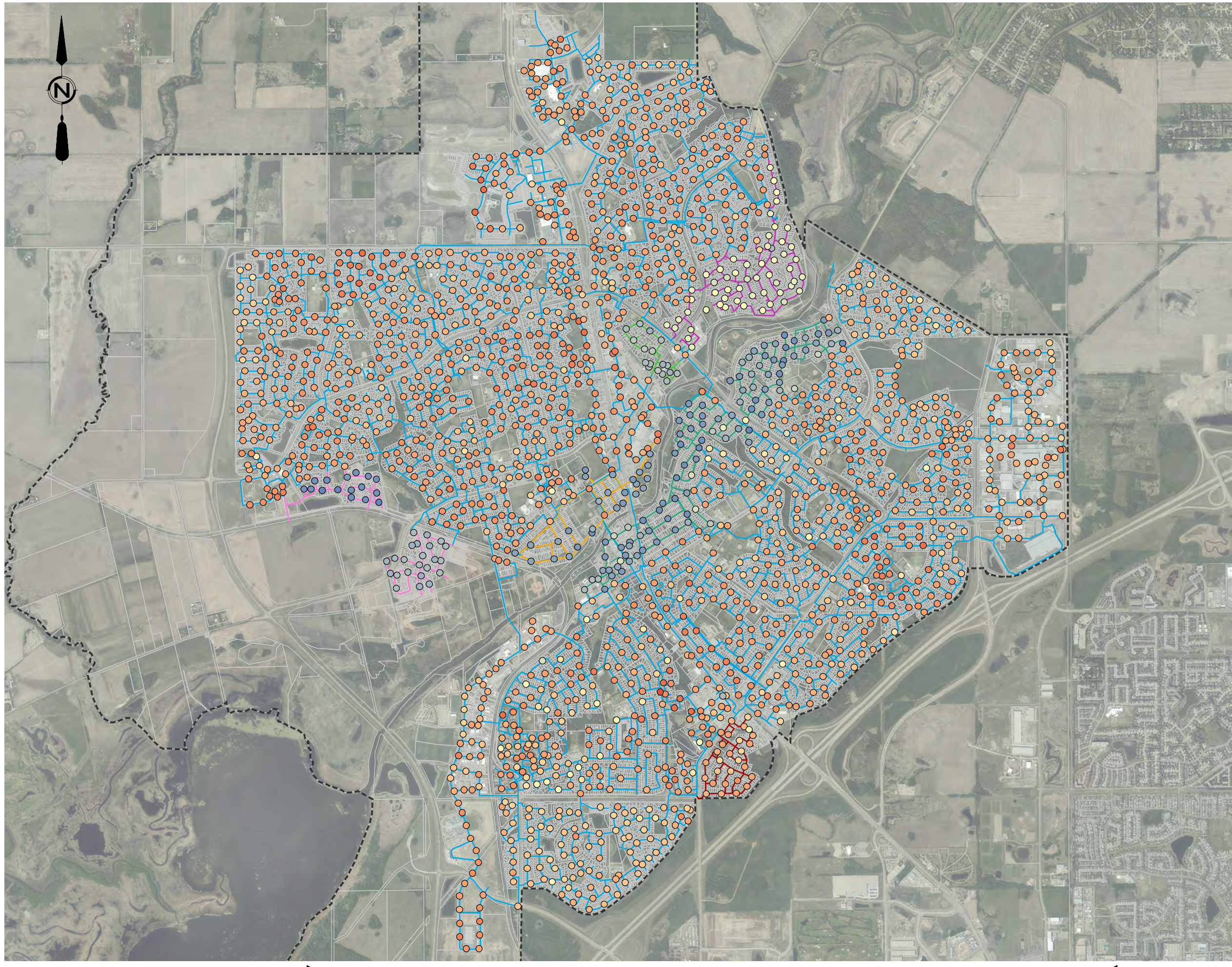
EXISTING WATER SYSTEM  
HYDRANT HGL & PRESSURE ZONES  
2017

AE PROJECT No.	2020-3838-00
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DATE	2021JULY
REV	
DESCRIPTION	ISSUED FOR REPORT



SAVE DATE: 5/20/2021 12:45:17 PM SAVED BY:  
DRAWING PATH: \\ae.ca\data\working\esfm\2020-3838-00\gis\model\wmp\_9-1\_Hydrants\_HGL\_2017.mxd  
DATA SOURCE: :

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE  
IF NOT 25 mm AS NOTED OTHERWISE



LEGEND:

Hydrant HGL 2018	Pressure Zone
● >752	— Zone 100
● 751 - 752	— Zone 101
● 749 - 750	— Zone 102
● 747 - 748	— Zone 103
● 745 - 746	— Zone 104
● 743 - 744	— Zone 105
● 741 - 742	— Zone 106
● 739 - 740	
● 737 - 738	
● 735 - 736	
● 733 - 734	
● 731 - 732	
● 729 - 730	
● 727 - 728	
● 725 - 726	
● 723 - 724	
● 721 - 722	
● 719 - 720	
● 717 - 718	
● 715 - 716	
● 713 - 714	
● 711 - 712	
● 709 - 710	
● 707 - 708	
● 705 - 706	
● <705	

Note: Extreme, outlier, and '0' value hydrants were excluded from classification.



FIGURE A-2

CITY OF ST. ALBERT WATER DISTRIBUTION SYSTEM MASTER PLAN UPDATE

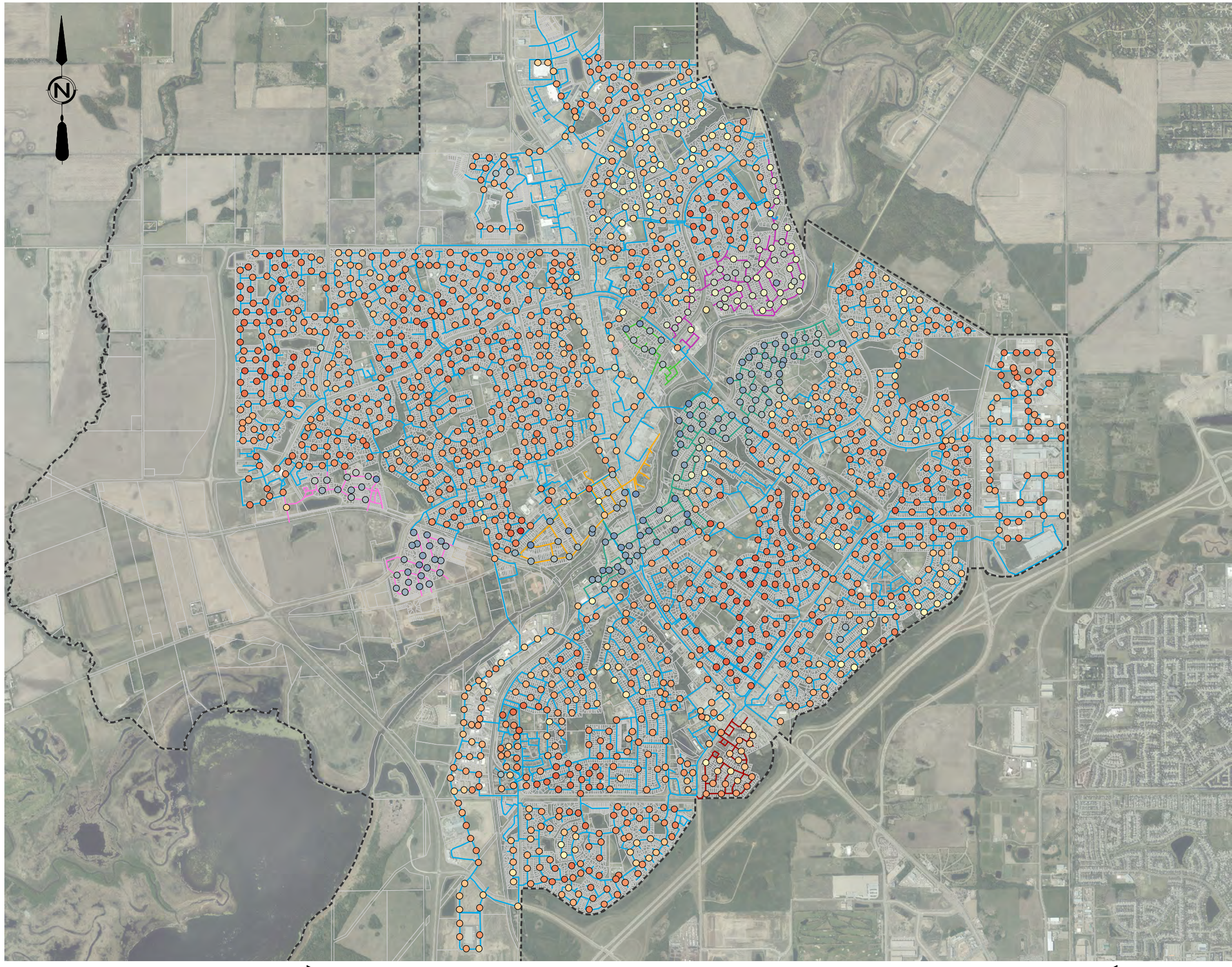
EXISTING WATER SYSTEM  
HYDRANT HGL & PRESSURE ZONES  
2018

AE PROJECT No.	2020-3838-00
SCALE	1:36,000
APPROVED	
DATE	2021JULY
REV	
DESCRIPTION	ISSUED FOR REPORT



SAVE DATE: 5/20/2021 12:46:12 PM SAVED BY:  
DRAWING PATH: \\ae.ca\data\working\esfm\2020-3838-00\gis\model\wmp\_9-1\_Hydrants\_HGL\_2017.mxd  
DATA SOURCE: :

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE  
IF NOT 25 mm AS NOTED OTHERWISE 25 mm



LEGEND:

Hydrant HGL 2019	Pressure Zone
● >752	Zone 100
● 751 - 752	Zone 101
● 749 - 750	Zone 102
● 747 - 748	Zone 103
● 745 - 746	Zone 104
● 743 - 744	Zone 105
● 741 - 742	Zone 106
● 739 - 740	
● 737 - 738	
● 735 - 736	
● 733 - 734	
● 731 - 732	
● 729 - 730	
● 727 - 728	
● 725 - 726	
● 723 - 724	
● 721 - 722	
● 719 - 720	
● 717 - 718	
● 715 - 716	
● 713 - 714	
● 711 - 712	
● 709 - 710	
● 707 - 708	
● 705 - 706	
● <705	

Note: Extreme, outlier, and '0' value hydrants were excluded from classification.



FIGURE A-3  
CITY OF ST. ALBERT WATER DISTRIBUTION  
SYSTEM MASTER PLAN UPDATE

EXISTING WATER SYSTEM  
HYDRANT HGL & PRESSURE ZONES  
2019

AE PROJECT No.	2020-3838-00
SCALE	1:36,000
APPROVED	
DATE	2021JULY
REV	
DESCRIPTION	ISSUED FOF REPORT



## APPENDIX B - SCADA REVIEW





**Figure B-1: Average Hourly Discharge Pressure (kPa)**

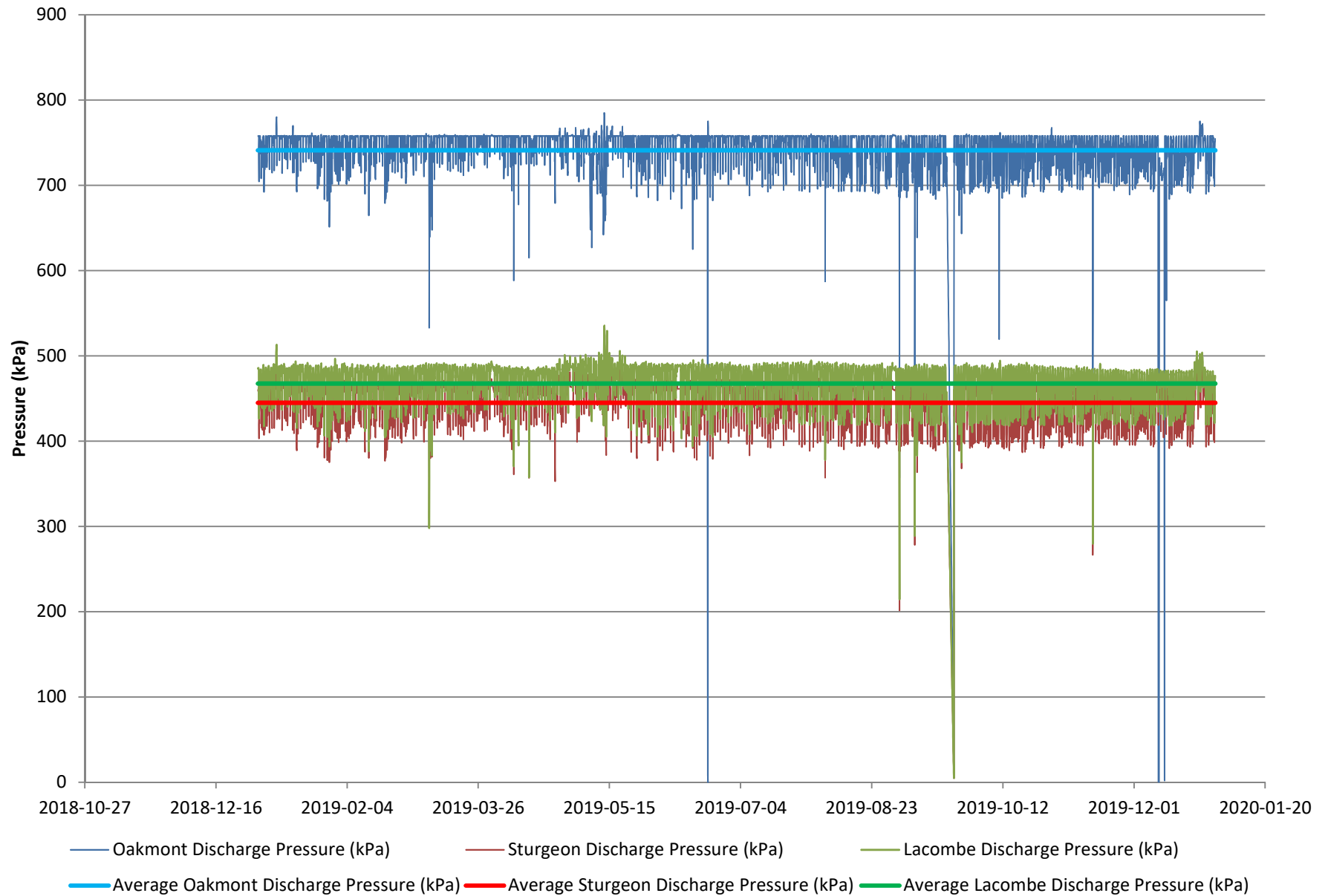


Figure B-2: Sturgeon Reservoir Pump Station - May 2019

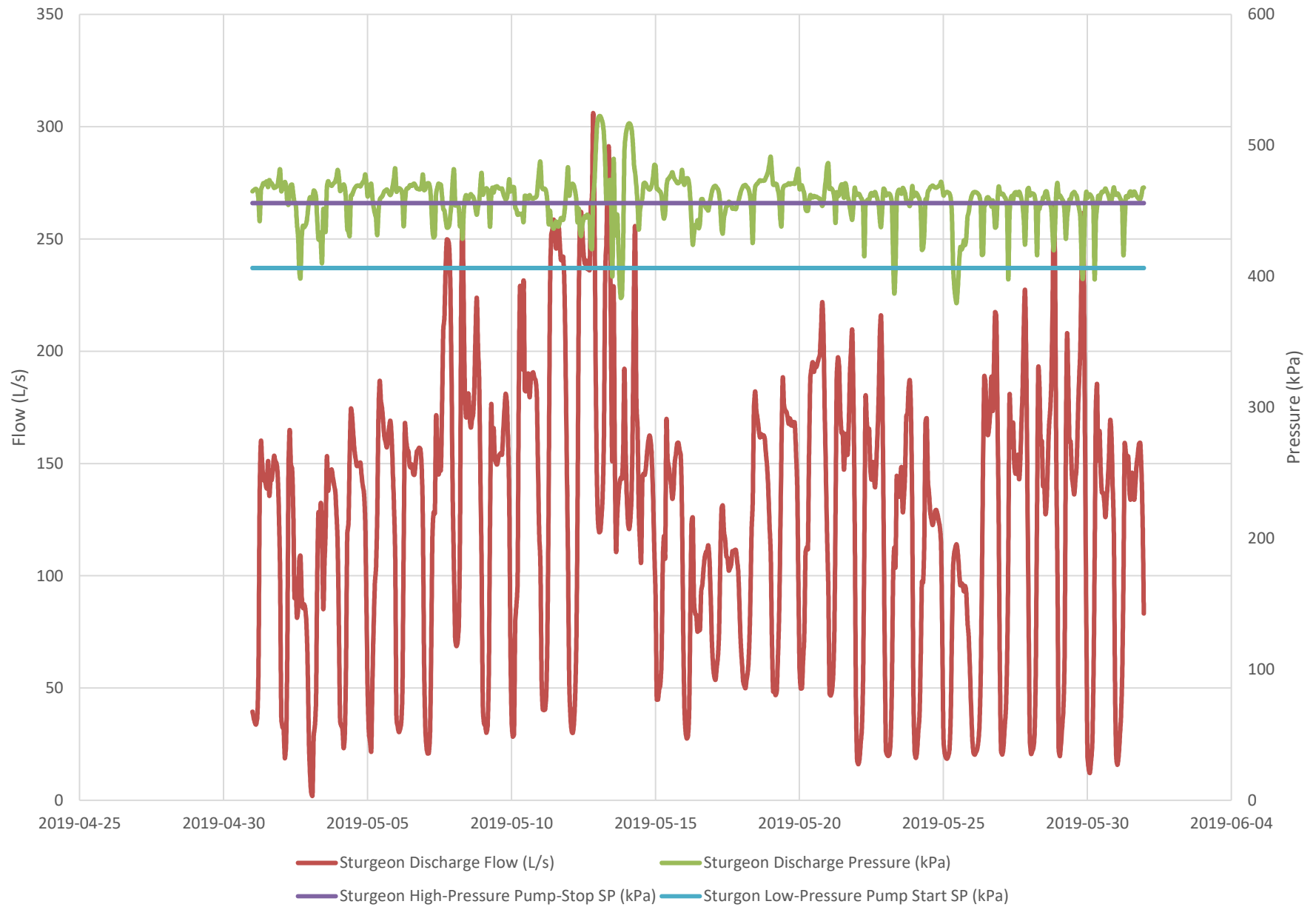




Figure B-3: Sturgeon Reservoir Pump Station - November 2019

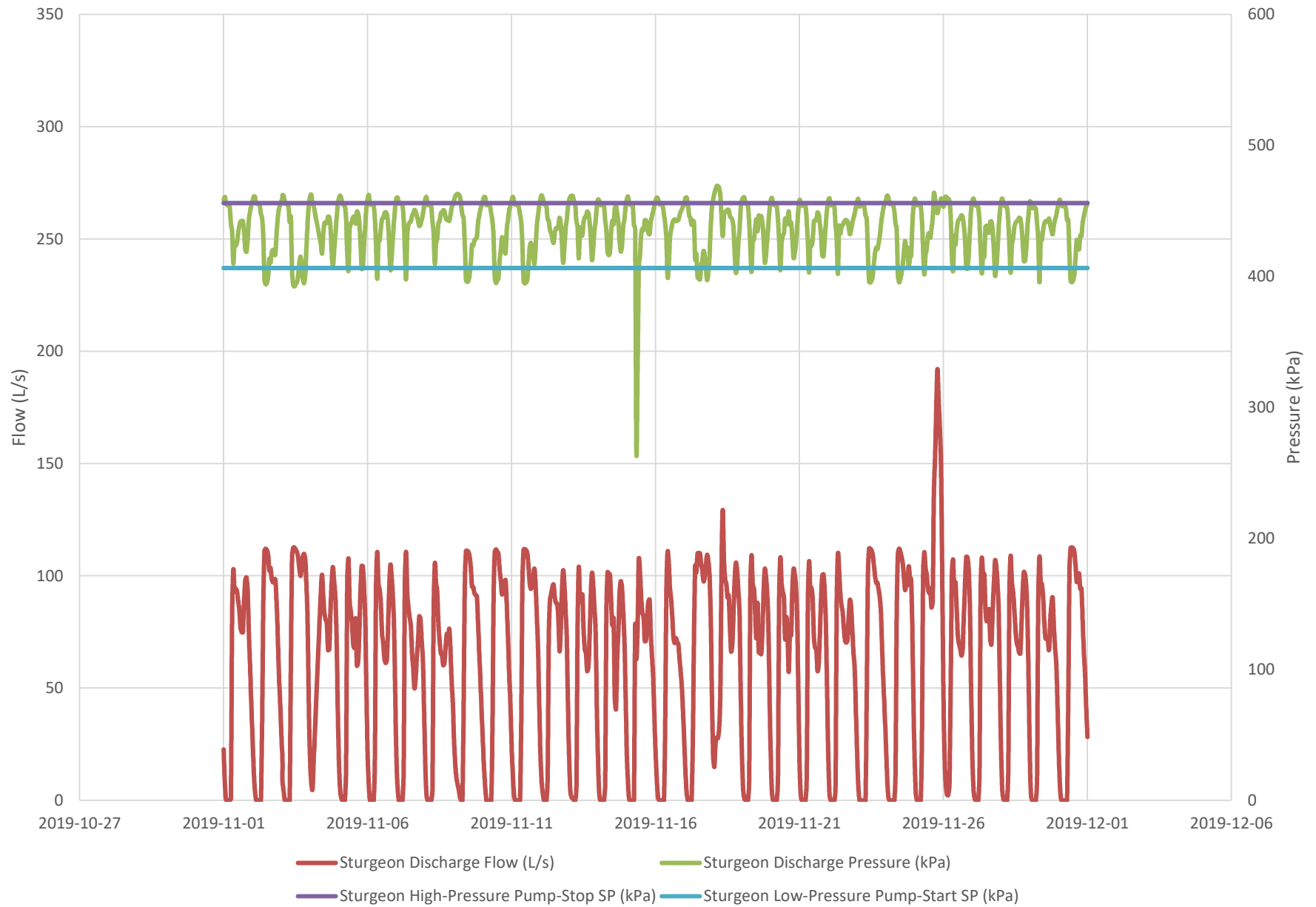


Figure B-4: Oakmont Reservoir Pump Station - February 2019

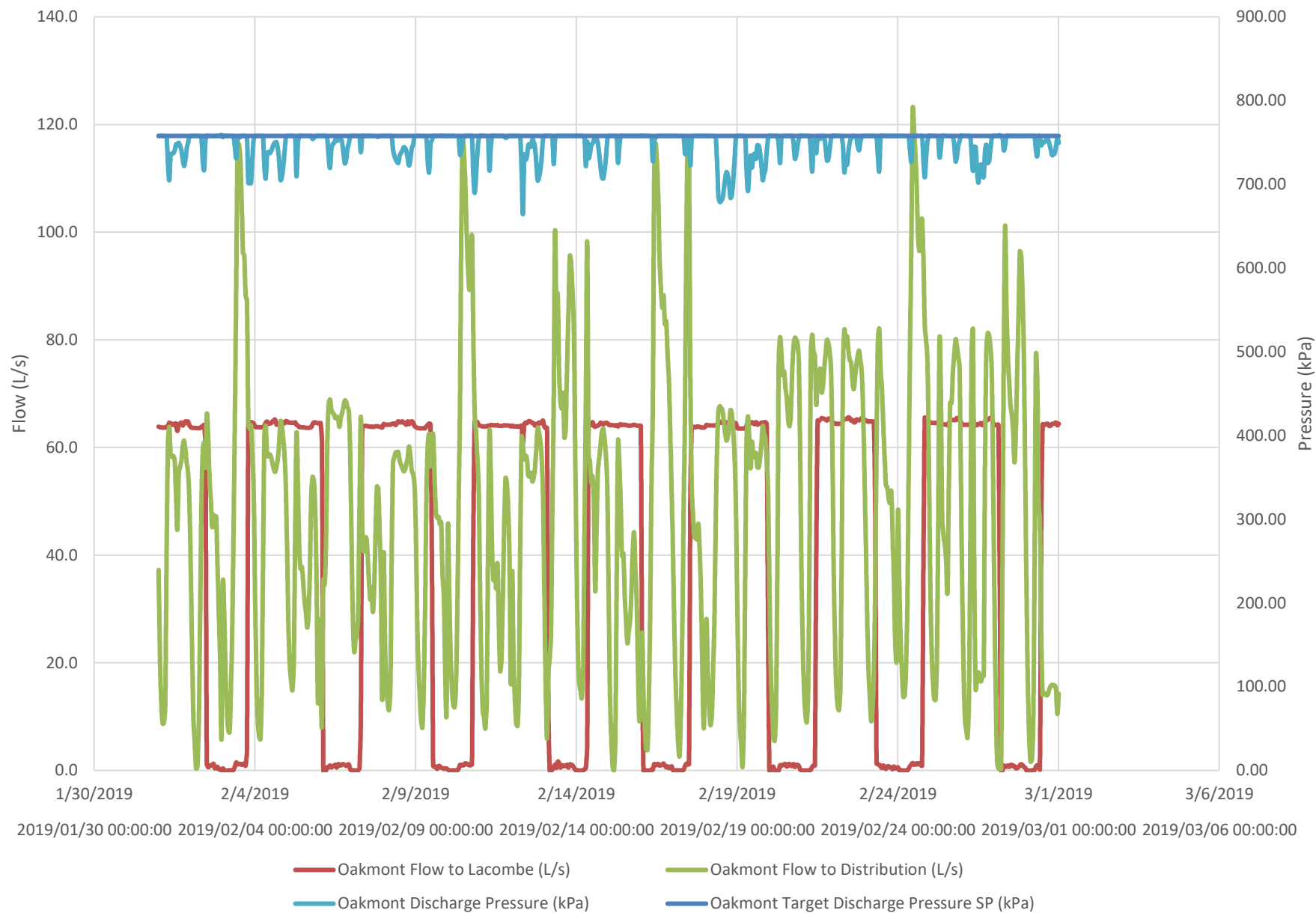




Figure B-5: Oakmont Reservoir Pump Station - July 2019

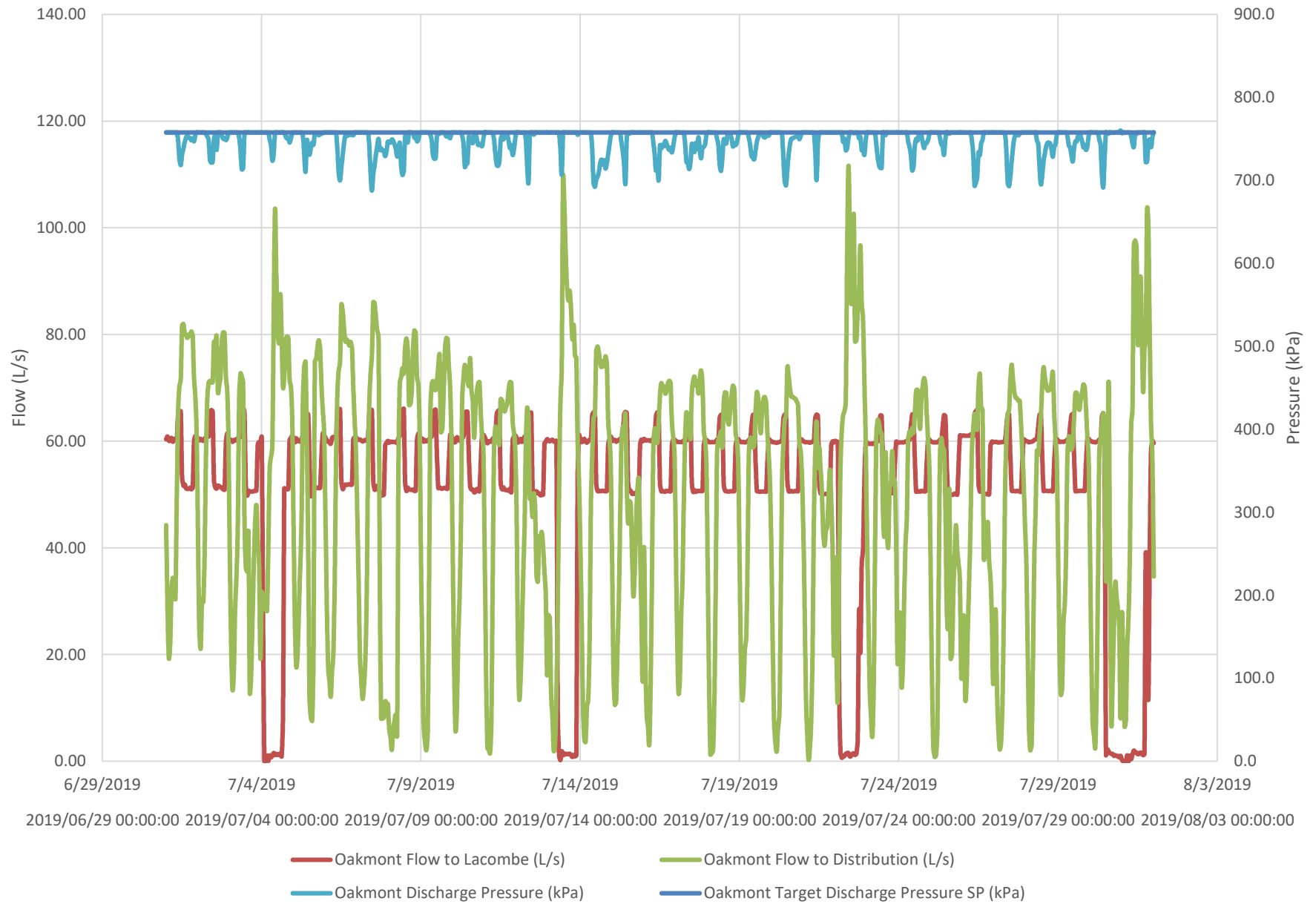


Figure B-6: Lacombe Reservoir Pump Station - February 2019

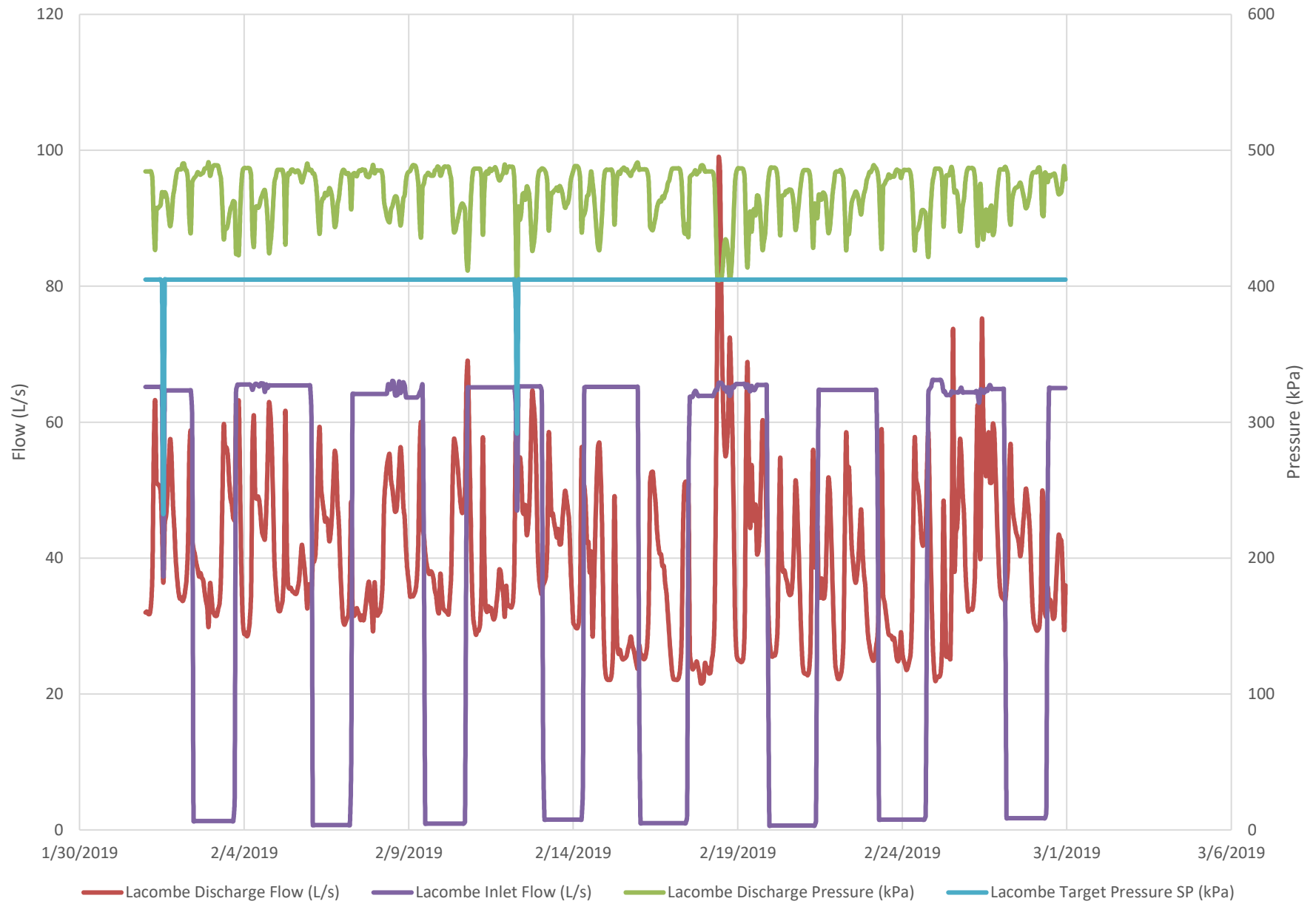
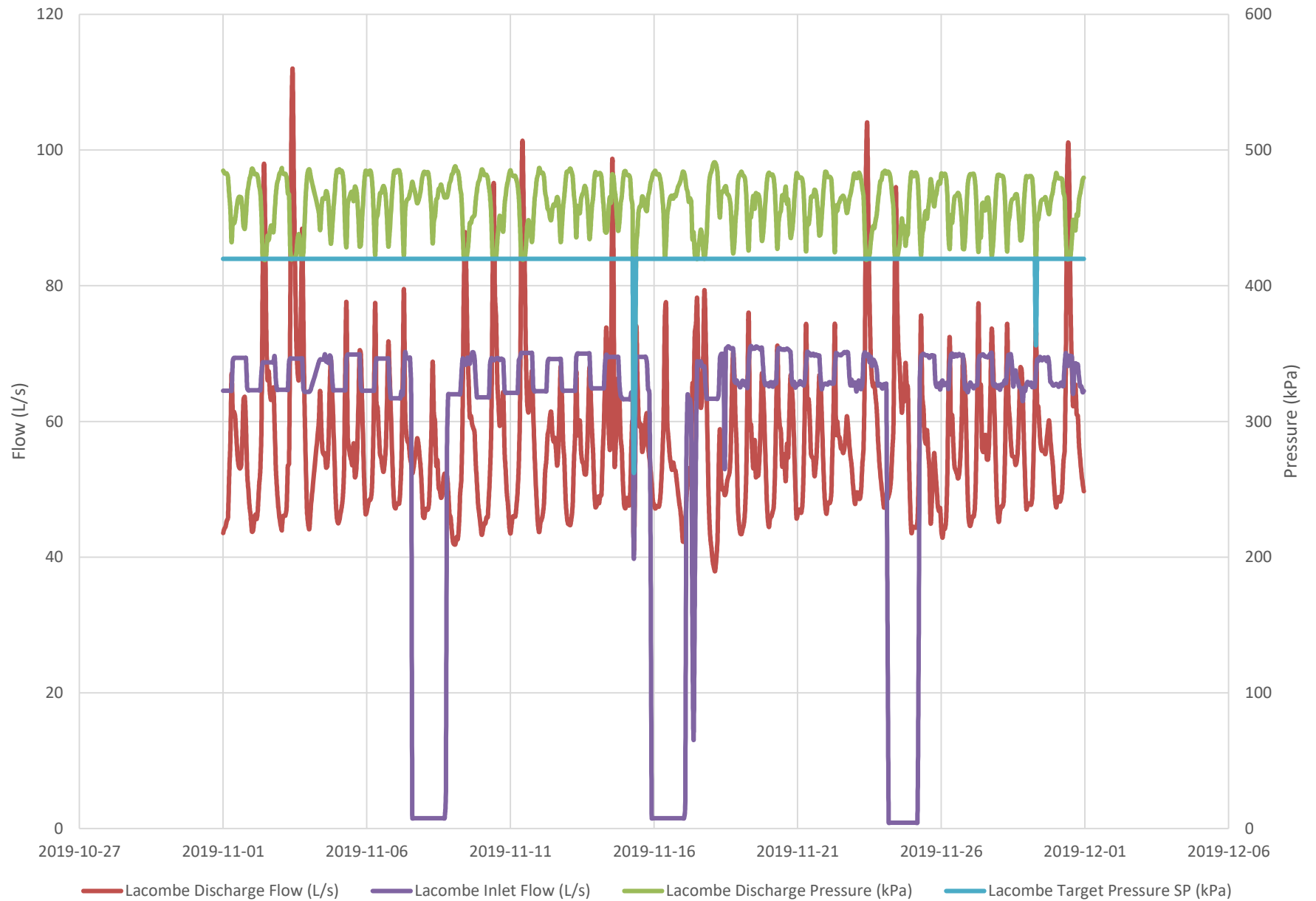




Figure B-7: Lacombe Reservoir Pump Station - November 2019



## APPENDIX C - COST ESTIMATE





City of St. Albert - Water Distribution System Master Plan Update  
Table 3-11 - PRV Update Table

PRV #	Address	Pressure Zone	2020 Survey Guage 1 (m)	2020 Survey Guage 2 (m)	2020 Survey Top of Pipe (m)	Prior PRV Gauge Reading <sup>3</sup> (psi)	Prior PRV Gauge Reading <sup>2</sup> (m)	2019 PRV Gauge Reading (psi)	2019 PRV Gauge Reading <sup>2</sup> (m)	Modelled Setpoint <sup>2,4</sup> (m)	Proposed Setpoint <sup>2</sup> (m)	Proposed Setpoint (psi)
21	90 Boudreau Rd.	100	<b>655.21</b>	655.47	655.17	85.2	715.2	86	715.8	715.5	713	82.1
17	34 Ironwood	100	<b>673.95</b>	673.92	673.83	58.6	715.2	59	715.5	715.5	713	55.5
16	79 Bellerose - High	100	<b>662.62</b>			75.1	715.5	56	702.1	715.5	713	71.5
	79 Bellerose - Low									N/A	709.5	66.6
19	9 Evergreen Cl.	102	<b>659.42</b>	659.20	659.82	91.2	723.6	91	723.5	724.2	716.4	80.9
24	Old Holes Site - High	102	<b>659.87</b>		659.80	86.8	721.0	92	724.7	724.2	716.4	80.3
	Old Holes Site - Low									N/A	712.9	75.3
18	1 Odessa Place	102	<b>677.13</b>			66.9	724.2	66	723.6	724.2	716.4	55.8
20	1 Oakdale	102	<b>675.93</b>		675.70	68.7	724.3	70	725.2	724.2	716.4	57.5
22	48 Oak Vista Drive	102	<b>669.45</b>		669.60	77.4	724.0	82	727.2	724.2	716.4	66.7
23	28 Oakcrest Terrace	102	<b>669.24</b>		669.13	78.2	724.3	78	724.2	724.2	716.4	67.0
15	375 St.Albert Rd.	103	Not surveyed, could not see from surface <sup>1</sup>			89.7		90		710.7	711	TBD
13	1 Madonna Dr.	103	<b>668.55</b>	668.43	668.40	60	710.8	60	710.8	710.7	711	60.3
12	13 St. Vital Ave.	103	<b>668.90</b>	668.90	668.97	60.3	711.4	58	709.7	710.7	711	59.8
14	71 Mission Ave.	103	<b>660.96</b>	660.94	661.09	70.5	710.6	72	711.7	710.7	711	71.1
9	42 Butterfield	104			<b>653.82</b>	80	710.2	80	710.2	710.8	711	81.2
8	49 Bradburn	104	<b>666.82</b>		666.85	62.6	710.9	63	711.2	710.8	711	62.7
7	60 Burnham Ave.	104	<b>664.34</b>	664.29	664.43	66	710.8	66	710.8	710.8	711	66.3
6	18 Burnham Ave.	104	<b>668.09</b>	668.10	668.19	60.9	711.0	60	710.3	710.8	711	60.9
4	6 Bernard Dr	104	<b>679.80</b>	679.73	679.85	44.1	710.9	50	715.0	710.8	711	44.3
5	29 Bishop St.	104	<b>674.52</b>	674.42	674.33	51.9	711.1	64	719.6	710.8	711	51.8
3	5 Perron St.	104	<b>654.36</b>	654.25	654.17			95	721.3	710.8	711	80.4
1	27 Sir Winston Ave	104	<b>656.30</b>	656.26	656.35	78.1	711.3	80	712.6	710.8	711	77.7
2(31) <sup>5</sup>	7 Tache	104	<b>651.61</b>		651.86	84.7	711.3	90	715.0	710.8	711	84.3
10	60 Woodlands Rd.	104	<b>659.17</b>	659.14	659.15	72.4	710.2	72	709.9	710.8	711	73.6
11	2 Waverly Dr.	104	<b>658.35</b>	658.30	658.47	74.3	710.7	70	707.6	710.8	711	74.8
25	50 Royal St - High	106	<b>657.85</b>		657.69			78	712.8	714.3	710	74.1
	50 Royal St - Low	106									706.5	69.1
30	Riverside 8 - High	106	<b>659.44</b>	659.39	659.51			80	715.8	714.3	710	71.8
	Riverside 8 - Low	-						-			706.5	66.8
26	31 Leveque Way - High	106	<b>668.19</b>		668.03	60	710.4	82	725.9	712.5	710	59.4
	31 Leveque Way - Low	106									706.5	54.4
27	8 Lachance Drive - High	106	<b>670.31</b>		670.13	57.2	710.6	60	712.6	712.5	710	56.4
	8 Lachance Drive - Low	106									706.5	51.4
28	Villemagne Road - High	106	<b>666.51</b>		666.34			64	711.6	712.5	710	61.7
	Villemagne Road - Low	106									706.5	56.8
29	Rodeo Drive	Riel	<b>654.44</b>	654.42	654.65	-	-	-	-	-	703.7	70.0

Notes: 1. Rim for PRV 15 is 654.99 m  
2. Elevations shown in bold were used to establish setpoint in metres  
3. Prior PRV Gauge readings are suspect due to level of precision  
4. Existing setpoints within zones vary, as such the Modelled Setpoint has been averaged or assumed  
5. Identified as PRV 2 in the table provided and PRV 31 in the GIS



Table C-1  
City of St. Albert  
Cost Breakdown - Water System

### Upgrades to Existing Watermains

Location	From	Start Node	To	Stop Node	Length (m)	Diameter (mm)	Unit Cost (\$/m)	Pipe Cost (\$)	Upgrade
Mission Avenue West		2400080		PRV 14	220	300	\$3,010	\$662,000	1
Mission Avenue East	St. Albert Trail	2100330	Rivercrest Crescent	J2239	101	300	\$3,010	\$304,000	2
St. Thomas Street	Perron Street	3900110	St. Albert Trail	J-649	91	300	\$3,010	\$274,000	3
Boudreau Road	North	J-653	South	4500180	35	300	\$3,010	\$105,000	4
Alpine Place	Alpine Blvd	4700140	East Alpine Place	4800080	110	300	\$3,010	\$331,000	5
Giroux Road	Hogan Road	156	Bellerose High School	1000340	450	300	\$3,010	\$1,355,000	6
Glenview Crescent	Grandin Road	5300220	Grandin Place	3900180	113	300	\$3,010	\$340,000	7
Sir George Simpson Junior High	Grosvenor Blvd	J2164	West of School	5600060	172	300	\$3,010	\$519,000	8
Total Upgrades to Existing Watermains								\$3,890,000	

### Upgrades to Existing Facilities

Item	Quantity	Unit Cost (\$/each)	Total Cost
Valve Removal	3	\$50,000	\$150,000
PRV Setpoint Check/Adjustments	1	Lump Sum	\$25,000
PRV Installation			
Kingswood Area	2	\$500,000	\$1,000,000
Riel Drive Area	4	\$500,000	\$2,000,000
PRV Removal	7	\$200,000	\$1,400,000
St. Vital Hydrant Installation	2	\$60,000	\$120,000
Bernard PRV Piping	8	\$2,800	\$22,000
Sturgeon Reservoir/Pump Station	23,000	\$1,000	\$23,000,000
Grandin Booster Decommission	1	Lump Sum	\$150,000
Henday Booster Decommission	1	Lump Sum	\$150,000
Total Upgrades to Existing Facilities			\$28,017,000

## Stage 1 Watermains

[illegible]

## Stage 1 Facilities

Item	Quantity	Unit Cost (\$/each)	Total Cost
PRV Installation			
Range Road 260	2	\$500,000	\$1,000,000
Riverside	1	\$500,000	\$500,000
Oakmont Pump Station Upgrades <sup>1</sup>			\$4,000,000
Total Stage 1 Facilities			\$5,500,000

## Stage 2 Watermains

[illegible]

## Stage 2 Facilities

Item	Volume (m³)	Unit Cost (\$/each)	Total Cost
North Reservoir/Pump Station	20,000	\$1,000	\$20,000,000
Total Stage 2 Facilities			\$20,000,000

## Stage 3 Watermains

[illegible]



Stage 3 Facilities

Item	Volume (m³)	Unit Cost (\$/each)	Total Cost
North Reservoir Expansion	12,000	\$1,000	\$12,000,000
PRV Installation			
Range Road 260	1	\$500,000	\$500,000
Southwest Emplment Lands	1	\$500,000	\$500,000
Total Stage 3 Facilities			\$13,000,000

Ultimate Watermains

Location	From	Start Node	To	Stop Node	Length (m)	Diameter (mm)	Unit Cost (\$/m)	Pipe Cost (\$)
Lorraine Crescent	Larose Drive	1000340	Giroux Road	J-4	300	450	\$3,490	\$1,047,000
Giroux Road	Bellrose School	J-4	Lockart Drive	J-5	310	350	\$3,160	\$980,000
Giroux Road	Lockart Drive	J-5	Durham Ave	1700030	390	300	\$3,010	\$1,174,000
West of Henday Industrial	Henday Ind. Park	GWL-J3	Riel Drive	J-252	3900	350	\$2,180	\$8,502,000
North Reservoir Distribution Main	North Reservoir	J-631		J-512	870	400	\$2,560	\$2,227,000
North Reservoir Dedicated Fill					5125	450	\$2,740	\$14,043,000
Total Ultimate Watermains								\$27,973,000

Ultimate Facilities

Item	Volume (m³)	Unit Cost (\$/each)	Total Cost
PRV Installation			
Range Road 260	1	\$500,000	500000
Total Ultimate Facilities			\$500,000

**Table C-2**  
**City of St. Albert**  
**Water Distribution System Unit Costs (\$/m)**

**Watermains**

Undeveloped Lands

Item	200mm	250mm	300mm	350mm	400 mm	450 mm	500 mm	600 mm
Topsoil Stripping and Stockpile (assume depth of 0.4m)	\$25	\$25	\$25	\$25	\$29	\$29	\$29	\$29
Trenching and backfilling	\$570	\$572	\$578	\$585	\$760	\$765	\$772	\$785
Pipe Zone Material	\$35	\$35	\$35	\$35	\$60	\$60	\$60	\$60
Supply and Install DR18 Pipe	\$305	\$335	\$392	\$460	\$540	\$635	\$737	\$949
Place Topsoil, compact and seed	\$35	\$35	\$35	\$35	\$43	\$43	\$43	\$43
Fire Hydrant (1 every 90 m)	\$170	\$170	\$170	\$170	\$170	\$170	\$170	\$170
Gate valve (1 per 100m 300mm down, 1 per 200m 400mm and up)	\$42	\$63	\$84	\$110	\$73	\$94	\$121	\$152
Fittings (Tees, Bends, Reducers, Plugs)	\$90	\$96	\$100	\$104	\$112	\$120	\$130	\$138
Miscellaneous (Mob/De-Mob, Survey, Signage) (10%)	\$127	\$133	\$141.90	\$152	\$179	\$192	\$206	\$233
Total Construction	\$1,399	\$1,464	\$1,561	\$1,676	\$1,966	\$2,108	\$2,268	\$2,559
Contingency (15%)	\$210	\$220	\$234	\$251	\$295	\$316	\$340	\$384
Engineering (15%)	\$210	\$220	\$234	\$251	\$295	\$316	\$340	\$384
Total	\$1,819	\$1,903	\$2,029	\$2,179	\$2,555	\$2,740	\$2,949	\$3,326
<b>Project Total (rounded)</b>	<b>\$1,820</b>	<b>\$1,900</b>	<b>\$2,030</b>	<b>\$2,180</b>	<b>\$2,560</b>	<b>\$2,740</b>	<b>\$2,950</b>	<b>\$3,330</b>

Developed Lands

Item	200mm	250mm	300mm	350mm	400mm	450 mm	500 mm	600 mm
Asphalt Pavement Removal	\$54	\$54	\$54	\$54	\$72	\$72	\$72	\$72
Granular Base Removal and and Replacement	\$70	\$70	\$70	\$70	\$92	\$92	\$92	\$92
Curb, Gutter and Sidewalk Removal	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
Trenching and Backfilling	\$570	\$572	\$578	\$585	\$760	\$765	\$772	\$785
Pipe Zone Material	\$35	\$35	\$35	\$35	\$60	\$60	\$60	\$60
Supply and Install DR 18 Pipe	\$305	\$335	\$392	\$460	\$540	\$635	\$737	\$949
Existing Pavement Repair	\$140	\$140	\$140	\$140	\$185	\$185	\$185	\$185
New Monolithic Curb, Gutter and Sidewalk	\$200	\$200	\$200	\$200	\$200	\$200	\$200	\$200
Fire Hydrant (1 every 90 m)	\$170	\$170	\$170	\$170	\$170	\$170	\$170	\$170
Gate valve (1 per 100m 300mm down, 1 per 200m 400mm and up)	\$42	\$63	\$84	\$110	\$73	\$94	\$121	\$152
Fittings (Tees, Bends, Reducers, Plugs)	\$90	\$96	\$100	\$104	\$112	\$120	\$130	\$138
Reconnect Services	\$231	\$231	\$231	\$231	\$0	\$0	\$0	\$0
Manhole/Valve/Catch Basin Adjustments	\$11	\$11	\$11	\$11	\$11	\$11	\$11	\$11
Miscellaneous (Mob/De-Mob, Survey, Signage) (10%)	\$196	\$202	\$211	\$221	\$232	\$244	\$259	\$285
Total Construction	\$2,154	\$2,219	\$2,316	\$2,431	\$2,547	\$2,688	\$2,849	\$3,139
Contingency (15%)	\$323	\$333	\$347	\$365	\$382	\$403	\$427	\$471
Engineering (15%)	\$323	\$333	\$347	\$365	\$382	\$403	\$427	\$471
<b>Project Total (rounded)</b>	<b>\$2,800</b>	<b>\$2,880</b>	<b>\$3,010</b>	<b>\$3,160</b>	<b>\$3,310</b>	<b>\$3,490</b>	<b>\$3,700</b>	<b>\$4,080</b>