

City of Chestermere

2024 Utility Master Plan

CA001027

CIMA+ file number: CA001027
08 May 2026 - Review FINAL Rev 1



CIMA+



City of Chestermere

CA001027

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1. Introduction

1.1 Authorization and Terms of Reference

In March 2023, the City of Chestermere retained CIMA+ to prepare an updated Utility Master Plan (UMP). This Utility Master Plan update will encompass a review of the water and wastewater infrastructure under existing conditions and constraints, as well as under future demands at growth projections of 25 Years and Full Buildout

This Utility Master Plan will assess the following infrastructure elements:

- Wastewater collection and transmission
- Water supply, treatment, storage and distribution

1.2 Background

This report was developed to assist the City's administrators to direct and plan for development, improve system utilization and plan for future upgrades. This study will also assist the City's Administrators to develop projects that will apply to the City's Offsite Levy Model.

A collection of existing infrastructure plans, studies and planning documents have been reviewed and incorporated into this study.

1.3 Objectives

The stated objectives of the Utility Master Plan are as follows:

- To prepare an initial Design Basis and Risk Assessment memo
- To conduct a detailed assessment of the existing water and sanitary systems' capacities. This will be done using real and historical data collected from the City of Chestermere's facilities and networks.
- To identify system deficiencies and provide recommendations for system improvements.
- To develop a servicing strategy for future growth and development for 25 Year and full buildout growth scenarios.
- To develop a list of capital projects that serve to improve system resiliency and facilitate development. The list will include a high-level estimated cost, an approximate timeline for implementation over the planning period, and inform on the application of these projects to the City's Offsite Levy Model.



Two additional objectives were established as the Utility Master Plan progressed:

- Assess interim wastewater servicing options for the East Acreages development area utilizing existing system capacity (Appendix B)
- Assess water and wastewater servicing options for the North Acreages development area utilizing existing system capacity. (Appendix C)

The results of these additional objectives were considered in the outcomes of this report.

1.4 Background Documentation

The following are some of the background reports and documents previously developed which aided in the process of this Utility Master Plan:

- 2017 Utility Master Plan (CIMA+)
- 2021 Utility Master Plan Amendment (CIMA+)
- 2021 Engineering Design and Construction Standards (City of Chestermere)
- 2023 Levy Support Water Infrastructure Technical Memorandum (HMR Engineering Inc.)
- 2023 Levy Support Wastewater Infrastructure Technical Memorandum (HMR Engineering Inc.)
- 2023 Chestermere Growth Projections (City of Chestermere)



2. Growth and Development Analysis

To assist the development of the Utility Master Plan, a technical memo outlining the water and wastewater demands design basis was prepared and finalized in November 2023. The full memo can be found in Appendix A - Design Basis Memo.

2.1 Growth Areas and Projections

CIMA+ worked with the City of Chestermere's planning staff to establish the anticipated growth in the City over the next 25 years and delineate the expected locations and gross developable area of the projected growth across the various offsite levy areas. The growth projections are intended to be very high level and are not intended to anticipate the precise locations of growth in each Offsite Levy Area.

These growth projections align with the City's Offsite Levy Model, with discrete growth in each of the 20 Offsite Levy Areas in the City.

Growth was divided into two horizons, 25 Years and Full Buildout of the annexation area. Projections were developed by City of Chestermere staff by analysing the previous rate of development through each of the OSL areas. Utilizing these development rates, the total development area was projected out to the 25-year horizon and the Full Buildout.

The OSL areas and the projected growth for each growth horizon can be seen on Figures 2.1 through 2.3 below.



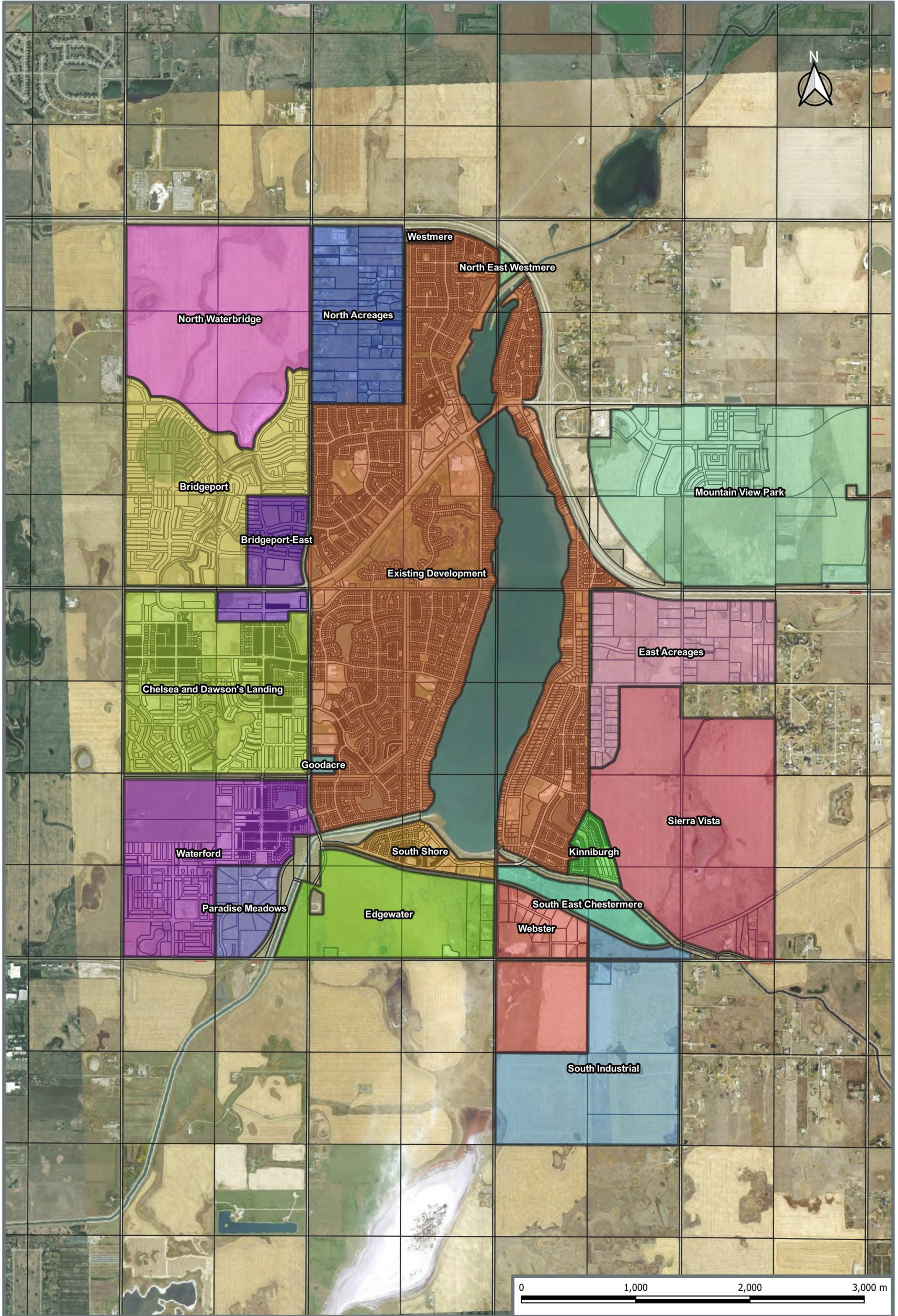


Figure 2.1 - OSL Levy Areas

Scale 1:30,000

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Figure 2.1 - OSL Levy Areas



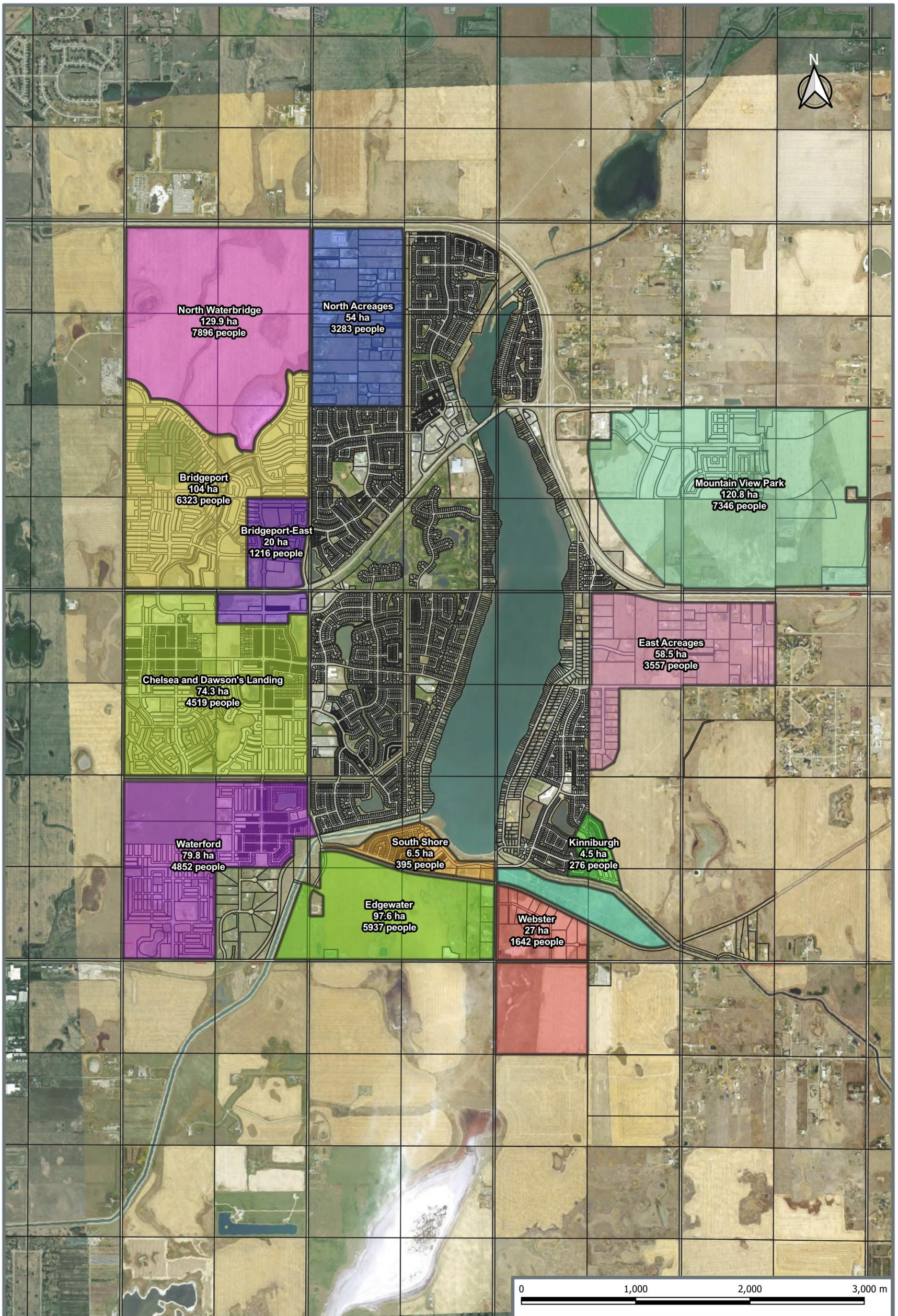


Figure 2.2 - OSL Levy Growth Areas 25 Year Horizon

Scale 1:30,000

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Figure 2.2 - OSL Growth Areas 25 Year Horizon



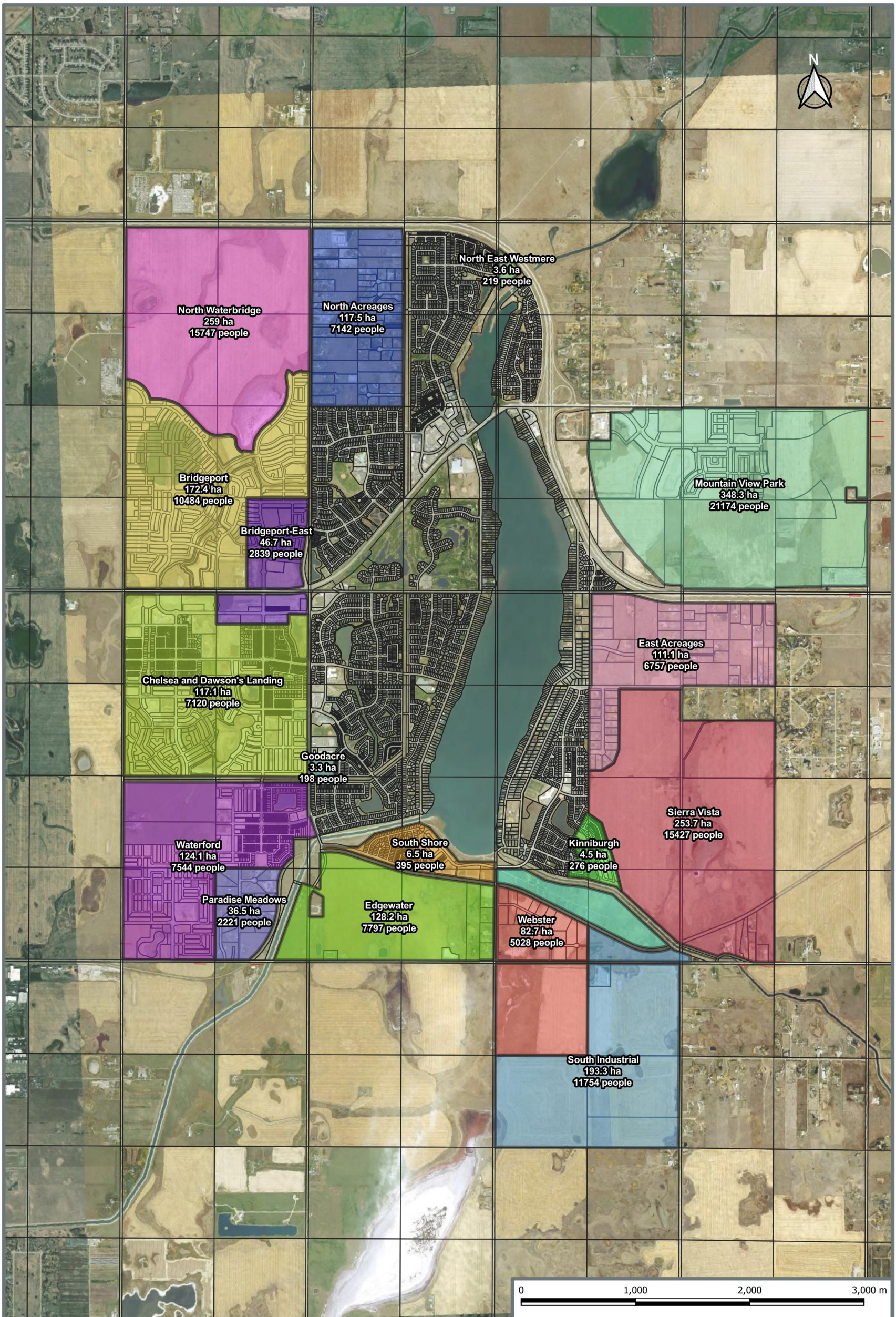


Figure 2.3 - OSL Levy Growth Areas Full Buildout Horizon

Scale 1:30,000

Figure 2.3 - OSL Growth Areas Full Buildout

As per engagement with the City, growth projections and subsequent water and wastewater demands will be developed using population equivalents for all growth in the City. This is represented as a population density, with 19 development units per gross developable hectare and 3.2 people per development unit, for a population density of 60.8 people per hectare.

The total net developable area for the 25 Year Horizon is 777 ha, and the Full Buildout is 2036 ha. Net Area excludes ER, 10% MR Allowance and Arterial ROW.

The following tables show the projected developable area and the additional population for each OSL area under each growth horizon.

Table 2.1 - OSL Area Growth Projections

OSL Area	Net Developable Area (ha)	Population	Net Developable Area (ha)	Population
	25 Year Horizon		Full Buildout	
Westmere	0	0	0	0
North Waterbridge	130	7,896	259	15,747
Chelsea & Dawson's Landing	74	4,519	117	7,120
South Shore	7	395	7	395
Edgewater	98	5,937	128	7,797
South Industrial	0	0	193	11,754
Kinniburgh	5	276	5	276
Sierra Vista	0	0	254	15,427
East Acreages	59	3,557	111	6,757
Mountain View Park	121	7,346	348	21,174
Goodacre	0	0	3	198
North East Westmere	0	0	4	219
North Acreages	54	3,283	117	7,142
Paradise Meadows	0	0	37	2,221
Existing Development	0	0	0	0
BridgePort	104	6,323	172	10,484
Waterford	80	4,852	124	7,544
South East Chestermere	0	0	27	1,642
BridgePort-East	20	1,216	47	2,839
Webster	27	1,642	83	5,028
Total	777	47,242	2,036	123,764

The following tables shows a summary of the growth projections for the City.



Table 2.2 - Growth Projections Summary

Growth Horizon	Gross Developable Area (ha)	Additional Population
25 Year	777	47,242
Full Buildout	2,036	123,764

2.2 Development Community Engagement

To facilitate consensus on the growth projections and design basis with the Chestermere area development community, CIMA+ and the City of Chestermere held roundtable meetings with members of BILD.

In these discussions, the methodology of developing the growth projections and design basis was outlined to BILD, whose members provided feedback and comments. This input was taken into consideration when preparing the UMP.

3. Water System

3.1 System Characterization

The City of Chestermere receives potable water from Calgary through two transmission mains. The water is stored in a single potable water reservoir and distributed throughout the city from this location.

3.1.1 Pipe Diameters and Materials

The water mains in Chestermere primarily consist of PVC piping. The following tables provide an overview of the distribution of the system by pipe diameter and material.

Table 3.1- Water Mains Diameter Distribution

Diameter (mm)	Length (km)	Percentage
100	0.9	1%
150	9.9	9%
200	45.2	40%
250	27.8	25%
300	19.2	17%
400	4.1	4%
500	2.7	2%
UNK	3.2	3%
Total	113.1	

Table 3.2 - Water Mains Material Distribution

Material	Length (km)	Percentage
PVC	109.1	96%
HDPE	0.6	0%
UNK	3.4	3%
Total	113.1	

The existing water system can be seen in the following Figure 3.1



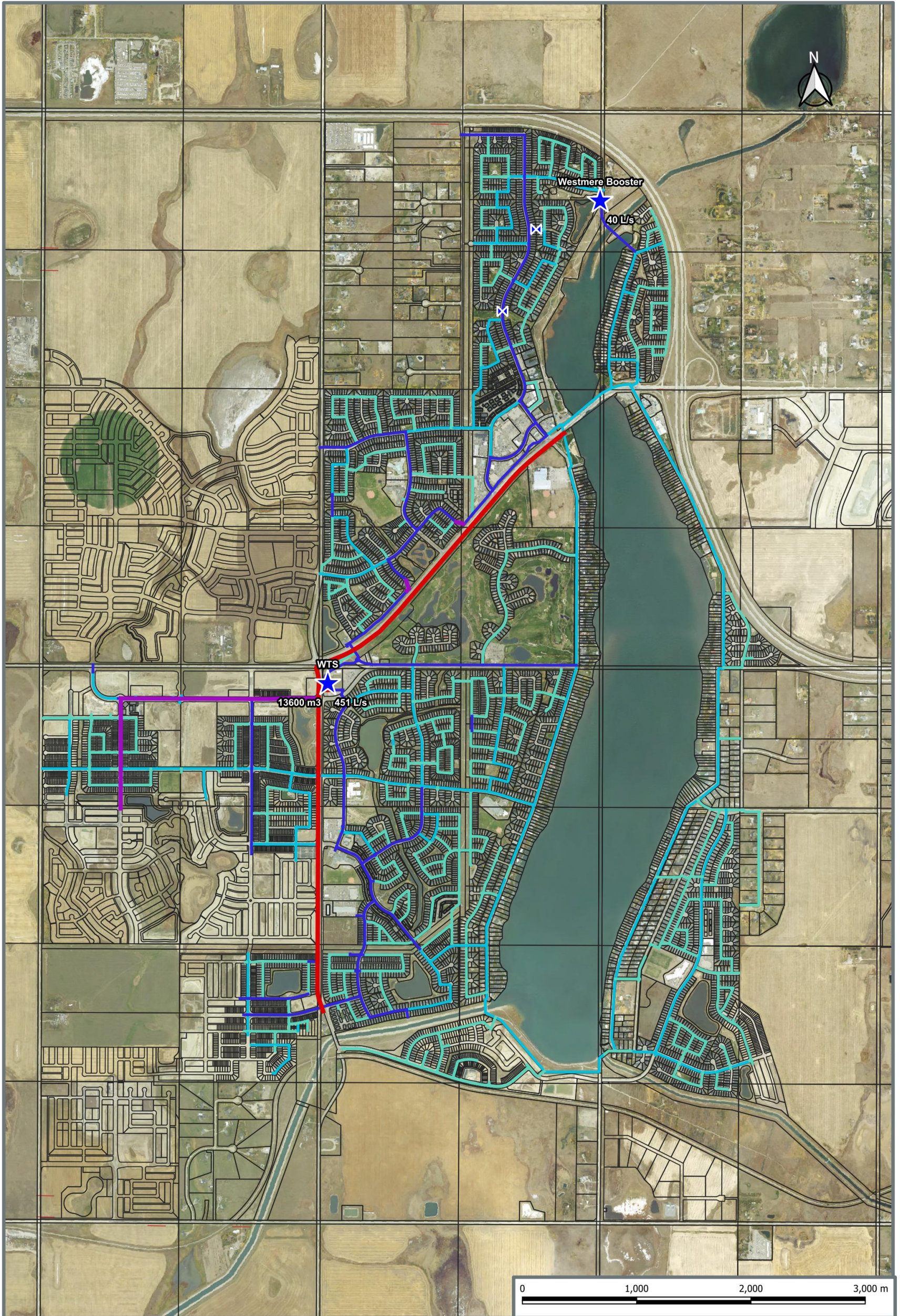


Figure 3.1 - Existing Water System

Scale 1:30,000

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- 200 mm — 350 mm ⇄ PRV
- 250 mm — 400 mm ★ Reservoir / Pump Station
- 300 mm — 500 mm

Figure 3.1 - Existing Water System

3.1.2 System Elevations and Pressure Zones

Chestermere currently has two pressure zones. The Main Pressure Zone consists of the majority of the current water distribution system, and is supported by the Water Transfer Station, which is the main pump station in the City. The second pressure zone is the Westmere Pressure Zone, which is located on the north side of the City.

The Westmere Pressure Zone is supported by the Westmere booster station and reverse flow pressure reducing valves which help provide fire flow.

The following table shows the elevation ranges of the two pressure zones.

Table 3.3 - Existing Pressure Zones

Pressure Zone	Low Elevation (m)	High Elevation (m)
Main	1025	1045
Westmere	1030	1053

When development occurs above the 1045 m elevation, which is the current limit of the Main Pressure Zone, a new pressure zone will be required with an additional pump station. This will be designated as the High-Pressure Zone.

3.1.3 Water Supply

Water is supplied to Chestermere through two transmission lines from Calgary:

- A 300 mm line along 17th Avenue, entering the city from the west at a transfer point on the northwest side of TWP 284 and Chestermere Boulevard.
- The East Calgary Regional Water Line (ECRW), which is 750/900 mm in diameter, enters through two approved transfer points. The first point is on the northwest side of Rainbow Road and TWP 240, while the second—currently unused—is located at TWP 240 and Range Road 281.
- A 400 mm - 500 mm along Rainbow Road which tees from the ECRW to fill the Main Reservoir. Modelling indicated this line has an approximate capacity of 310 L/s

The smaller 300 mm line provides a minimum capacity of 145 L/s at 365 kPa (53 psi) at the transfer point, up from a previous capacity of 110 L/s as per a recent agreement with the City of Calgary. The ECRW provides a maximum allotment of 272 L/s, bringing the total available supply capacity to 417 L/s. This configuration is depicted in Figure 3.2.



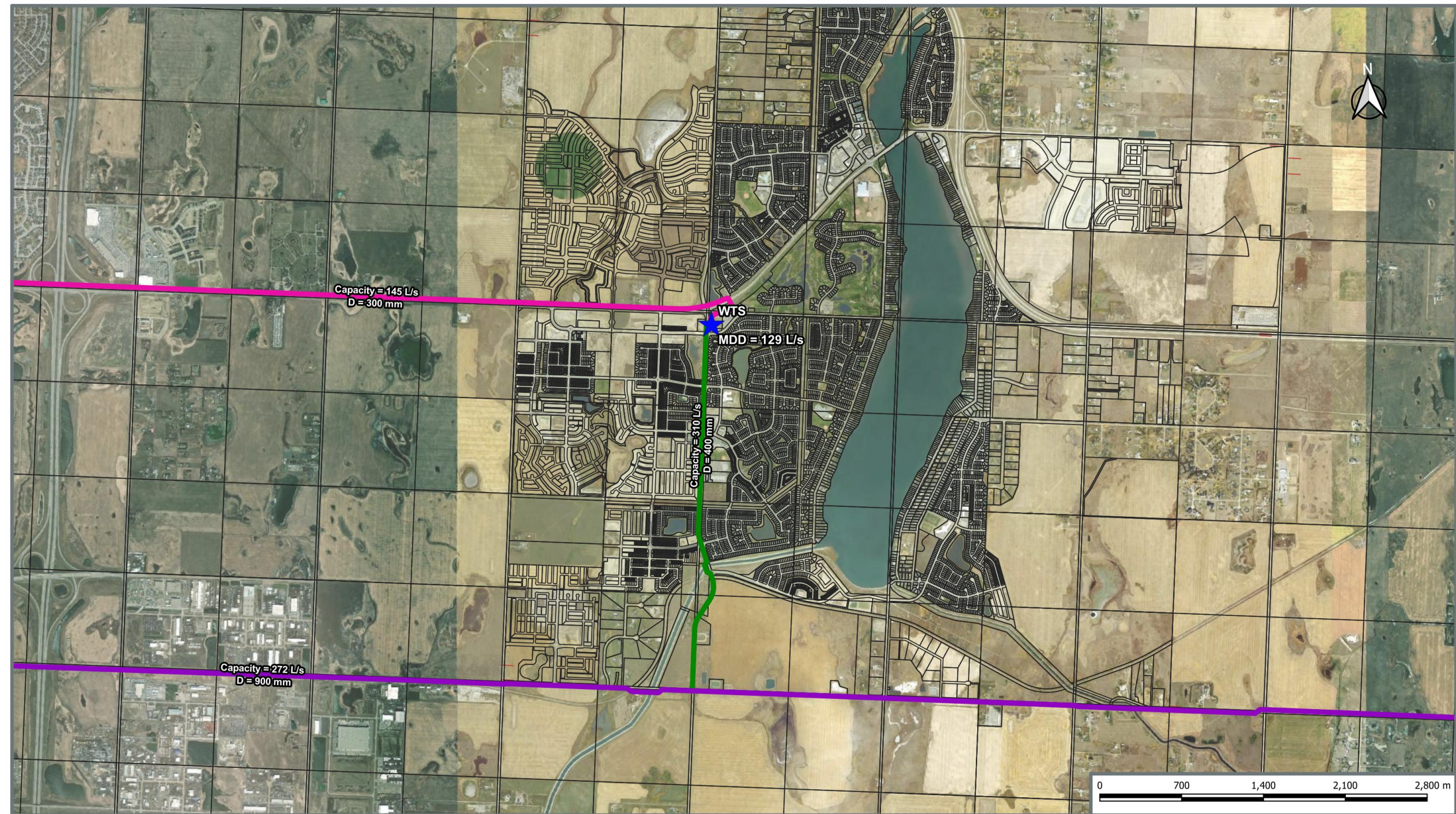


Figure 3.2 - Existing System Water Supply

Scale 1:30,000

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- ECRW
- RAINBOW ROAD
- 17TH AVE

Figure 3.2 - Existing Water Supply



3.1.4 Potable Water Storage

Chestermere currently has one potable water storage reservoir with four cells, located at the Water Transfer Station (WTS) at the southeast corner of Rainbow Road and Chestermere Boulevard. The total storage volume is 13,600 m³.

3.1.5 Water Distribution System

The City of Chestermere operates two pump stations:

1. Main Pump Station: Located at the Water Transfer Station, this station is responsible for distributing water throughout the Main Pressure Zone.
2. Westmere Booster Station: This station helps support the Westmere Pressure Zone and draws water directly from the Main Pressure Zone

3.2 Water Demand Analysis

CIMA+ prepared a design basis memorandum (DBM) in December 2023 to support the development of the Utility Master Plan (UMP). The technical memo established the design basis that was used to assess the existing and future systems, primarily in relation to anticipated water demands for both the existing and future systems, as well as metrics to assess the performance of the system. This included water supply, storage, and distribution.

The Design Basis Memo is included in Appendix A and is summarized in Sections 3.2 and 3.3 for the water system.

3.2.1 Existing Water Demands

Existing average day water demands were developed by assessing the total volume of water distributed to the City over a period of several years, in order to develop the Average Daily Demand.

The following table shows the system wide average day demand.

Table 3.4 - Existing System Average Day Demands

Year	Annual Demand (m ³)	Average Daily Demand (m ³)	Average Daily Demand (L/s)
2020	1,962,501	5,362	62
2021	2,061,510	5,648	65
2022	2,071,288	5,675	66
Average	2,031,766	5,562	64



Max Day Demand (MDD) and Peak Hour Demand (PHD) were assessed through review the historical SCADA data from the Main Pump Station flow meter from previous years. Using these values averages across the previous three years, the MDD and PHD peaking factors for the existing system were determined.

Table 3.5 - Existing System MDD and PHD

Year	Max Day (L/s)	Peak Hour (L/s)	MDD PF	PHD PF
2020	113	199	1.8	3.2
2021	134	239	2.0	3.7
2022	120	209	1.8	3.2
Average	122	216	1.9	3.4

These demands were then be assigned to the hydraulic model through geolocated customer water meters data, which has been scaled such that the total volume of consumption is equivalent to the total volume of distribution. This accounts for any water losses in the water distribution system, or any unaccounted-for flows. The scaled customer water meter data was added to the nearest node in the model.

The following table shows the total volume of customer metered data against the total volume of water distribution, and the scale factor applied to the metered data.

Table 3.6 - Customer Meter Data Scale Factor

Year	Distribution (m ³)	Consumption (m ³)	Scale Factor
2021	2,061,510	1,700,319	1.2
2022	2,071,288	1,836,602	1.1
Average	2,066,399	1,768,461	1.2

3.2.2 Future Water Demands

Future water demands will be assessed using a per capita unit demand, which will act as a composite demand for all land uses. Population projections for each OSL area will determine the water demands and be added into the model evenly across future developable areas for each OSL area under each growth horizon.

The population of Chestermere for the previous three years was provided by the City. Dividing the average daily demand by the current population results in the per capita demand, which will be used to project future demands.

Peaking factors for Max Day Demand and Peak Hour Demand will be 2x ADD and 3.7x ADD respectively, as per the current design guidelines.



Table 3.7 - Future Water Demand Unit Rates

Year	Annual Average Demand (m ³ /day)	Population	Per Capita (L/c/day)
2020	5362	21,372	251
2021	5648	22,166	255
2022	5675	23,626	240
Average	5562	22,388	249

The recommended per capita unit rate for determining future water demands is 250 L/c/day. The following table shows the system wide additional water demands for each growth horizon.

Table 3.8 - Future Water Demands

	City Population	ADD (L/s)	ADD (m ³ /day)	MDD (L/s)	MDD (m ³ /day)	PHD (L/s)
Existing	23,626	64	5,562	129	11,123	238
25 Year	70,868	201	17,372	402	34,744	744
Full Buildout	147,390	422	36,503	845	73,005	1561

3.3 Design Criteria

3.3.1 Water Demands Criteria

As described in Section 3.2, historical water demands were reviewed to determine the water demand criteria that will be used to assess the system. Peaking factors for Maximum Day Demand (MDD) and Peak Hour Demand (PHD) were determined using historical data from the existing system. The criteria developed for this report for both existing and future demands are as follows:

- MDD = 2.0x ADD
- PHD = 3.7x ADD

3.3.2 Water Supply Requirements

The water supply from Calgary should be able to support the Maximum Day Demand flows with all water lines in service.

3.3.3 Level of Service Criteria

The following are the level of service requirements for the water distribution system during low water usage and peak hourly demand. There were no revisions from the previous UMP and are in line with the Engineering and Design Guidelines.



- Minimum system pressure: 275 kPa (40 psi)
- Maximum system pressure: 550 kPa (80 psi)
- Maximum velocity in system: 3.0 m/s

3.3.4 Available Fire Flow Criteria

The following are the available fire flow requirements. The water distribution system should be able to support these fire flows for each land use under MDD conditions.

- Residential areas without Multi-Family unit dwellings: 83 L/s for 2.0 hours
- Residential areas with Multi-Family unit dwellings: 120 L/s for 2.5 hours
- Industrial, Commercial and Institutional (ICI) land uses: 220 L/s for 2.5 hours
- Minimum residual pressure of 140 kPa (20 psi) during fire flow

3.3.5 Water Distribution Pumping Requirements

Alberta Environment and Protected Areas requires that a water distribution pumping system should be able to provide the greater of PHD or MDD + Fire Flow.

AEPA also requires that the water distribution system facility be designed to deliver maximum design flow with the largest pump out of service to maintain system redundancy.

3.3.6 Water Storage Requirements

It is recommended to adopt the City of Calgary standard of 1x ADD when assessing storage reservoirs.

Additional reservoir capacity is required to mitigate the risks of a supply line disruption when ADD flows exceed the capacity of the City's water supply with the largest supply line out of service. The additional reservoir capacity should have a volume of 2x the deficit of flows when that occurs. This will give the City an effective 2x ADD of combined storage and water supply when the largest supply line is out of service. The storage requirement is similar to Strathmore's, which requires 2x ADD storage and has no redundant water supply line. After a population of approximately 50,000 people, this additional storage would be necessary.

As an example, the smaller supply line has a capacity of 145 L/s. If the ADD is 160 L/s, then two times the 15 L/s deficit would result in an additional required capacity of 2,600 m³ in the storage reservoir alongside the 1x ADD.

In comparison, the previous UMP design criteria required the AEP storage calculation plus 3x the deficit of ADD and the capacity of the water supply with the largest line out of service. When comparing the previous UMP storage calculations to the revised design criteria, significantly less storage is required.



3.4 Hydraulic Model Development

3.4.1 Existing Water Model Update

In 2020/2021 CIMA+ updated the City's hydraulic water model previously developed for the 2016 UMP using the software Bentley WaterCAD. The water model was updated again for the 2024 Utility Master Plan using the most recent GIS provided by the City, including water lines, PRVs, and pumping stations. Asset information such as pipe diameters and materials were updated, and new assets were included.

Pump curves for pumping and booster stations, PRV settings and reservoir elevations were carried over from the previous model and verified against record information.

The water demands were updated using the previous three years of geolocated customer water meter data, which were scaled to match the total water distribution volume using a loss factor of 1.2, as discussed in Section 3.2.1. These demands were assigned to the nearest node in the water model, resulting in proportional demands across the system that summed to the system wide ADD of 64 L/s, as shown in Table 3.4.

ADD, MDD and PHD demand scenarios were established based on the existing system peaking factors.

3.4.2 Future Water System

The growth projections have individual population projections for each of the OSL areas. The breakdown for each of the OSL areas can be found in Section 2.1. The unit demands described in Section 3.2.2 were set up in the hydraulic model. Four demand scenarios were developed, covering the two growth horizons for each of the growth projection options under Max Day Demand + Fire Flow and Peak Hour Demand.

As the exact phasing of the future development areas are unknown, the future water system was built out using 300 mm water lines along quarter section boundaries. Developers will be required to validate the level of service each phase of development will provide on a case by case basis.

Under each growth horizon, the projected population for each OSL area was distributed evenly across the water network in the area.

Peaking factors for future demands were 2x ADD for MDD, and 3.7x ADD for PHD.



3.5 Existing System Evaluation

3.5.1 Water Supply Analysis

The two water supply lines in Chestermere have a combined maximum flow rate of 417 L/s. Using the established design criteria for 2024, as shown in Table 3.8, the MDD is 129 L/s. Therefore, the current water supply is adequate for the existing system.

With the smaller water supply line having a capacity of 145 L/s, the existing system can currently be supported from a single line in the case of an emergency.

3.5.2 Water Storage Analysis

The total volume of potable water storage in Chestermere is 13,600 m³. As per the design criteria, the total storage requirements are one day of volume at ADD, with additional storage required when the MDD of the system exceeds the capacity of the water supply with the largest line out of service. As indicated in Section 3.5.1, the current smaller 300 mm supply line has sufficient capacity to support the existing MDD of the system. As such, the existing storage only needs to meet the daily ADD under the new design criteria.

The ADD of the system is 64 L/s, which is 5530 m³/day. The current reservoir volume can accommodate the existing system.

3.5.3 Pump Station Analysis

Main Pump Station

As per Section 3.1.5, the Main Pump Station has a current pumping capacity of 451 L/s with the largest pump out of service. The pump station must be able to supply the greater of Max Day Demand + Fire Flow (MDD+FF), or Peak Hour Demand (PHD).

As shown in Table 3.8, the existing system MDD is 129 L/s, and the highest level of available fire flow is 220 L/s, for a total MDD+FF of 349 L/s. The current PHD is 238 L/s. As such, the existing pump station has adequate pumping capacity for the current water demands.

The following table summarizes the pump station analysis.

Table 3.9 - Existing System Main Pump Station Analysis

Demand Scenario	Flow (L/s)	Pumping Capacity (L/s)
MDD+FF	349	451
PHD	238	



Westmere Pump Station

As the Westmere Pressure Zone has a booster pump supporting it, the Westmere area was assessed separately. The booster pump supports the non-fire flow demands in the area, and the PRVs along Marina Dr provide fire flows by allowing reverse flows through it when there is sufficient pressure drop. As such only the PHD of the zone will be used to assess the pump station. The demands of the Westmere Pressure Zone were reviewed in the water model, and the area was determined to have PHD of 23 L/s. This is within the current pumping capacity of 40 L/s.

3.5.4 Level of Service Analysis

Figure 3.3 shows the hydraulic model results for the existing system at Peak Hour Demand. Pressure nodes that are below the standard minimum pressure requirement of 275 kPa (40 psi) are shown in red. Pressures above the 550 kPa (80 psi) limit are shown in purple.

Under Peak Hour Demand, all of the existing water network are within the level of service design criteria, with no pressure deficiencies identified with the exception of the eastern side of South Shores. Pressures above 80 psi are predicted in areas below the Low elevation of the Main pressure zone of 1025 m. Areas with an elevation below this will require Pressure Reducing Valves on service lines.

3.5.5 Fire Flow Analysis

Figure 3.4 shows the hydraulic model results for the MDD+Fire Flow scenario. The water model was used to calculate the available fire flow at each node while maintaining at least 138 kPa (20 psi) residual at every point in the distribution system. The nodes are color coded corresponding to whether the fire flow requirements were met, based on the surrounding land use.

In general, the Town's water distribution network meets the available fire flow requirements when compared against land use, with some minor exceptions.

- North side of Westmere are very minorly below the multifamily land use requirement of 120 L/s, with values in the 113-115 L/s range.
- The area around East Lake School is below the ICI land use requirement of 220 L/s, with values of approximately 145 L/s.
- In all these cases, future connectivity through growth resolves these deficiencies.

There are also isolated cul-de-sacs with fire flows below the minimum standard, these are due to small diameter (100 mm) dead end mains, which are hydraulically restrictive. Future asset renewal plans should consider a minimum pipe size of 150 mm.





Figure 3.3 - Existing System Peak Hour Demand Pressure

Scale 1:20,000

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- Water Lines
- < 40 psi
- 40 psi - 80 psi
- > 80 psi

Figure 3.3 - Existing System PHD



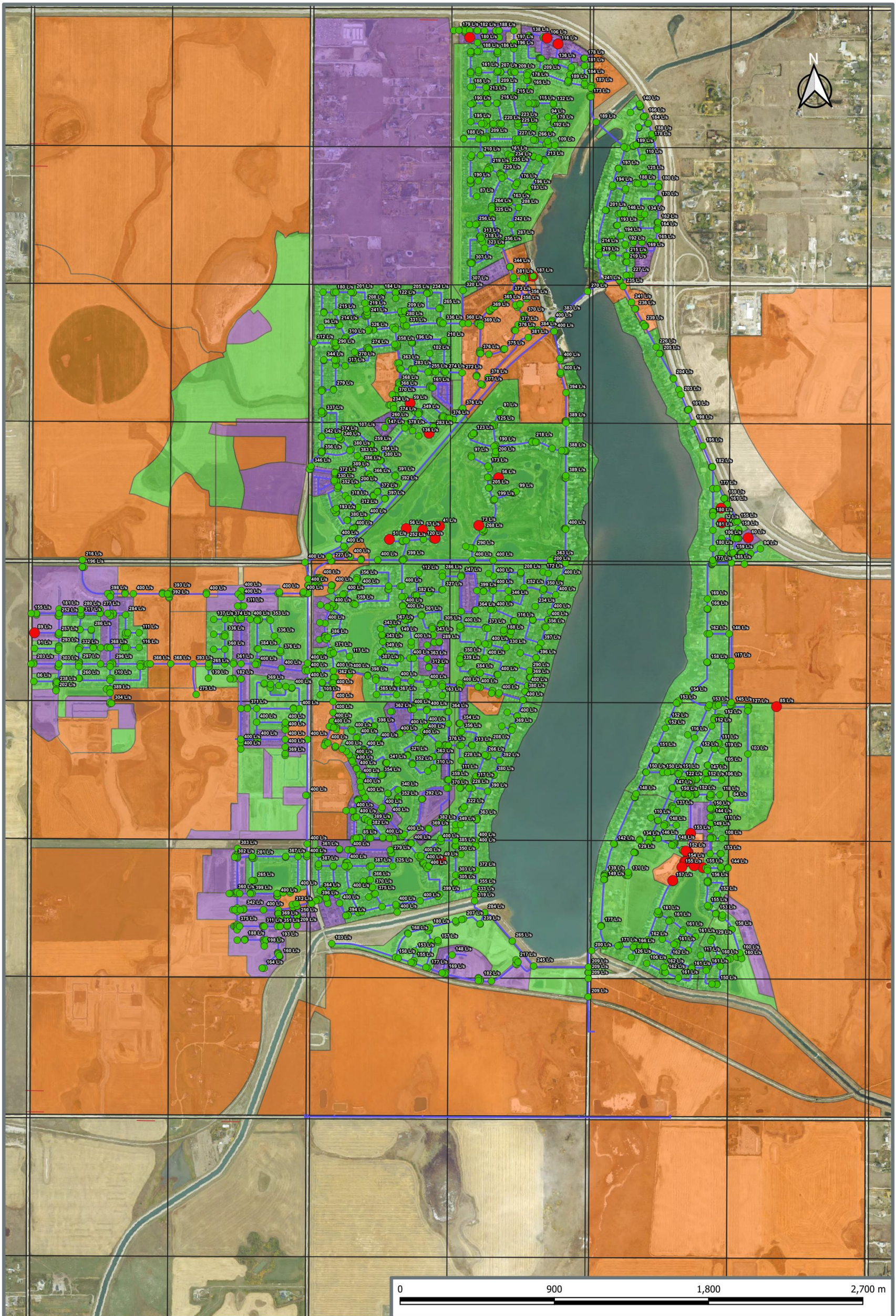


Figure 3.4 - Existing System Available Fire Flow

Scale 1:20,000

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- Water Lines
- Does Not Meet Fire Flow Constraints
- Meets Fire Flow Constraints
- 83L/s Fire Flow (Single Family)
- 120 L/s Fire Flow (Multi Family)
- 220 L/s Fire Flow (ICI)

Figure 3.4 - Existing System MDD+FF



3.6 Future System Evaluation

Each element of the future system will be assessed under the two growth horizons, the 25 Year Horizon and the Full Buildout Horizon. Where system upgrades are required prior to the completion of a horizon, the incremental growth required to trigger the upgrade will be identified, along with the impacted OSL areas.

3.6.1 Future Distribution System

The proposed future water distribution network for the City will contain an offsite component that creates a 500 mm diameter trunk line that encircles the city. The following are the remaining sections required to complete the loop:

- Rainbow Rd from Waterford Blvd to Twp Rd 240 - 1.3 Km
- Twp Rd 240 from RR 282 to RR281 - 1.2 km
- RR 281 from Twp Rd 240 to Clearwater Park - 4.0 km

Note at the time of writing of this report the 500 mm diameter from Rainbow Road to Clearwater Park along Chestermere Blvd is under construction.

Figures 3.6 and 3.7 show the high-level water networks for the 25 Year Horizon and the Full Buildout horizon.



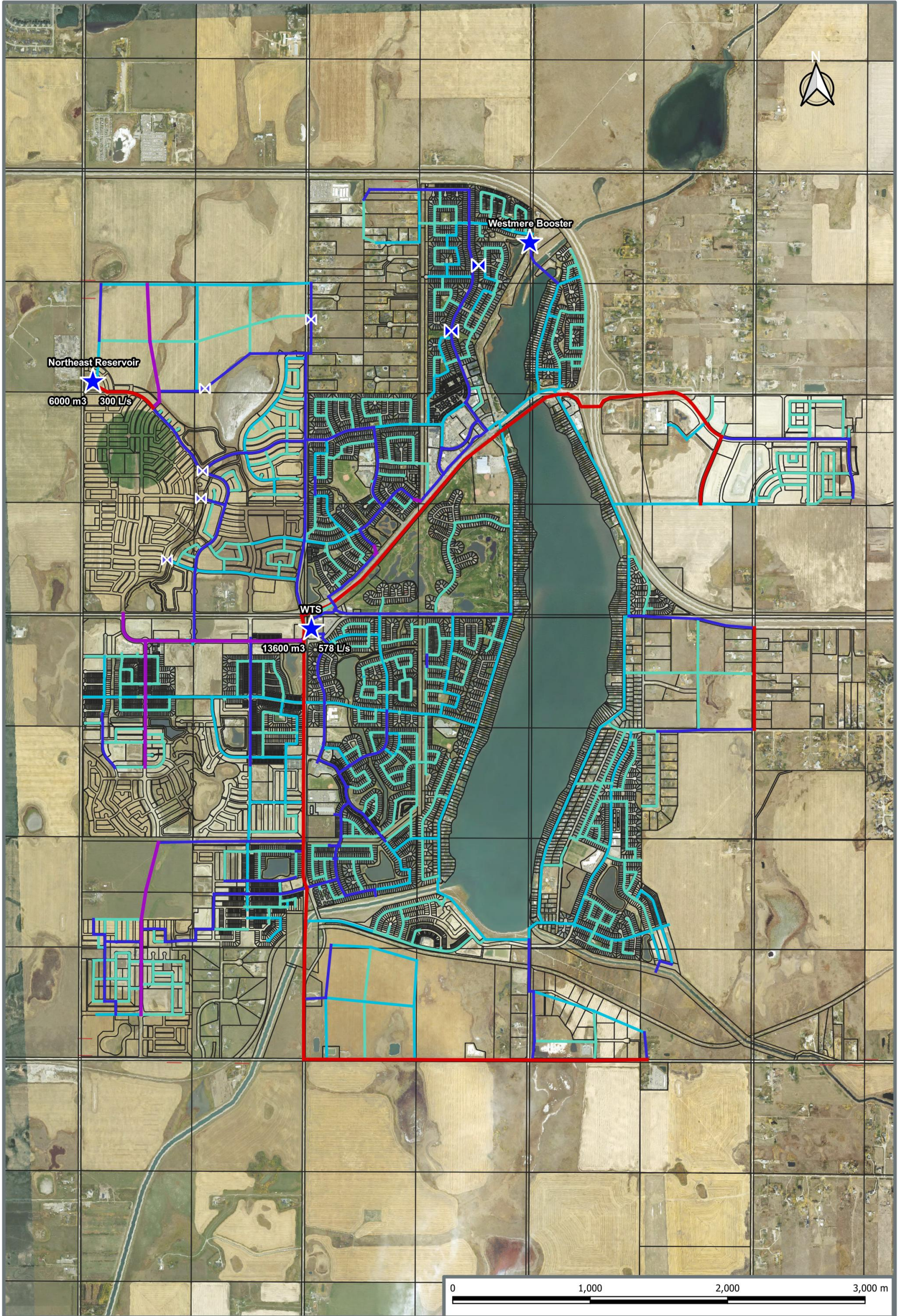


Figure 3.5 - 25 Year Water System

Scale 1:25,000

CITY OF CHESTERMERE
UTILITY MASTER PLAN
OCTOBER 2024

- 200 mm — 350 mm ✕ PRV
- 250 mm — 400 mm ★ Reservoir / Pump Station
- 300 mm — 500 mm

Figure 3.5 - 25 Year Water System

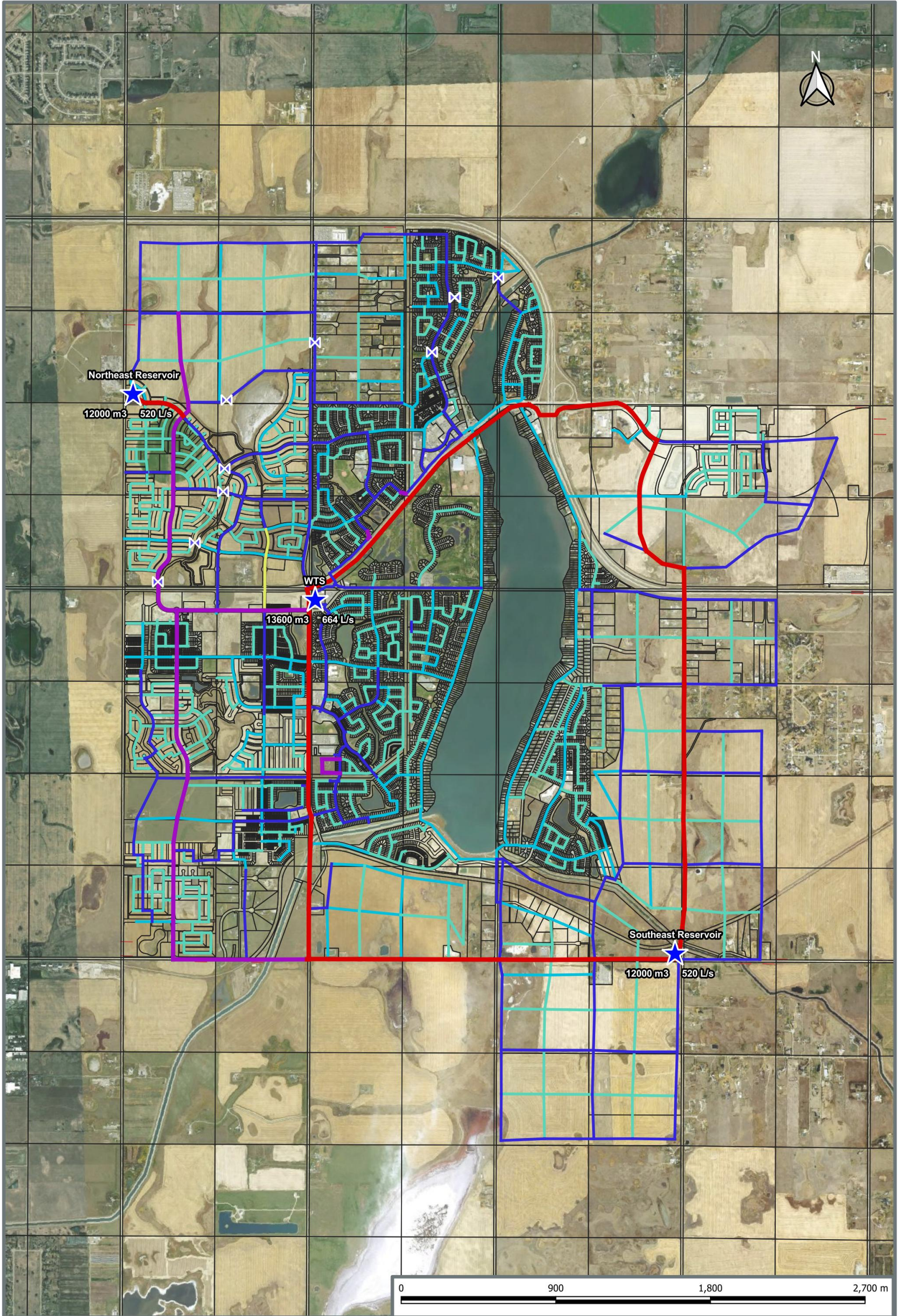


Figure 3.6 - Full Buildout Water System

Scale 1:30,000

CITY OF CHESTERMERE
UTILITY MASTER PLAN
OCTOBER 2024

- 200 mm — 350 mm ✕ PRV
- 250 mm — 400 mm ★ Reservoir / Pump Station
- 300 mm — 500 mm

Figure 3.6 - Full Buildout Water System



3.6.2 Water Supply Analysis

25 Year Horizon

Under the 25 Year Horizon, the water distribution system has a system wide MDD of 402 L/s. With a total available water supply of 417 L/s, the existing water supply is sufficient to accommodate the MDD of the 25 Year Horizon. However, with the largest main offline, there is only 145 L/s of available capacity.

According to current design criteria, this limitation could necessitate significant investments in additional potable water storage to compensate for the reduced supply capacity. A new water supply line from Calgary will be required soon after the 25-Year Horizon to adequately meet the MDD. This new supply line could also be constructed earlier, allowing the City to defer reservoir expansion investments. As discussed in Section 3.6.2, this new supply line would have to be constructed prior to a City population of 57,000 people or a system wide ADD of 160 L/s to accommodate the storage requirements.

An extension of the existing supply line from the East Chestermere Regional Water Line (ECRW) along Rainbow Road, will be required to support and fill the proposed Northwest Reservoir. The Rainbow Road supply line and extension up to the proposed Northwest Reservoir site was reviewed in the model with the 25 Year max day demands added to the line, discounting the available capacity in the 300 mm line along 17th Ave. The hydraulic grade line of the ECRW was obtained from the City of Calgary to assist in the modeling. It was determined that the supply line can fill the proposed Northwest Reservoir unassisted.

Full Buildout

Under the Full Buildout Horizon, the water distribution system has a system wide MDD of 845 L/s. With a current supply capacity of 417 L/s, an additional water supply line from Calgary will be required. This supply line will need to have a capacity of at least 428 L/s to support to the Full Buildout demands.

The City of Calgary has proposed plans to construct an approximately 900 mm water distribution trunk line for future servicing within the City limits. The approximate alignment of this future trunk line is east along the projected Memorial Dr alignment, then south along 100 St SE. This provides an opportunity for a future water supply connection to a nearby source. The City of Calgary has been engaged with preliminary discussions regarding the new water supply main.



The proposed future water supply main would connect to the new distribution trunk from Calgary at the corner of Memorial Dr and 100 St SE, directly east to tie into the proposed Northwest Reservoir. This would minimize the length of a new supply line, requiring approximately 1.6 km to span across two quarter sections. This could also cross connect with the initial supply line for the Northwest Reservoir, allowing water supply to back feed into the Main Reservoir and to the future Southeast Reservoir, if there was ever a disruption of service to the ECRW.

To support a peak flow rate of 428 L/s the pipe will need to be 500 mm in diameter to maintain a velocity below 3.0 m/s.

The new supply line will be required prior to a City population of 74,000 people. The following chart shows the projected MDD of the City against population.

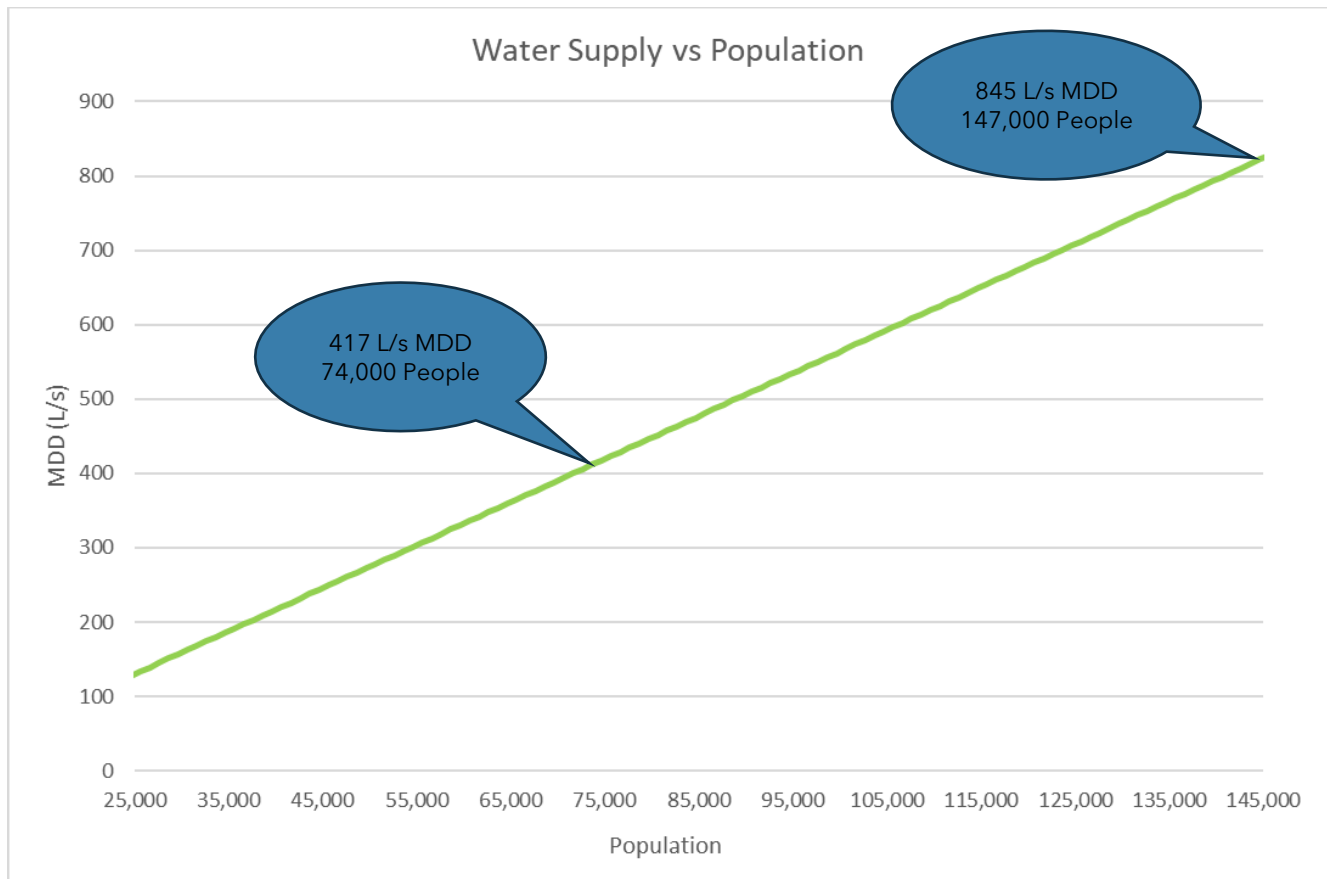


Figure 3.7 - Water Supply Requirements

The future Water Supply network can be seen in Figures 3.8 and 3.9.



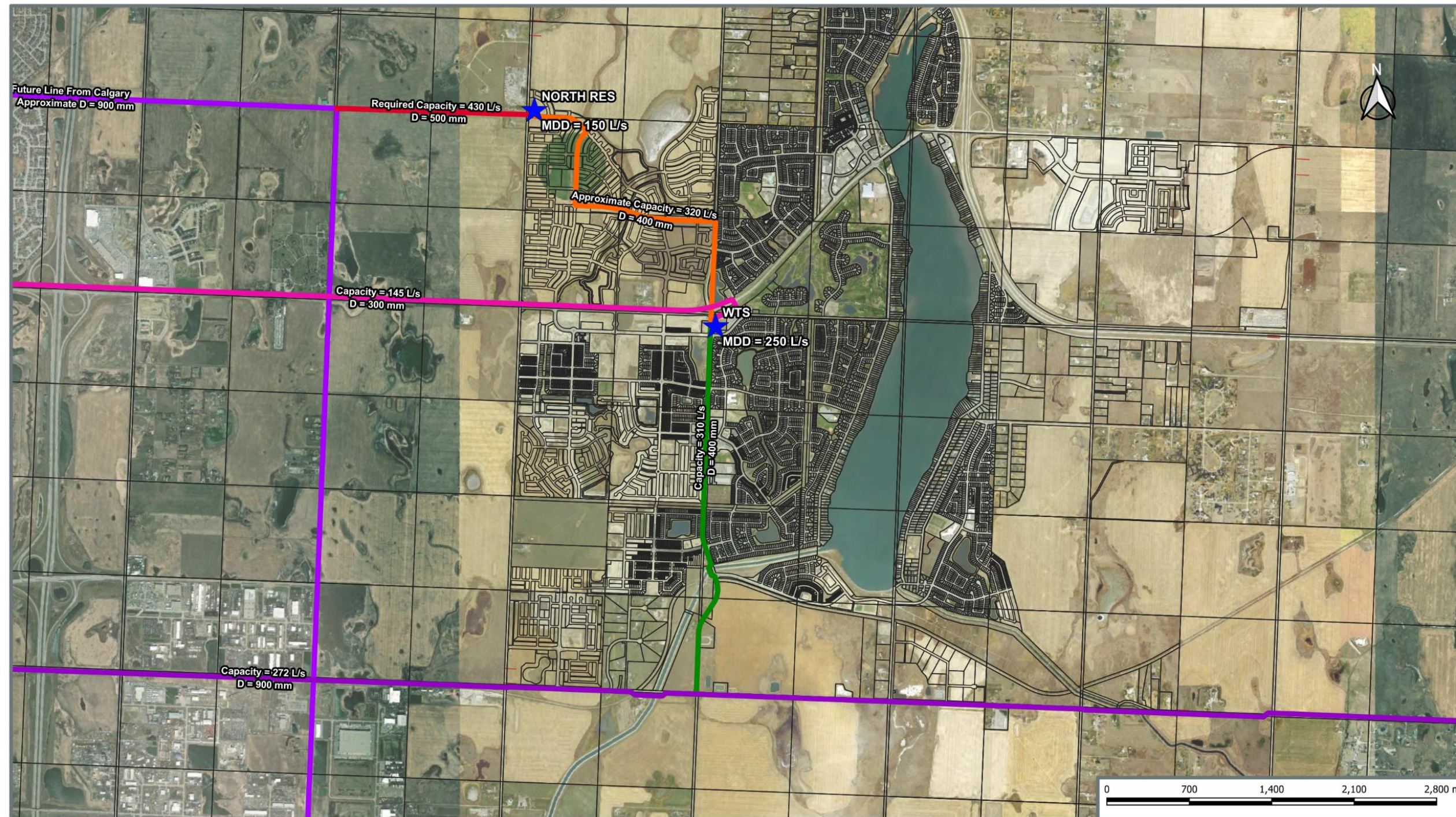


Figure 3.8 - 25 Year Horizon Water Supply

Scale 1:30,000

CITY OF CHESTERMERE
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OCTOBER 2024

- ECRW
- RAINBOW ROAD
- 17TH AVE
- NORTH RESERVOIR
- NEW CALGARY LINE
- NEW CHESTERMERE LINE

Figure 3.8 - 25 Year Horizon Water Supply



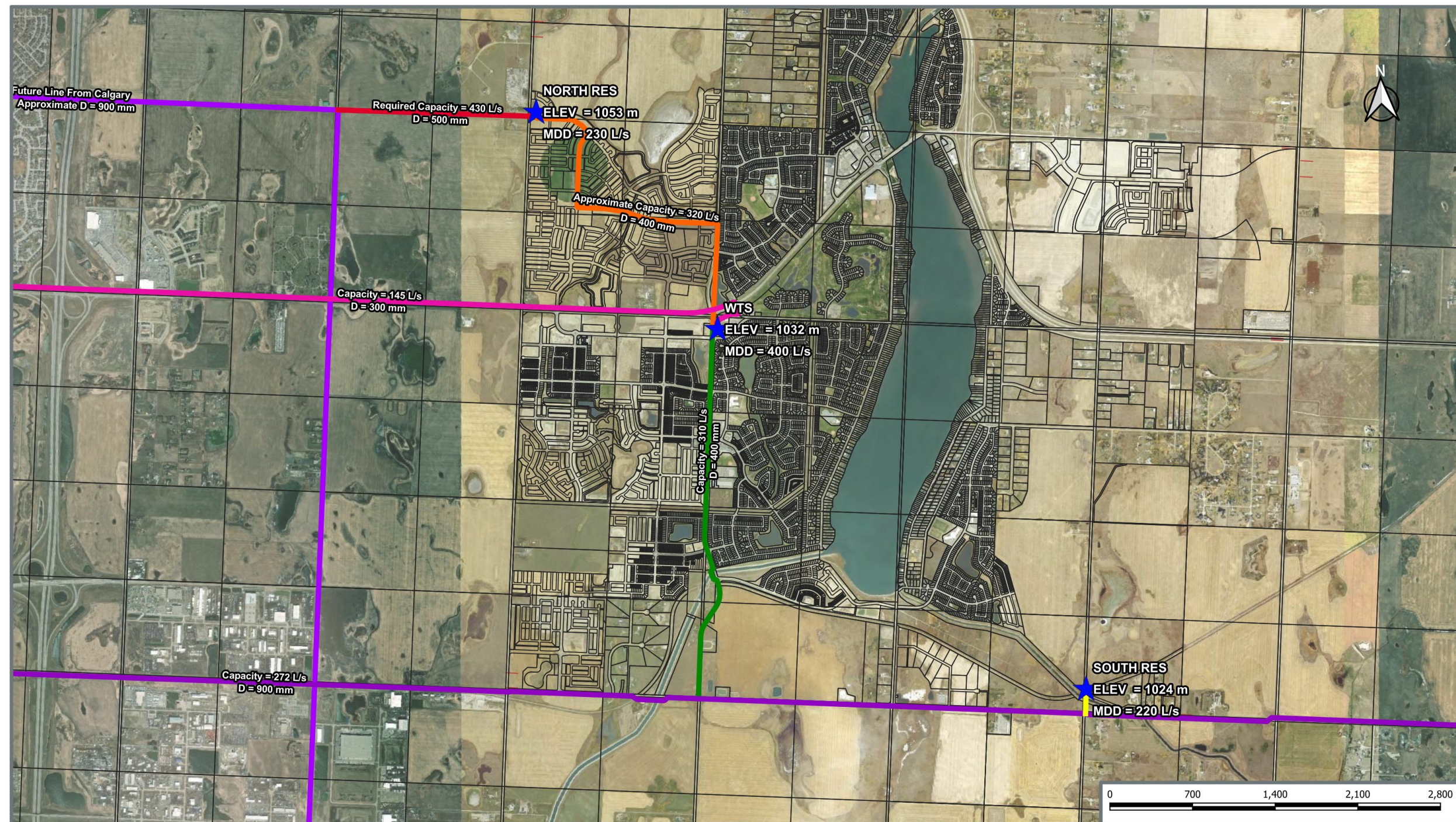


Figure 3.9 - Full Buildout Horizon Water Supply

Scale 1:30,000

CITY OF CHESTERMERE
UTILITY MASTER PLAN
OCTOBER 2024

- ECRW
- RAINBOW ROAD
- 17TH AVE
- NORTH RESERVOIR
- SOUTH RESERVOIR
- NEW CALGARY LINE
- NEW CHESTERMERE LINE

Figure 3.9 - Full Buildout Water Supply



3.6.3 Water Storage Analysis

25 Year Horizon

The 25 Year Horizon has a system wide ADD of 201 L/s, or 17,400 m³/day. After a population of approximately 50,000 people the capacity of the water supply with the largest supply main offline will equal the ADD of the system, which will initiate the secondary storage criteria of 2x the deficit of the ADD minus the redundant supply capacity. At a population of 52,000 people, the storage requirements of the system will exceed the available storage capacity at the Main reservoir, and additional storage will be required.

Under this scenario, an additional storage capacity of 14,400 m³ would be needed, resulting in a total system-wide storage capacity of 28,000 m³. This represents a significant short-term investment in reservoir infrastructure.

However, if the proposed new water supply line were constructed, providing a capacity of 417 L/s with the largest supply line offline, the system would only require an additional 4,000 m³ of storage, resulting in a total system-wide storage capacity of 17,600 m³. This approach would defer 10,000 m³ of additional storage to a later stage in Chestermere's development.

The following chart illustrates the required storage capacity as a function of population, comparing the existing water supply scenario to the requirements with the new proposed supply line.

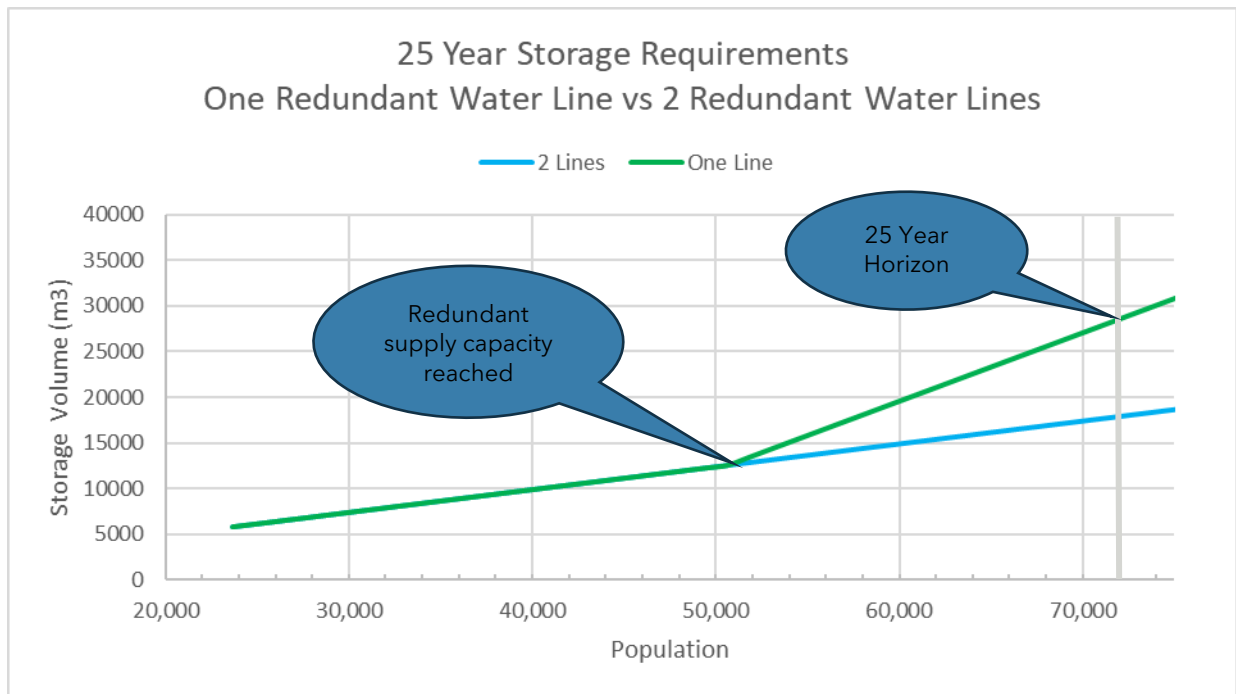


Figure 3.10 - 25 Year Storage Requirements

With 4,000 m³ of additional storage, the new water supply line would have to be constructed prior to a City population 57,000 people, or a system wide ADD of 160 L/s.

In the 25-Year Horizon, development is expected in the Bridgeport and North Waterbridge OSL areas above the 1045 m upper limit of the Main Pressure Zone. To service this higher elevation, at a minimum, a booster station will be required. Additional reservoir storage will also be needed to meet the requirements of the 25-Year Horizon, and a new storage reservoir and pump station located in the High-Pressure Zone would enhance system resiliency.

The first phase of the proposed reservoir will have a minimum capacity of 4,000 m³, which will support the 25-year storage requirements along with the construction of a new supply line. The reservoir will be filled by a supply line from the existing City supply and will include a pump station for distribution and fire flows.

According to the full buildout assessment, the total storage requirement for the Northwest Reservoir is 12,000 m³. It is recommended that the initial phase of the reservoir be 6,000 m³, providing an additional storage buffer beyond the 25-Year Horizon before another reservoir phase becomes necessary. With 6,000 m³ of storage, the new supply line from Calgary will need to be constructed before the population reaches 65,000.

Full Buildout Horizon

The Full Buildout horizon has a system wide ADD of 422 L/s, or 36,460 m³/day. Once the population reaches approximately 144,000 people, the capacity of the water supply with the largest supply main offline will equal the ADD of the system, triggering the secondary storage criteria of 2x the deficit of the ADD minus the redundant supply capacity. The total storage requirements for the Full Buildout are 37,600 m³.

With the first phase of the Northwest Reservoir constructed during the 25 Year Horizon, the total available storage is 19,600 m³. The system storage requirements will reach this capacity at a population of 78,000 people, after which additional storage will need to be constructed.

The following chart demonstrates the required storage capacity as a function of population up to the Full Buildout.



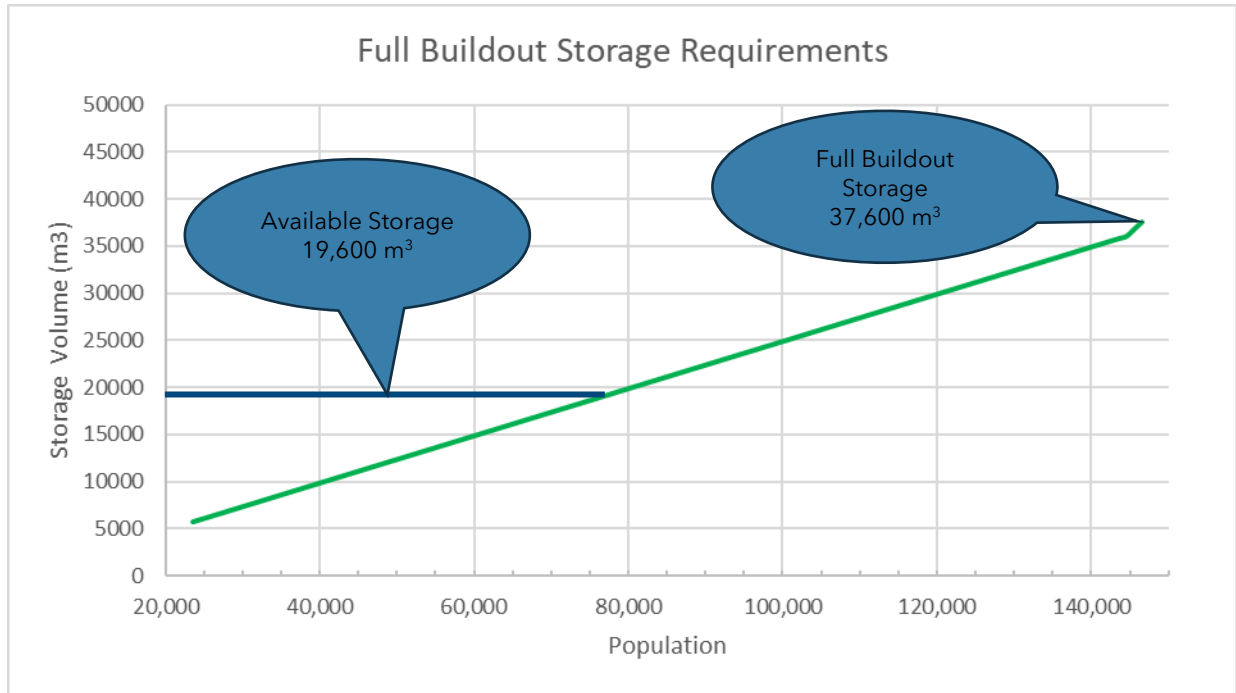


Figure 3.11 - Full Buildout Storage Requirements

To meet the Full Buildout storage requirements, an additional 18,000 m³ of storage will be needed beyond the 25-Year Horizon.

Initial assessments of the Full Buildout network, including the Main Pump Station and Reservoir and the proposed Northwest Pump Station and Reservoir, indicated that the southwest and northeast corners of the network were not meeting level of service design criteria due to high peak flows, head losses, and the distance from the pump stations. To address this and enhance network resiliency, a third reservoir and pump station are proposed in the southeast corner of the network.

The two proposed reservoirs will equally share the additional storage required to support the Full Buildout. With a total of 24,000 m³ of storage required in addition to the existing storage, each reservoir should have a total storage capacity of 12,000 m³.

The reservoirs can be constructed in phases to minimize and defer upfront costs. With the initial 6,000 m³ phase at the Northwest Reservoir, this would leave one more 6,000 m³ phase at the Northwest Reservoir, and two 6,000 m³ phases at the Southeast Reservoir.

The next reservoir phase should be the Southeast Reservoir. This will assist in development in the south and east portions of the growth area. This should be constructed by a population of 78,000 people, or a system wide ADD of 220 L/s. The following two phases should be at the Northwest Reservoir, then the Southeast Reservoir. These would occur at populations of 103,000 people with a system wide ADD of 295 L/s, then 127,000 people with a system wide ADD of 364 L/s.

The following table summarizes the reservoir phasing, volumes and triggers.



Table 3.10 - Storage Reservoirs Phasing Summary

Reservoir Phase	Size (m ³)	Total Storage (m ³)	Population	System ADD (L/s)
Northwest Ph1	6,000	19,600	52,000	146
Southeast Ph1	6,000	25,600	78,000	220
Northwest Ph2	6,000	31,600	103,000	295
Southeast Ph2	6,000	37,600	127,000	364

Similar volume storage reservoirs in Alberta were reviewed to determine total land requirements to support the facilities, with the result being a total of 1 ha of land would be required to support each of the full 12,000 m³ reservoirs at buildout.

3.6.4 Pump Station Analysis

25 Year Horizon

In the 25-Year Horizon there will be one additional pump station required to support the growth in Chestermere, which is the pump station at the Northwest Reservoir. This pump station will need to have a pumping capacity of the MDD of the development in the High-Pressure Zone, along with 220 L/s for fire flow. The demands in the High-Pressure Zone were assessed in the model to be 65 L/s at MDD, for a total required pumping capacity of 285 L/s for the 25 Year Horizon. A firm pumping capacity of 300 L/s is recommended for the Northwest pump station to allow for some buffer in pumping capacity past the 25 Year Horizon. The trigger for the pump station will be when the Northwest Reservoir is planned to be constructed due to population growth, or when development is approved above the 1045 m elevation boundary.

The Main pump station has two existing planned pump upgrades, replacing the remaining 30HP and 75 HP pumps in Pumphouse 1 with two 150 HP pumps. The planned upgrades will bring the firm pumping capacity of the Main pump station to 578 L/s, then 664 L/s.

The timing of these upgrades will be assessed under two scenarios for the 25 Year Horizon - with only the Main Pump Station, and with the Northwest Reservoir and pump station constructed as well.



Table 3.11 - Main Reservoir Upgrade Assessment

Scenario	Existing Firm Pumping Capacity (L/s)	Firm Pumping Capacity Upgrade - Phase 2 (L/s)	Firm Pumping Capacity Upgrade - Phase 3 (L/s)	MDD+FF (L/s)	PHD (L/s)
Main Only	451	578	664	622	744
Main and NW Res	751	878	964	622	744

Under Main Only scenario the Main Pump Station will require an upgrade prior to the end of the 25 Year Horizon. With only the Main Pump Station, both upgrades will not be able to support the PHD of the horizon and will need the Northwest pump station to support it. This is in line with the additional storage requirements as well.

The following chart shows the projected MDD+FF and PHD through the 25 Year Horizon. The PHD becomes the defining pumping requirement after a population of approximately 46,000.

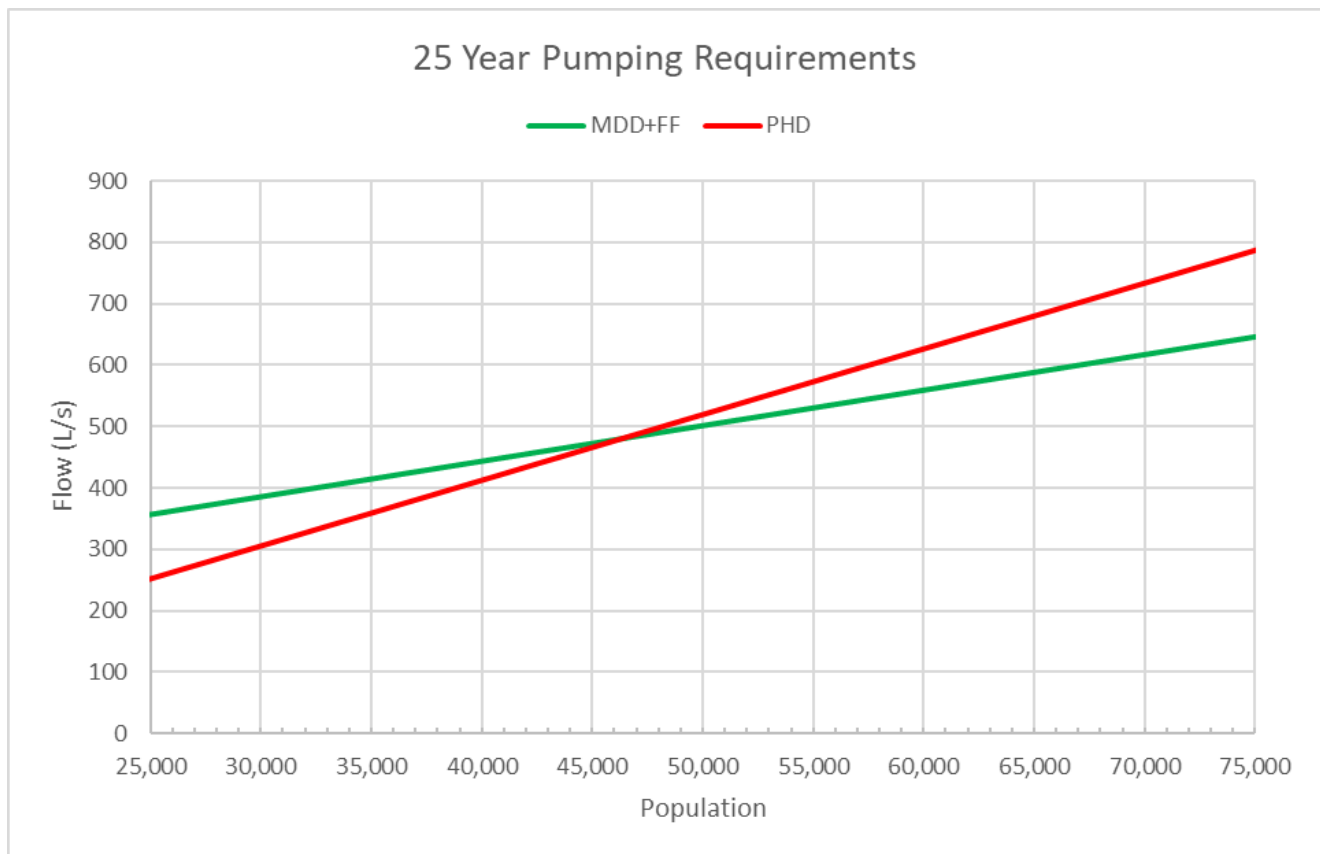


Figure 3.12 - 25 Year Pumping Requirements

Without the Northwest pump station, Pump Upgrade - Phase 2 at the Main Pump Station will be required at population of 42,000 people. This is prior to the population of the existing



storage capacity running out and will be implemented first if the Northwest reservoir has not been constructed due to development pressure.

If the Northwest reservoir has been constructed prior to a population of 42,000 people, the Main Pump Station Upgrade - Phase 2 can be deferred until after the 25-Year Horizon.

Full Buildout Horizon

To support the PHD demand of the Full Buildout Horizon, the system will require a total of 1,561 L/s of pumping capacity.

Under the Full Buildout Horizon there will be an additional pump station at the proposed Southeast Reservoir, which can be phased like the reservoir. The initial pumping capacity is recommended to be 300 L/s to meet the system demands and the fire flow requirements.

In addition, there will be one more pump upgrade at the Main Pump Station, and a pumping capacity upgrade at the Northwest Reservoir. With a firm pumping capacity of 664 L/s at the Main Pump Station after the second upgrade, each of the proposed reservoir pump stations will require an ultimate pumping capacity of 510 L/s to meet the system wide PHD.

The following chart shows the projected PHD of the system through the Full Buildout Horizon.

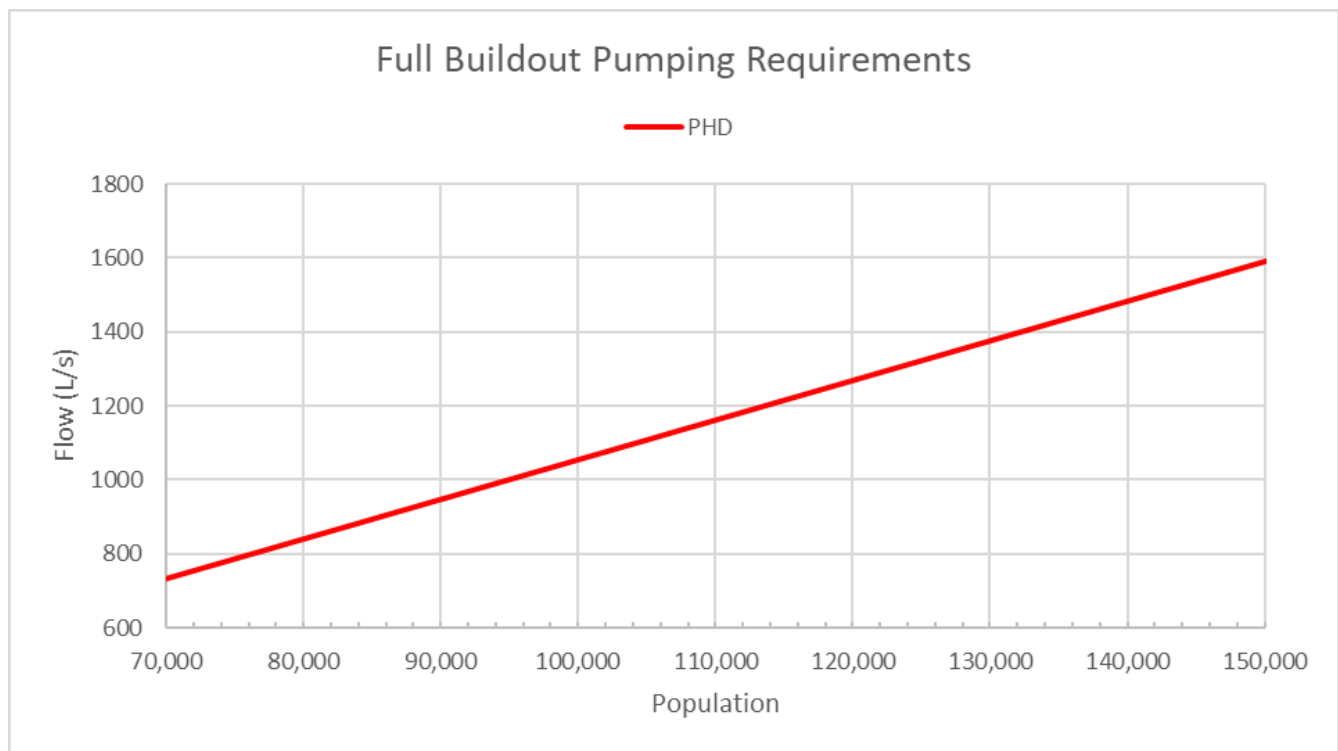


Figure 3.13 - Full Buildout Pumping Requirements



With the system upgrades proposed in the 25 Year Horizon, the system PHD will reach the system pumping capacity of 878 L/s by a population of 78,000 people. This is in line with the projected storage upgrade requirement where the Southeast Reservoir will be constructed.

The following table summarizes the proposed pumping capacity upgrades and their population triggers to support the Full Buildout.

Table 3.12 - Buildout Pumping Summary

Upgrade Scenario	Capacity Upgrade (L/s)	System Capacity (L/s)	Population Trigger	System ADD Trigger (L/s)
Main Upgrade Ph 2	107	578	42,000	120
Northwest Reservoir	300	878	52,000	148
Southeast Reservoir	300	1,178	78,000	220
Main Upgrade Ph 3	86	1,264	105,000	295
Northwest Upgrade 2	210	1,474	113,000	316
Southeast Upgrade 2	210	1,684	130,000	369

Both the Northwest Reservoir Phase 2 and the Southeast Reservoir Phase 2 hit their population triggers for storage requirements prior to pumping requirements. In those cases, the pumping upgrades should be constructed in tandem with the storage upgrades.

3.6.5 Level of Service Analysis

Figures 3.14 and 3.16 shows the hydraulic model results for each of the future growth horizons at Peak Hour Demand. Pressure nodes that are below the standard minimum pressure requirement of 280 kPa (40 psi) as set out in the design criteria are shown in orange. Pressures above the 550 kPa (80 psi) limit are shown in purple.

The full buildout network for the growth areas has been implemented for all OSL areas with projected growth.

Under both the 25 Year horizon and the Full Buildout horizon there are no areas below the minimum pressure requirements as per the design criteria. Portions of the future growth areas in the southeast, such as Webster and Sierra Vista, may be above the upper limit of 80 psi due to a lower elevation. As such, any future development areas with an elevation below an elevation of 1025 m, the Low elevation for the Main pressure zone, should have pressure reducing valves on service lines.



3.6.6 Fire Flow Analysis

Figures 3.15 and 3.17 shows the hydraulic model results for the MDD+Fire Flow scenario for each of the growth horizons. The water model was used to calculate the available fire flow at each node while maintaining at least 140 kPa (20 psi) residual at every point in the distribution system. The nodes are color coded corresponding to whether the fire flow requirements were met, based on the surrounding land use.

The full buildout network for the growth areas has been implemented for all OSL areas with projected growth. All growth areas were assumed to have a 220 L/s fire flow requirement.

Under the 25 Year Horizon the East Acreages development area is below the assumed 220 L/s available fire flow requirement that was applied to growth areas without discrete land use types established, with a value of approximately 185 L/s. However this area is likely to be majority residential development, and any deficiencies for ICI will be resolved with future connectivity.

Under the Full Buildout Horizon, all previously identified deficiencies are resolved, outside of isolated areas with small diameter pipes and dead-end mains.



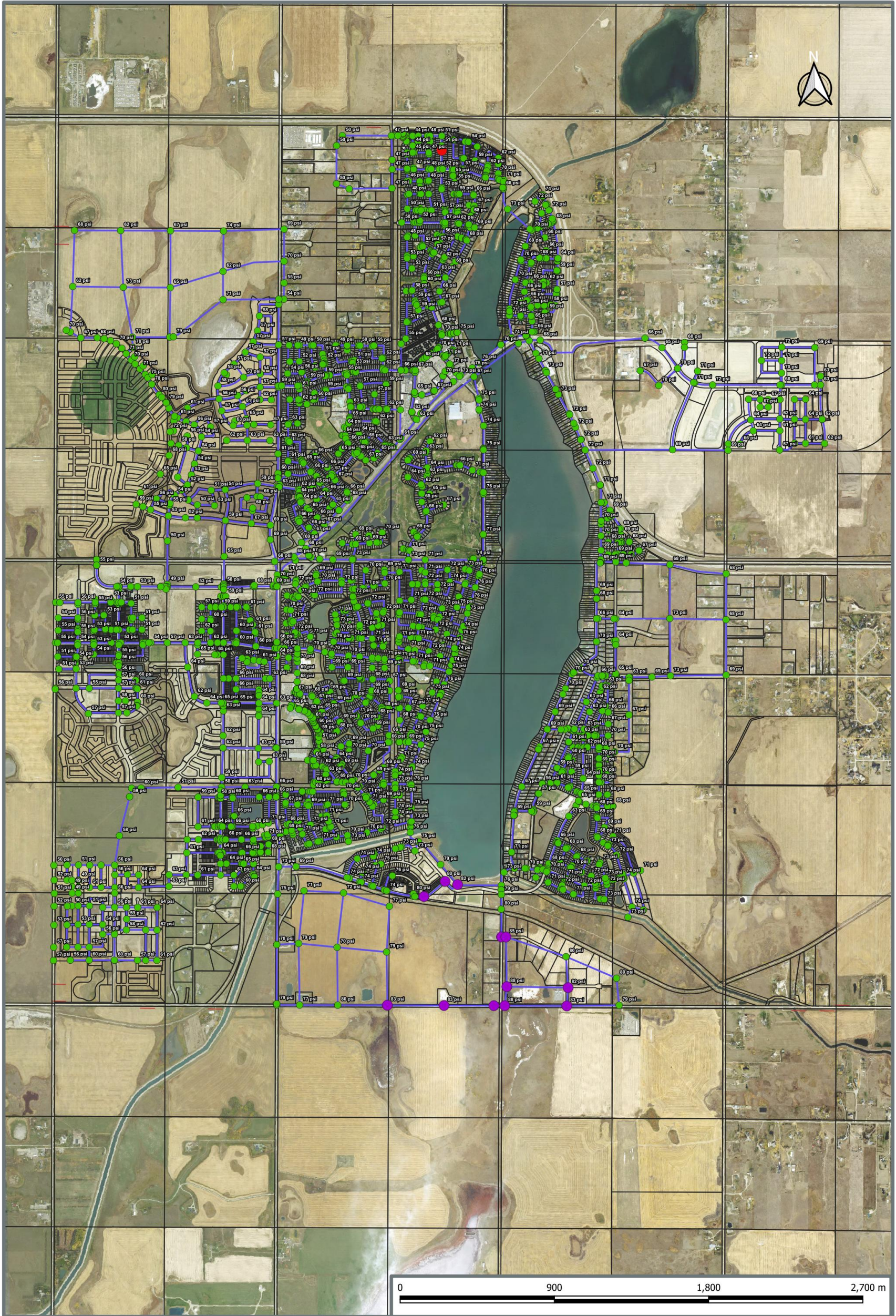


Figure 3.14 - 25 Year Peak Hour Demand Pressure

Scale 1:25,000

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- Water Lines
- < 40 psi
- 40 psi - 80 psi
- > 80 psi

Figure 3.14 - 25 Year System PHD



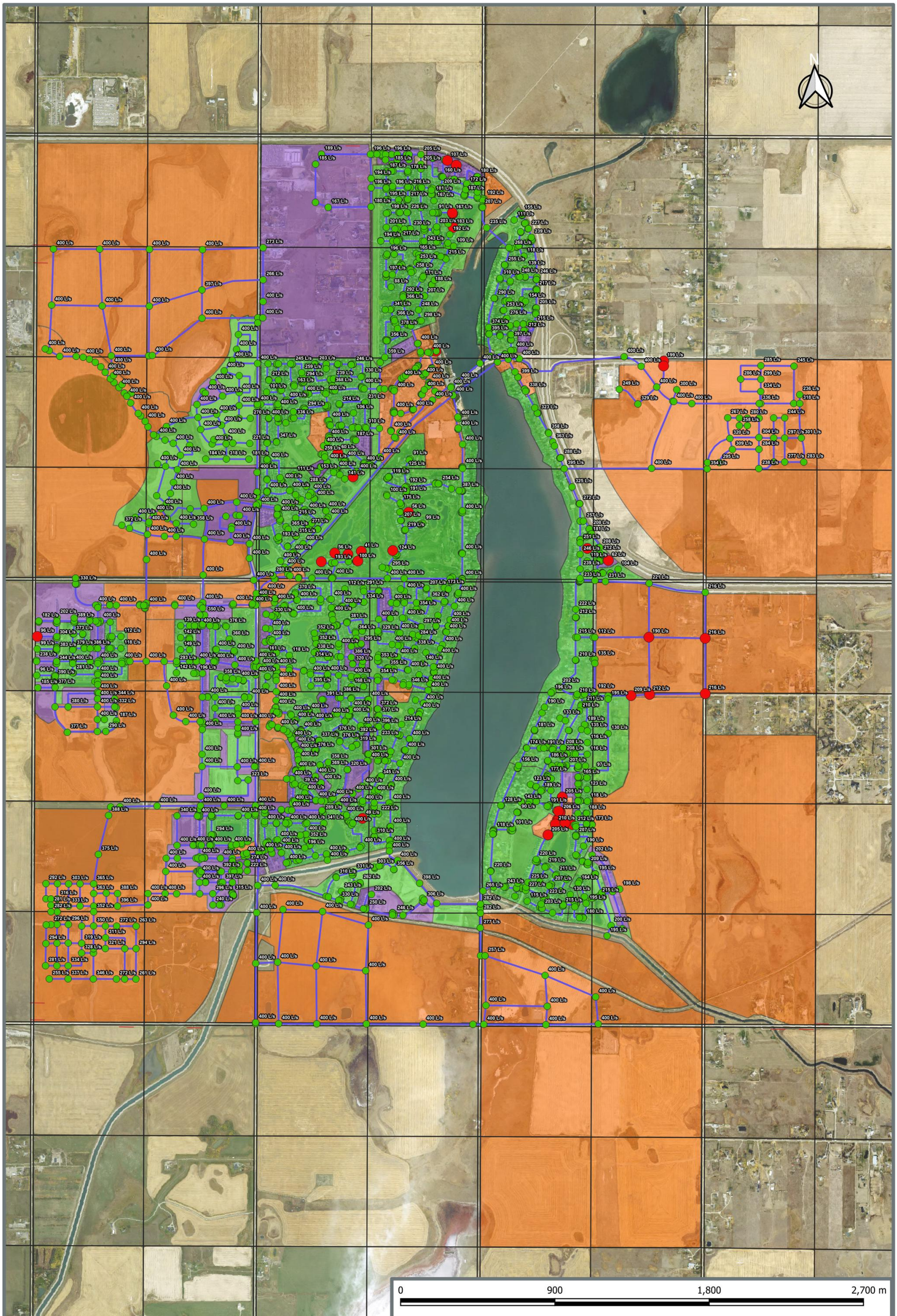


Figure 3.15 - 25 Year Available Fire Flow

Scale 1:25,000

CITY OF CHESTERMERE
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- Water Lines
- Meets Fire Flow Constraints
- Does Not Meet Fire Flow Constraints
- 83L/s Fire Flow (Single Family)
- 120 L/s Fire Flow (Multi Family)
- 220 L/s Fire Flow (ICI)

Figure 3.15 - 25 Year System MDD+FF



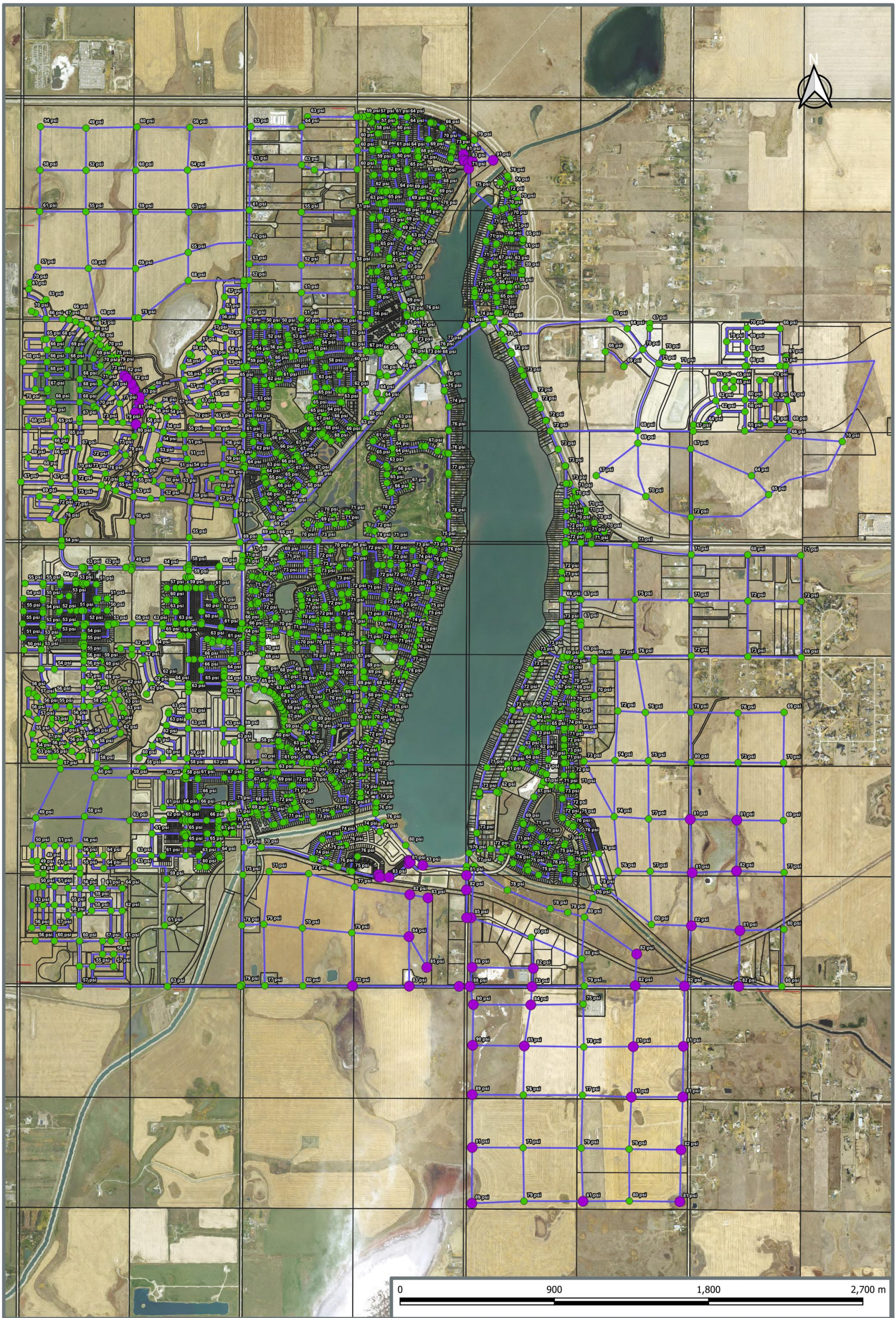


Figure 3.16 - Full Buildout Hour Demand Pressure

Scale 1:25,000

CITY OF CHESTERMERE
UTILITY MASTER PLAN
OCTOBER 2024

- Water Lines
- < 40 psi
- 40 psi - 80 psi
- > 80 psi

Figure 3.16 - Full Buildout PHD



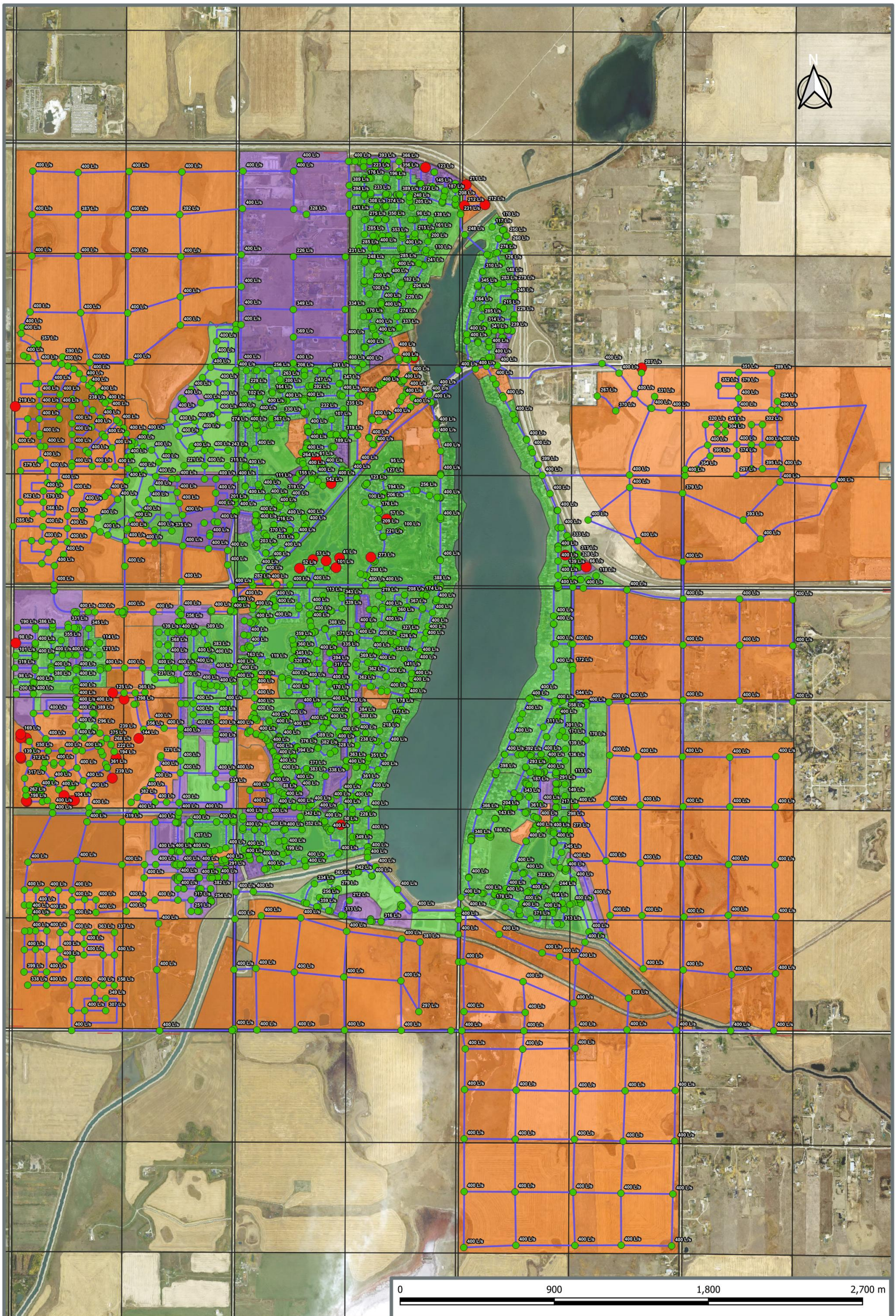


Figure 3.17 - Full Buildout Available Fire Flow

Scale 1:25,000

CITY OF CHESTERMERE
UTILITY MASTER PLAN
OCTOBER 2024

- Water Lines
- Does Not Meet Fire Flow Constraints
- Meets Fire Flow Constraints
- 83L/s Fire Flow (Single Family)
- 120 L/s Fire Flow (Multi Family)
- 220 L/s Fire Flow (ICI)

Figure 3.17 - Full Buildout MDD+FF



4. Wastewater System

4.1 System Characterization

The City of Chestermere's wastewater system consists of approximately 90 km of gravity sewer, 30km of forcemains, and fourteen City-operated lift stations. Currently, all the City's wastewater is collected at the Lift Station 10 and Lift Station 13 before being discharged to Calgary

4.1.1 Pipe Diameters and Materials

The wastewater gravity mains in Chestermere are predominantly PVC, while the forcemain network is primarily HDPE. The following table shows the distribution of pipe diameters:

Table 4.1 - Wastewater Pipe Diameters

Diameter (mm)	Length (km)	Percentage
100	1.0	1%
150	2.3	2%
200	63.1	53%
250	27.6	23%
300	11.0	9%
375	2.3	2%
450	9.5	8%
600	0.3	0%
675	0.2	0%
1200	2.2	2%
Total	119.6	100%

4.1.2 Lift Stations

The City operates fourteen lift stations. Firm pumping capacity, as shown in Table 4.2, is defined as the capacity with the largest pump out of service. Capacities were determined through SCADA data, pump curve interpolation, and drawdown testing from the previous Utility Master Plan (UMP). The lift stations and their catchment areas are illustrated in Figure 4.1.



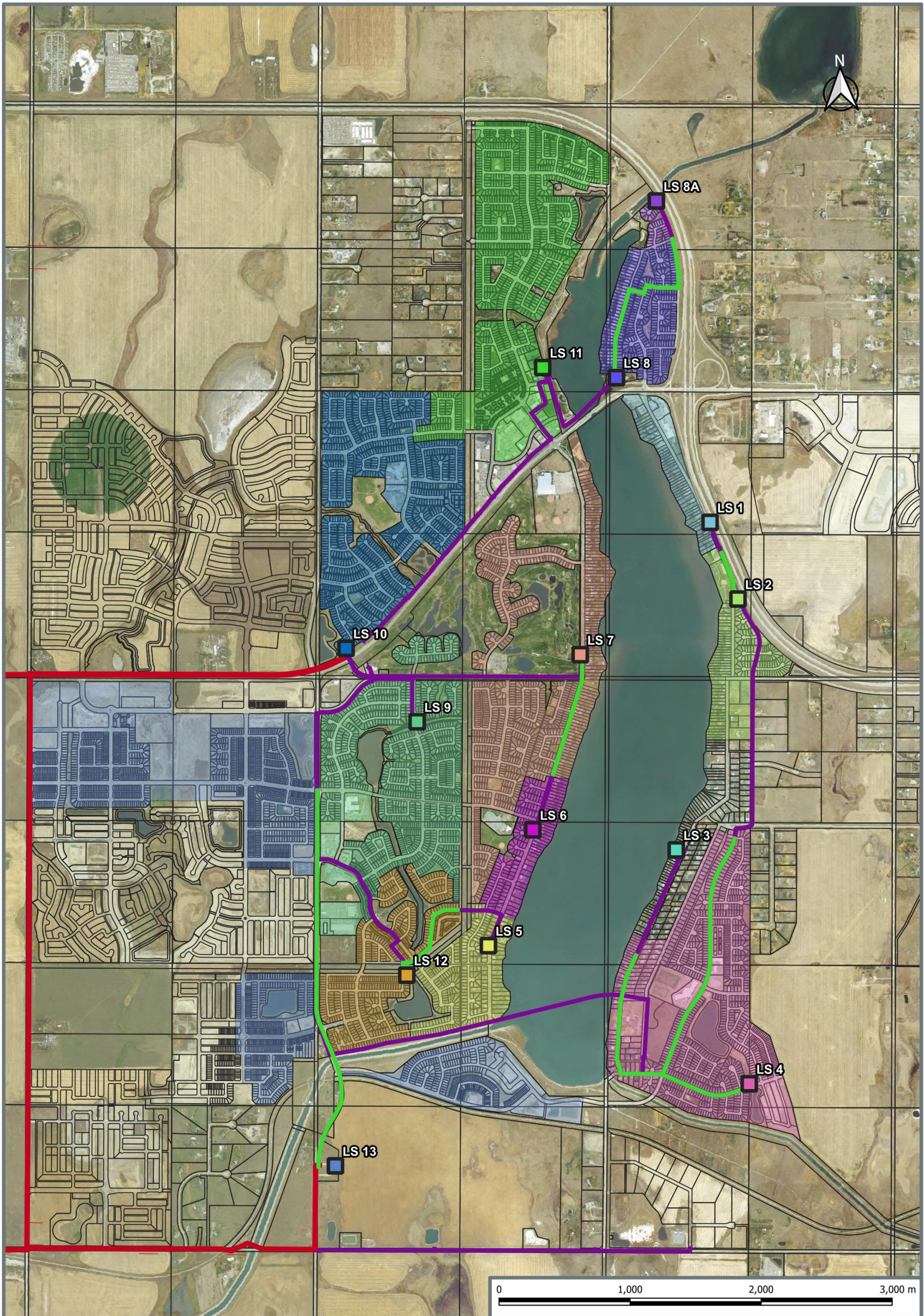


Figure 4.1 - Existing Wastewater System

Scale 1:20,000

CITY OF CHESTERMERE
UTILITY MASTER PLAN
OCTOBER 2024

- | | | | | | | | | | | | | | | | | | |
|---|---|---|---|--|---|--|--|--|---|--|--|---|--|--|---|---|--|
| <ul style="list-style-type: none"> — Lift Station Forcemain — Discharge Forcemain — Gravity Lines Lift Station (Various Colours) | <p style="text-align: center;">Lift Station Catchments</p> <table border="0"> <tr> <td> LS 1</td> <td> LS 5</td> <td> LS 8</td> <td> LS 12</td> </tr> <tr> <td> LS 2</td> <td> LS 6</td> <td> LS 9</td> <td> LS 13</td> </tr> <tr> <td> LS 3</td> <td> LS 7</td> <td> LS 10</td> <td></td> </tr> <tr> <td> LS 4</td> <td> LS 8A</td> <td> LS 11</td> <td></td> </tr> </table> | LS 1 | LS 5 | LS 8 | LS 12 | LS 2 | LS 6 | LS 9 | LS 13 | LS 3 | LS 7 | LS 10 | | LS 4 | LS 8A | LS 11 | |
| LS 1 | LS 5 | LS 8 | LS 12 | | | | | | | | | | | | | | |
| LS 2 | LS 6 | LS 9 | LS 13 | | | | | | | | | | | | | | |
| LS 3 | LS 7 | LS 10 | | | | | | | | | | | | | | | |
| LS 4 | LS 8A | LS 11 | | | | | | | | | | | | | | | |

Figure 4.1 - Existing Wastewater System



Table 4.2 - Lift Station Capacities

Lift Station Name	Firm Capacity (L/s)	Firm Capacity (m ³ /day)
1	13	1,123
2	22	1,901
3	6.5	562
4	75	6,480
5	20	1,728
6	25	2,160
7	79	6,826
8A	5	432
8	26	2,246
9	30	2,592
10	250 (to RRST) 168 (to Calgary)	27,389
11	65	5,616
12	45	3,888
13	255	26,784
Total	1039	89,726

Current operations have all lift stations, except for Lift Station 13, discharging into Lift Station 10. Lift Station 10 discharges into the Rainbow Road Sanitary Trunk (RRST) which carries all wastewater to Lift Station 13 which then ultimately discharges to Calgary.

Both Lift Station 10 and Lift Station 13 are capable of discharging to Calgary, through separate forcemain to separate discharge locations. These locations have individual discharge limitations on them set by the City of Calgary.

Lift Station 13 currently operates its pumps at a reduced speed (45 Hz) during normal operations. The station was designed for four pumps, but only two are currently installed. With just one pump running, there is insufficient back pressure to operate at full speed without cavitation. In the future, when additional pumps are installed, running multiple pumps in parallel will allow them to operate at full speed without cavitation.

In the interim, the pumps are operating at a reduced speed of 45 Hz, which limits the flow rate to approximately 200 L/s. However, during high-level conditions at the lift station, the pumps can run at full speed, increasing the overall flow to about 255 L/s. This approach allows the City to utilize the full flow potential of the existing pump when necessary while minimizing wear and tear due to cavitation.



4.1.3 Wastewater Discharge to Calgary

The City of Chestermere currently has two active discharge points into the City of Calgary.

- Discharge #2 - 64 St and 90 Ave SE
 - Discharge from Lift Station 10
 - Maximum Instantaneous flow of 14,400 L/min (240 L/s)
- Discharge #4 - 50 Ave and 84 St SE
 - Discharge from Lift Station 13 (and Lift Station 10 if not discharging to RRST or Discharge #2)
 - Maximum Instantaneous flow of 27,000 L/min (450 L/s)

Figure 4.2 shows the discharge system to Calgary under current operations.



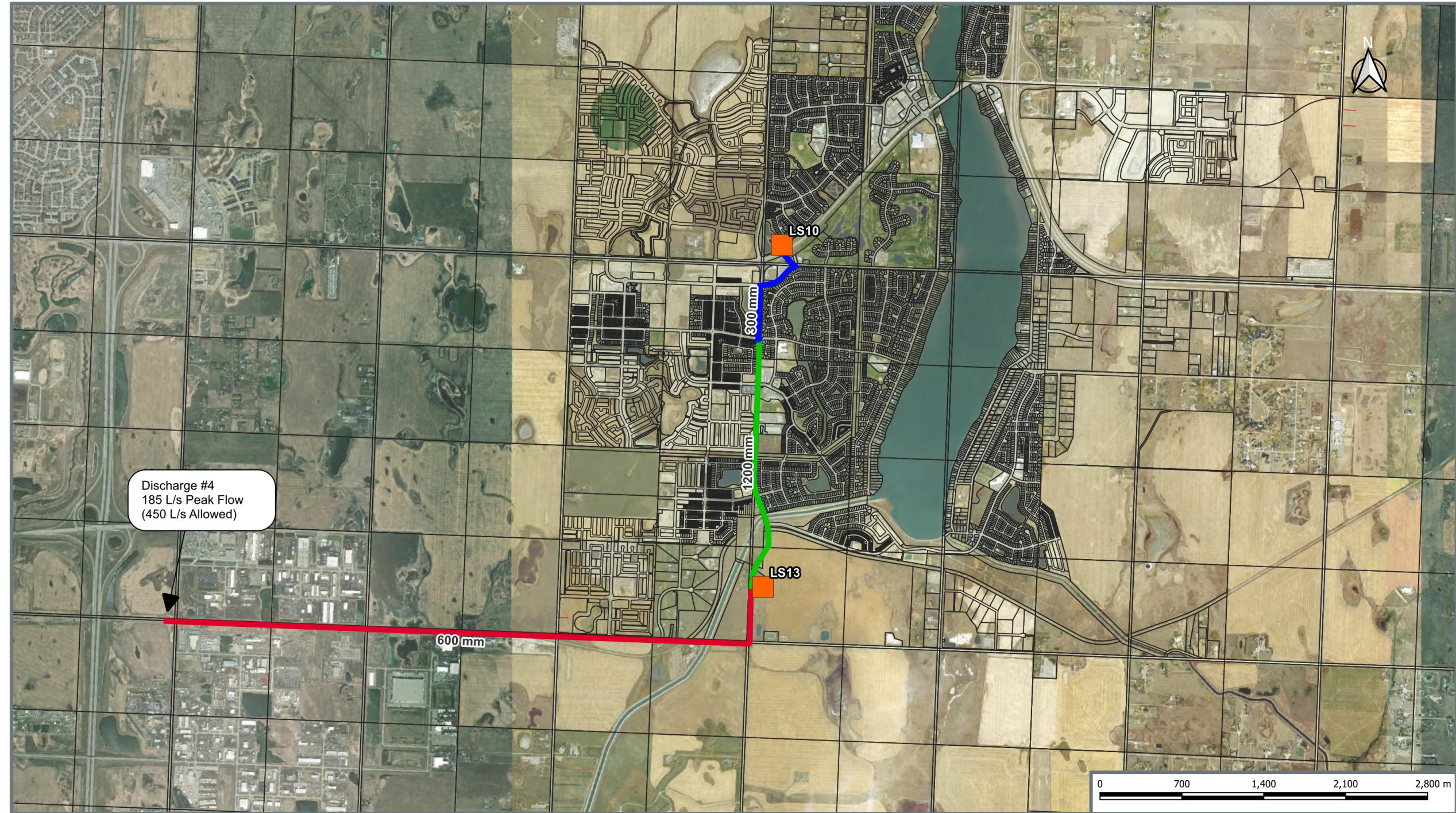


Figure 4.2 - Existing Operations Discharge

Scale 1:25,000

CITY OF CHESTERMERE
UTILITY MASTER PLAN
OCTOBER 2024

- Lift Stations
- Lift Station 13 FM
- Lift Station 10 FM
- Gravity Line

Figure 4.2 - Existing System Discharge to Calgary



4.2 Wastewater Flow Generation Analysis

CIMA+ prepared a design basis memorandum (DBM) in December 2023 to support the development of the Utility Master Plan (UMP). The technical memo established the design basis that was used to assess the existing and future systems, primarily in relation to anticipated wastewater generation rates for both the existing and future systems, as well as metrics to assess the performance of the system. The Design Basis Memo is included in Appendix A and is summarized in Sections 4.2 and 4.3 for the wastewater system.

Wastewater flow generation in the City of Chestermere was categorized into two periods: dry weather (with no appreciable rainfall) and wet weather (with significant rainfall).

4.2.1 Dry Weather Flow Generation

The following sections discuss how the dry weather flows were calculated in the existing system. The average dry weather flows represent the average day, with the diurnal patterns showing the low flows and peak flows throughout the day.

Existing Wastewater Demands

Existing dry weather wastewater flow generation will be developed by assessing the total volume of effluent being conveyed through the lift stations to Calgary over a period of several years to develop the Average Dry Weather Flow (ADWF). Demands will be assigned to the hydraulic model in the same way as the water system, by scaling customer water meter volumes to the total wastewater volumes conveyed through the lift stations.

Peaking Factors

Peaking factors were developed by analysing the SCADA data to develop diurnal flow patterns which can be applied to the average dry weather flow. This will act as a dynamic peaking factor that will fluctuate throughout the day and scale the flows to their measured values.

Diurnal peaking factors were developed for lift stations with flow meters on their discharge and applied to their collection area. Lift stations without a flow meter had the diurnal pattern of the nearest downstream lift station applied to their collection area.

The diurnal patterns for the lift stations can be found in Appendix D.



4.2.2 Wet Weather Flow Generation

Wet weather flows will be assessed by calibrating the model against the observed flow data during rainfall events. A 1:50 Year storm event will then be applied to the model to determine the peak wet weather flows. This, in combination with the diurnal patterns for dry weather flows, result in dynamic peak flows in system, that should more closely resemble both the overall peaks, and the total volume of flows entering the system.

4.2.3 Future Flow Generation

Future wastewater demands will be assessed using a per capita unit demand, which will act as a composite demand for all land uses. Population projections for each development area will determine the wastewater demands.

The population of Chestermere for the previous three years was provided by the City. Dividing the average daily demand by the current population results in the per capita demand, which will be used to project future demands.

Table 4.3 - Future Wastewater Unit Flow Rates

Year	Population	Daily Wastewater Flow (m ³ /day)	Per Capita (L/c/day)
2020	21,372	5,215	244
2021	22,166	4,784	216
2022	23,626	5,164	219
Average	22,388	5,054	226

The recommended per capita future wastewater generation rate is 240 L/c/day, which is lower than the maximum of the three years, but higher than the average.



4.3 Design Criteria

4.3.1 Flow Generation Criteria

Existing wastewater generation rates were calibrated using SCADA data records and water demands.

4.3.2 Collection System Criteria

The gravity collection system of Chestermere was modeled using the Peak Wet Weather Flow scenario. The pipes were evaluated based on the following criteria

- Hydraulic capacity
 - The capacity of a gravity sewer is evaluated based on the peak expected flow and the flow capacity of the pipe which is calculated using pipe slope and diameter at 86% flow depth. Pipe capacity must be greater than the expected peak flow or surcharging of the collection system can occur. This value is represented as a percentage which is calculated by dividing the peak flow by the pipe's flow capacity. A percentage less than 100% means that peak flow is less than the capacity of the pipe.
- Hydraulic grade line should not exceed the top of the pipe
- Pipe velocity should not exceed 3.0 m/s

4.3.3 Lift Station Pumping Requirements

Under peak wet weather flow conditions, a lift station should be able to convey peak flows using the station's firm flow capacity (i.e. with the largest pump out of service).

4.4 Hydraulic Model Development

4.4.1 Existing System Implementation

A wastewater hydraulic model of the City's wastewater system was developed for the 2016 UMP, however due to it being six years old, and the intent to move to a time-based model, the decision was made to remake the model utilizing Bentley SewerGEMS.

Schematic linework, manhole locations, and asset attributes such as pipe diameter, material, and invert elevations were established from the City's most recent GIS data. All assets were associated to the GIS IDs from the City's asset management system, which will result in easily updating and removing assets as the GIS information is updated. All new assets as of March 2023 were included in the model.

The inputs, particularly the invert elevations at pipes and manholes, were reviewed for completeness and to ensure all pipes in the network had their inverts oriented in the proper direction.



Lift station pump curves and operating points were retained from the previous UMP inputs and were reviewed for accuracy and updated where necessary as per information provided from EPCOR. Lift Station 2 was notably updated since the previous UMP, and had its new wet well location, orientation and inputs updated, in addition to updated lift station pump curves.

Any missing ground level or manhole rim inputs were updated as per the most recent LiDAR information provided by the City.

Wastewater flows were implemented into the model utilizing the customer water meter data. Each catchment area was divided into smaller sub catchments for each manhole in the system using Thiessen geometry. All water meters that fell into a particular manhole's sub catchment had their demands assigned to that manhole. The sum of demands in each of these sub catchments equals the Average Dry Weather Flow for each catchment area.

4.4.2 Extended Period Simulation

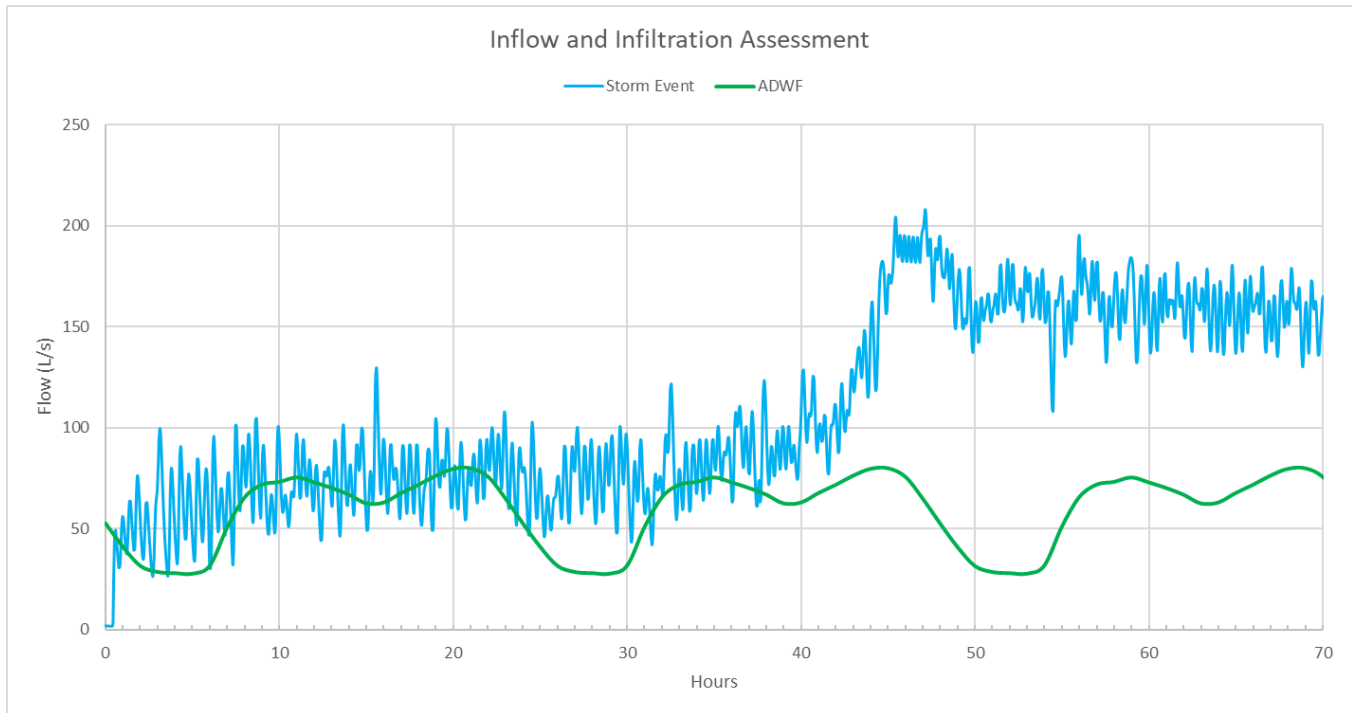
The model was developed as a time-based model, also known as an extended period simulation. This form of model simulates the daily demands and operational information such as pump cycles in real time and is a more accurate way of representing the flow patterns and characteristics in the system. The flows and hydraulic grade lines of the system can be charted over time to see when and how long particular events affect the system.

As discussed in Section 4.2.1, diurnal patterns were developed for each lift station catchment areas. These diurnal patterns act as peaking factors or multipliers for the demands, creating the peak and low flows throughout the day.

4.5 Existing System Evaluation

4.5.1 Inflow and Infiltration Assessment

The modelled peak I&I rates were assessed for the whole Chestermere wastewater collection system at Lift Station 13. The City has an approximate wastewater catchment area of 630 ha. The peak inflows during the modelled storm event were compared against the dry weather flow diurnal curves from Lift Station 13.



With a peak dry weather flow of approximately 80 L/s, and a peak wet weather flow of approximately 190 L/s, the City of Chestermere wastewater collection system has a peak modelled I&I rate of approximately 0.17 L/s/ha.

4.5.2 Lift Station Analysis

The existing lift stations were reviewed under the Peak Wet Weather (PWWF) flow scenario. All lift stations had a firm pumping capacity at or greater than the peak flows and meet the design criteria.

Table 4.4 - Existing System Lift Station Analysis

Lift Station Name	Peak Wet Weather Flow (L/s)	Firm Pumping Capacity (L/s)
1	5	13
2	13	22
3	10	10
4	43	75
5	11	20
6	9	25
7	34	79
8A	1	5
8	11	26
9	30	30
10	175	250
11	35	65
12	28	45
13	185	255 ¹

The pump stations and upstream collection systems were assessed in the wastewater model under PWWF conditions to ensure no surcharging upstream of the lift stations occurred.

4.5.3 Collection System Analysis

The existing collection system was reviewed under the Peak Wet Weather flow scenario, with particular focus on the peak flows during the day. The simulation results during the peak flows, showing pipe flows and any surcharging pipes can be found in Figure 4.3.

In the existing collection system, no surcharging pipes were identified.

¹ See Section 4.1.2 for explanation of Lift Station 13 operation



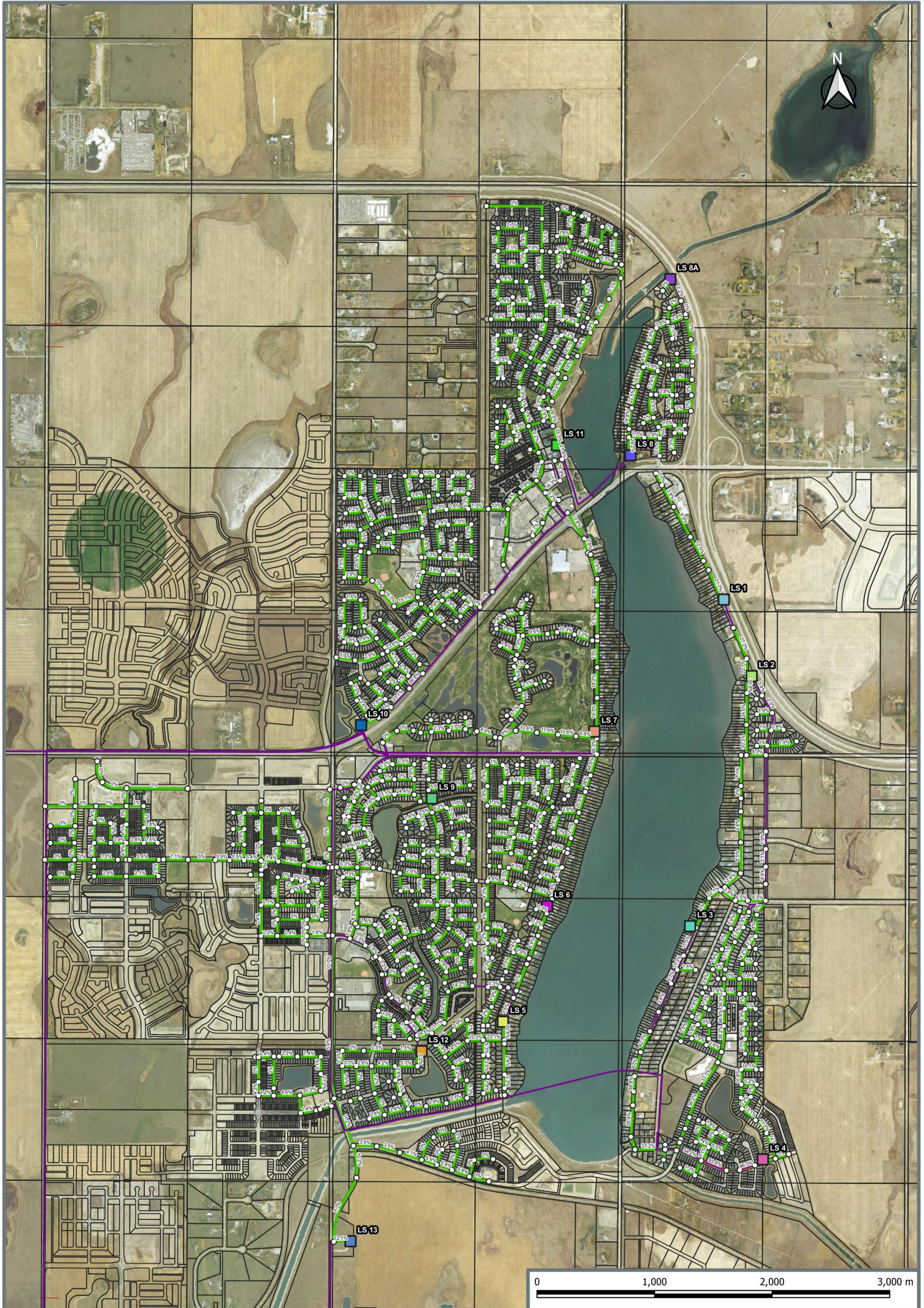


Figure 4.3 - Existing System PWWF Results

Scale 1:20,000

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Hydraulic Capacity

- 0% - 80%
- >100%
- Forcemains
- 80% - 90%
- Pipe is Surcharging
- Lift Stations (Various Colours)
- 90% - 100%

Figure 4.3 - Existing Collection System PWWF

4.6 Future System Evaluation

4.6.1 Lift Station Analysis - 25 Year Horizon

Under the 25-year horizon, the system-wide Peak Wet Weather Flow (PWWF) is approximately 540 L/s, which exceeds the maximum instantaneous discharge rate to Calgary at Discharge Location #4 (450 L/s). This is the primary discharge location under current operations.

To support the 25 Year Horizon, several elements of the wastewater conveyance system must be addressed.

- Total instantaneous discharge to Calgary
- Peak inflows and discharge at Lift Station 10
- Peak inflows and discharge at Lift Station 13
- A new lift station (Lift Station 14) to support the southeast portion of Chestermere

Additionally, a technical memo was developed regarding servicing the East Acreages Off-Site Levy (OSL) area prior to installing a future gravity trunk main. The outcomes are summarized below, with the full memo in Appendix B.

4.6.1.1 *Instantaneous Discharge to Calgary*

Under the current Master Service Agreement (MSA) with Calgary, Chestermere has two viable discharge points:

- Discharge #2 from Lift Station 10 (peak instantaneous flow of 240 L/s)
- Discharge #4 from Lift Station 14 (peak instantaneous flow of 450 L/s)

With a projected PWWF of 540 L/s, flows must be split between these two stations.

The proposed development areas and operational scenarios were reviewed in the model, and it was determined that Lift Station 10 can support the North Acreages and Mountainview Park OSL areas while discharging to Discharge Location #2 with a total PWWF of 170 L/s, equal to the pumping capacity of the lift station under that scenario. Lift Station 10 H₂S mitigation system will need to be upgraded or modified to meet the longer travel time to discharge #2 to meet the current City of Calgary requirements, and the 450 mm forcemain will require maintenance, such as pipe pigging and ARV inspection and repair.

The remaining lift stations and development areas will collect into the RRST, for a total PWWF of 370 L/s into Lift Station 13. This will service as the ultimate operational scenario for the 25 Year Horizon.

Figure 4.4 below shows the 25 Year Wastewater System and Figure 4.5 shows the 25 Year Discharge scenario.



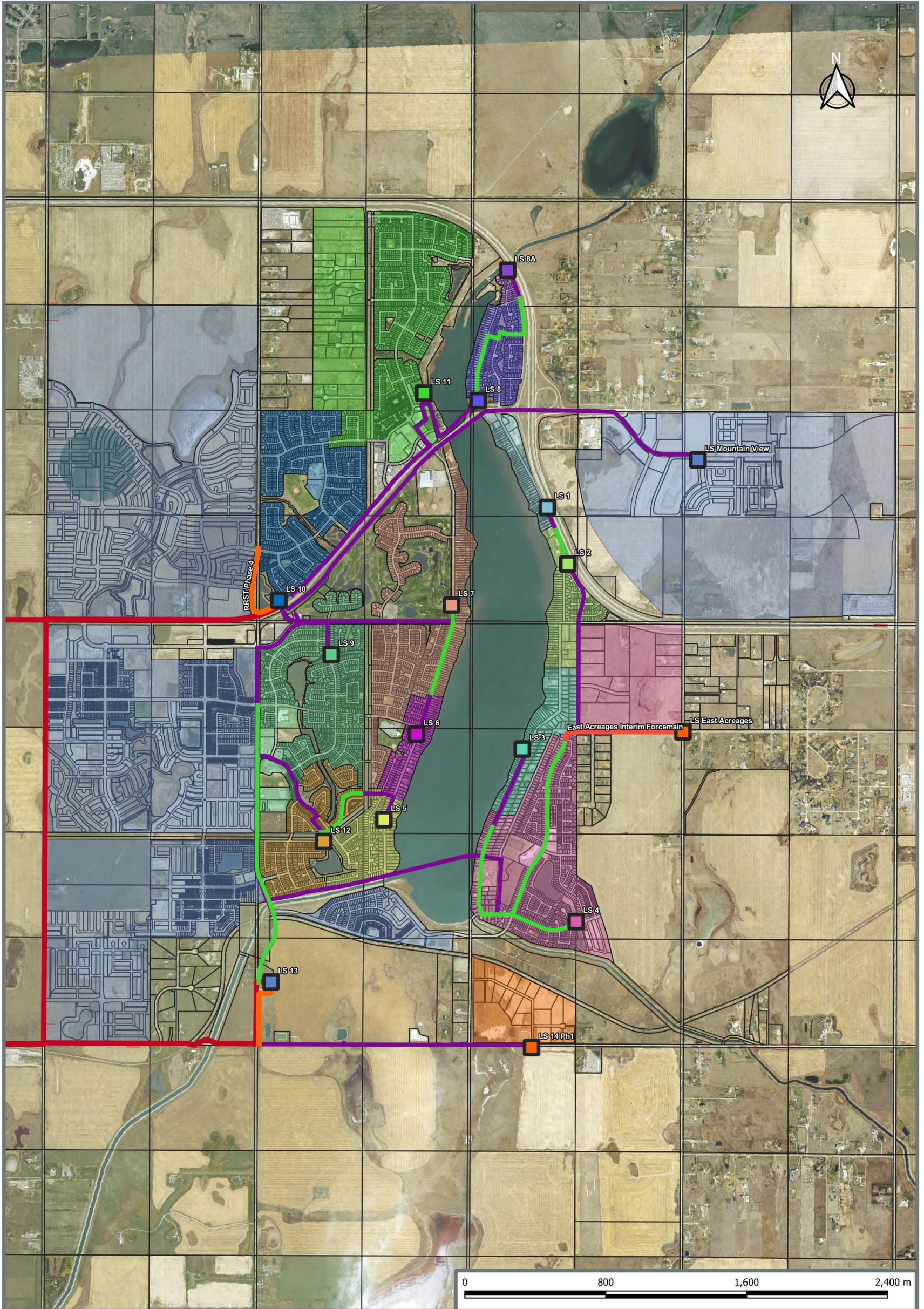


Figure 4.4 - 25 Year Wastewater System

Scale 1:27,000

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OCTOBER 2024

- | | | | | |
|--------------------------------|--------------------------------|-------|-------|-------|
| Wastewater Project Lines | Lift Station Catchments | | | |
| Future Lift Stations | LS 1 | LS 5 | LS 8 | LS 12 |
| Lift Station Forcemain | LS 2 | LS 6 | LS 9 | LS 13 |
| Discharge Forcemain | LS 3 | LS 7 | LS 10 | LS 14 |
| Gravity Lines | LS 4 | LS 8A | LS 11 | |
| Lift Station (Various Colours) | | | | |

Figure 4.4 - 25 Year Wastewater System



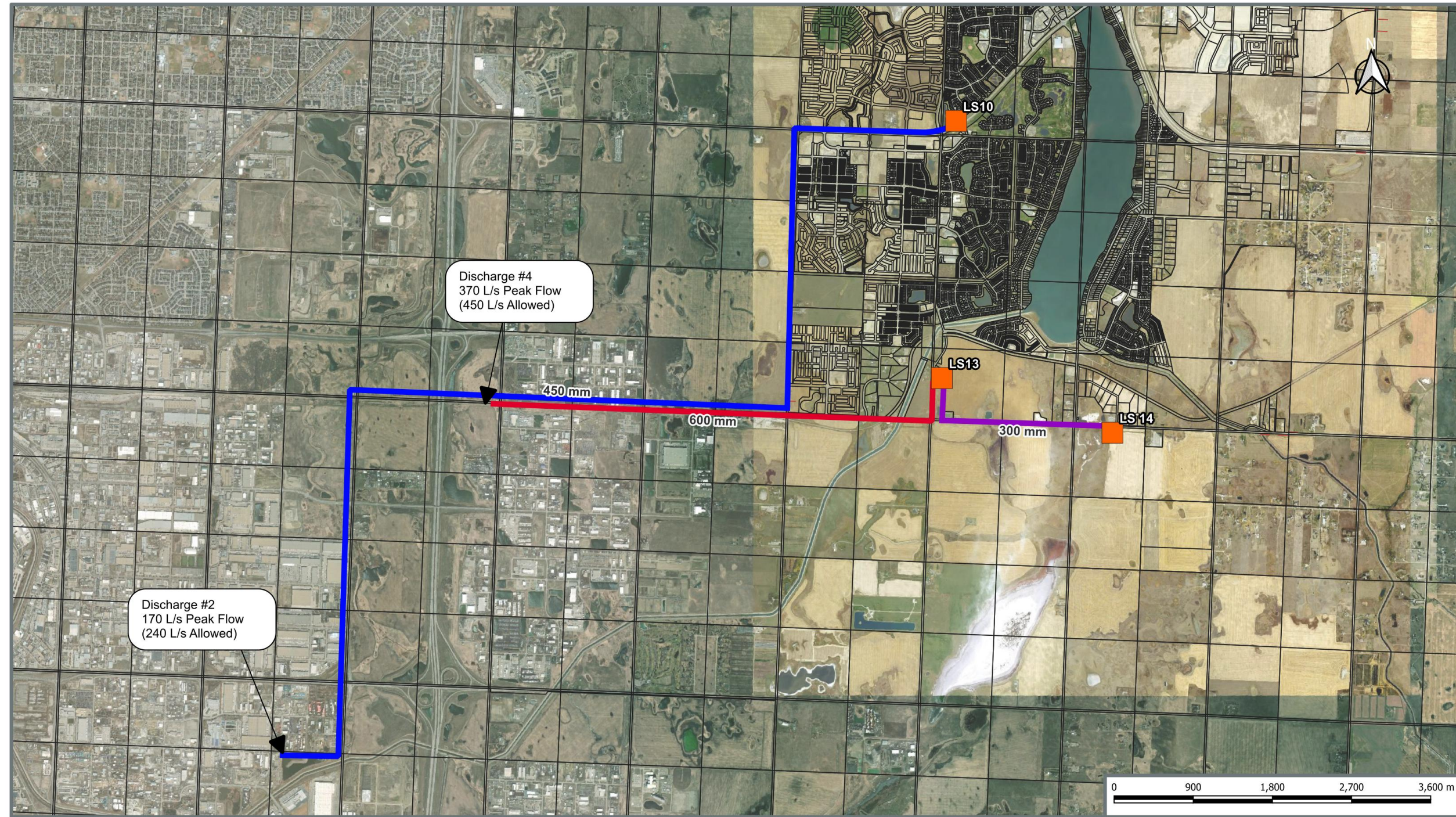


Figure 4.5 - 25 Year Horizon Discharge to Calgary

Scale 1:40,000

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- Lift Stations
- Lift Station 13 FM
- Lift Station 10 FM
- Lift Station 14 FM

Figure 4.5 - 25 Year Discharge Scenario



4.6.1.2 Lift Station 10

Lift Station 10 has an existing pumping capacity of 250 L/s when discharging to the RRST under current operations. In the interim, flows from the Bridgeport, Bridgeport East and North Waterbridge will collect into Lift Station 10 until its pumping capacity is reached, after which an extension of the RRST from the existing upstream end to the north side of Chestermere Blvd is required (RRST Ph3).

The model was reviewed with the full projected growth of North Acreages and Mountainview park in place, which both collect into Lift Station 10, and it was determined that Lift Station 10 can support up to an additional 195 ha, or 11,800 people from the Bridgeport and North Waterbridge. After that point the RRST Phase 3 project will be required to reroute those flows to Lift Station 13. In addition, once Lift Station 10 is required to discharge directly to Calgary, these flows will have to be rerouted through the RRST Ph3, as Lift Station 10 has a lower pumping capacity in that operational scenario.

4.6.1.3 Lift Station 13

Lift Station 13 has a current pumping capacity of 255 L/s (See Section 4.1.2 for a description of the operational constraints) when including the SDOX system and will require at least 370 L/s to support the 25 Year Horizon.

The wastewater model was assessed to determine how much additional growth the existing capacity can support, allowing for some level of system surcharge due to the deep and large diameter pipe upstream.

Through adding and incrementally increasing a catchment area with proportional demands in the existing system demand scenario, it was determined that the lift station can support an additional 200 ha of development, or 12,200 additional people, prior to a pump upgrade being required. This results in a PWWF of 300 L/s with surcharging in the RRST to the top of the pipe, which does not impact upstream developments.

With one additional pump the lift station should be able to operate both pumps at full speed, for a total pumping capacity of approximately 450 L/s. The total flow out of the lift station will have to be limited to 450 L/s due to the City of Calgary discharge limits.

The existing backup generator was reviewed, and it was determined that it has adequate amperage to support two pumps running at once. The existing generator can remain with 3 pumps in place if there is a physical interlock implemented to prevent 3 pumps running at once.



4.6.1.4 Lift Station 14

Lift Station 14 is a proposed future lift station that will be required to support the future development areas in the south and the east. Its approximate future location will be south of Township Rd 240 near Range Rr 282. This lift station will pump directly into Lift Station 13.

There is an existing 350 mm forcemain along Township Rd 240 that the lift station will initially use. This forcemain will need to be extended up Rainbow Rd to tie into Lift Station 13.

The collection area for the lift station has PWWF of approximately 15 L/s, which can increase up to 40 L/s if the East Chestermere Gravity Trunk is completed and the East Acreages flows, which would be collecting into the Lift Station 4 catchment as per the technical memo, get rerouted into Lift Station 14.

It is recommended that the first phase of the lift station be designed to be upgradeable up to 80 L/s pumping capacity. This will enable future growth nearby and ensure a lift station upgrade won't be required immediately after the 25 Year Horizon.

OSL Areas 6, 7, 8, 9, 18 and 20 will all contribute to this project.

Similar size lift stations were assessed to determine total land area required, and it was found that approximately 0.5 ha of land is required to support the full buildout facility.

4.6.1.5 East Acreages Interim Lift Station

As per the technical memo in Appendix B, the East Acreages OSL area can potentially be serviced on an interim basis through a lift station and forcemain that discharges into the existing system and Lift Station 4.

Off-peak pumping was explored for the lift station, and it was determined that a storage tank 650 m³ in volume would be required to facilitate that. The lift station would have a peak pumping capacity of 30 L/s and would require approximately 1 km of 150 mm forcemain to connect it to the existing system.

As indicated in the technical memo, the topography of the area determines the invert elevation of the lift station, which also dictates the upstream invert elevation of the future East Chestermere Gravity Trunk. This elevation is 1020.5 m.

Similar size lift stations were assessed to determine total land area required, and it was found that approximately 0.25 ha of land is required to support the facility.

4.6.2 Lift Station Analysis - Full Buildout

Under full buildout, the system-wide PWWF is projected at 1,200 L/s, significantly exceeding the current allowable discharge to Calgary (690 L/s).

To support full buildout, key elements that need addressing include total discharge to Calgary and peak flows from Lift Station 14.



4.6.2.1 *Instantaneous Discharge to Calgary*

Since the projected PWWF is much higher than the current allowable discharge to Calgary, a new discharge location downstream of the Great Plains Trunk (which currently acts as a bottleneck for Chestermere's discharge rates) will need to be negotiated with the City.

The City of Calgary was engaged for preliminary discussions regarding this future discharge location. There is no prospective discharge location at this time, but through the discussions it was determined that it would likely have to be significantly farther south than the existing discharge locations.

The proposed discharge location would be supported by a new lift station and forcemain. The lift station would be at the same site as Lift Station 13, in essence twinning the lift station. The original Lift Station 13 would be dedicated to pumping to Discharge Location #4, and the new lift station would be dedicated to pumping to the new discharge location. The lift station wet wells would be interconnected to share incoming flows.

With the existing Lift Station 13 limited to 450 L/s, the new lift station would need an ultimate pumping capacity of 750 L/s. The new forcemain is estimated to be 18 km long, with an approximate diameter of 750 mm.

At the end of the 25-Year Horizon, Lift Station 13 has projected incoming PWWF of approximately 370 L/s, leaving 80 L/s of additional capacity in Discharge Location #4. This means that the lift station and forcemain will be required by the time that 80 L/s of available capacity is used up. This will be reached at a system wide population of 80,000 people, or a total development of 935 ha.

Once this new discharge location is active, Lift Station 10 can be decommissioned, and the incoming flows rerouted to the RRST.



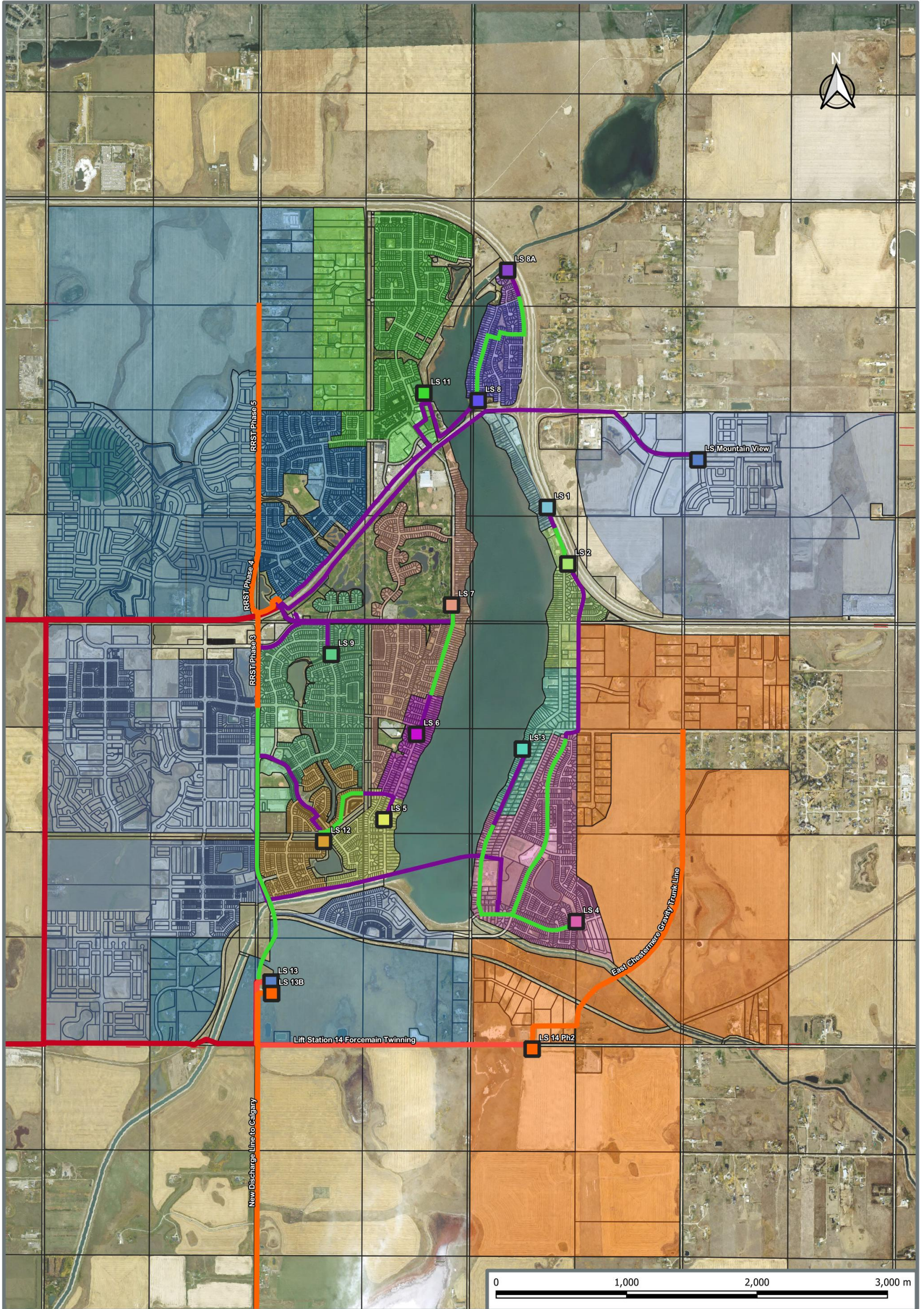


Figure 4.6 - Full Buildout Wastewater System

Scale 1:27,000

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Wastewater Project Lines

Future Lift Stations

Lift Station Forcemain

Discharge Forcemain

Gravity Lines

Lift Station (Various Colours)

Lift Station Catchments

LS 1 LS 5 LS 8 LS 12

LS 2 LS 6 LS 9 LS 13

LS 3 LS 7 LS 10 LS 14

LS 4 LS 8A LS 11

Figure 4.6 - Full Buildout Wastewater System



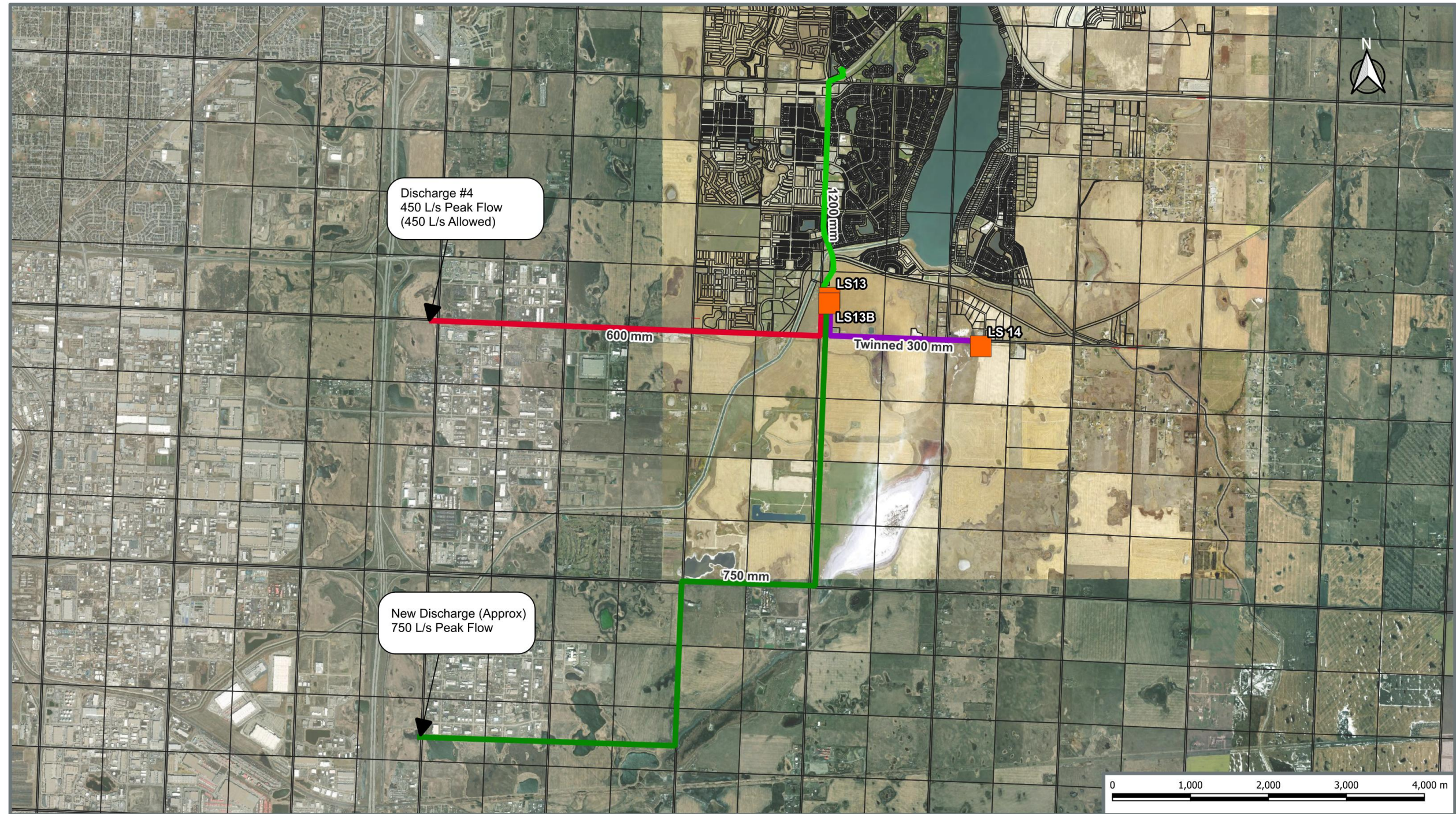


Figure 4.7 - Full Buildout Discharge Location #4 and New Location

Scale 1:45,000

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- Lift Stations
- New Discharge FM
- Lift Station 13 FM
- Gravity Line
- Lift Station 14 FM

Figure 4.7 - Full Buildout Discharge Scenario



4.6.2.2 Lift Station 14

The Lift Station 14 collection area will have an ultimate PWWF of approximately 320 L/s. With the initial stages of the lift station having a pumping capacity of 80 L/s, an additional 240 L/s of pumping capacity will be required to satisfy the Full Buildout demands. This upgrade will be triggered after a population growth of 9,000 people in the lift station catchment area, or development of 150 ha.

In addition to the lift station upgrade, eventually the existing forcemain for Lift Station 14 will be beyond its hydraulic capacity. Once that is reached, it is recommended to twin the existing 350 mm forcemain. This will allow for sufficient hydraulic capacity for the Full Buildout demands.

The forcemain has a capacity of approximately 180 L/s, as such the project will trigger by that PWWF, which amounts to a population growth of 20,000 people in the lift station catchment area, or development of 325 ha.

4.6.3 Collection System Analysis - 25 Year Horizon

The collection system for the 25 Year Horizon was reviewed under the Peak Wet Weather flow scenario, with particular focus on the peak flows during the day. The results during the peak flows, showing pipe flows and any surcharging pipes can be found in Figure 4.8.



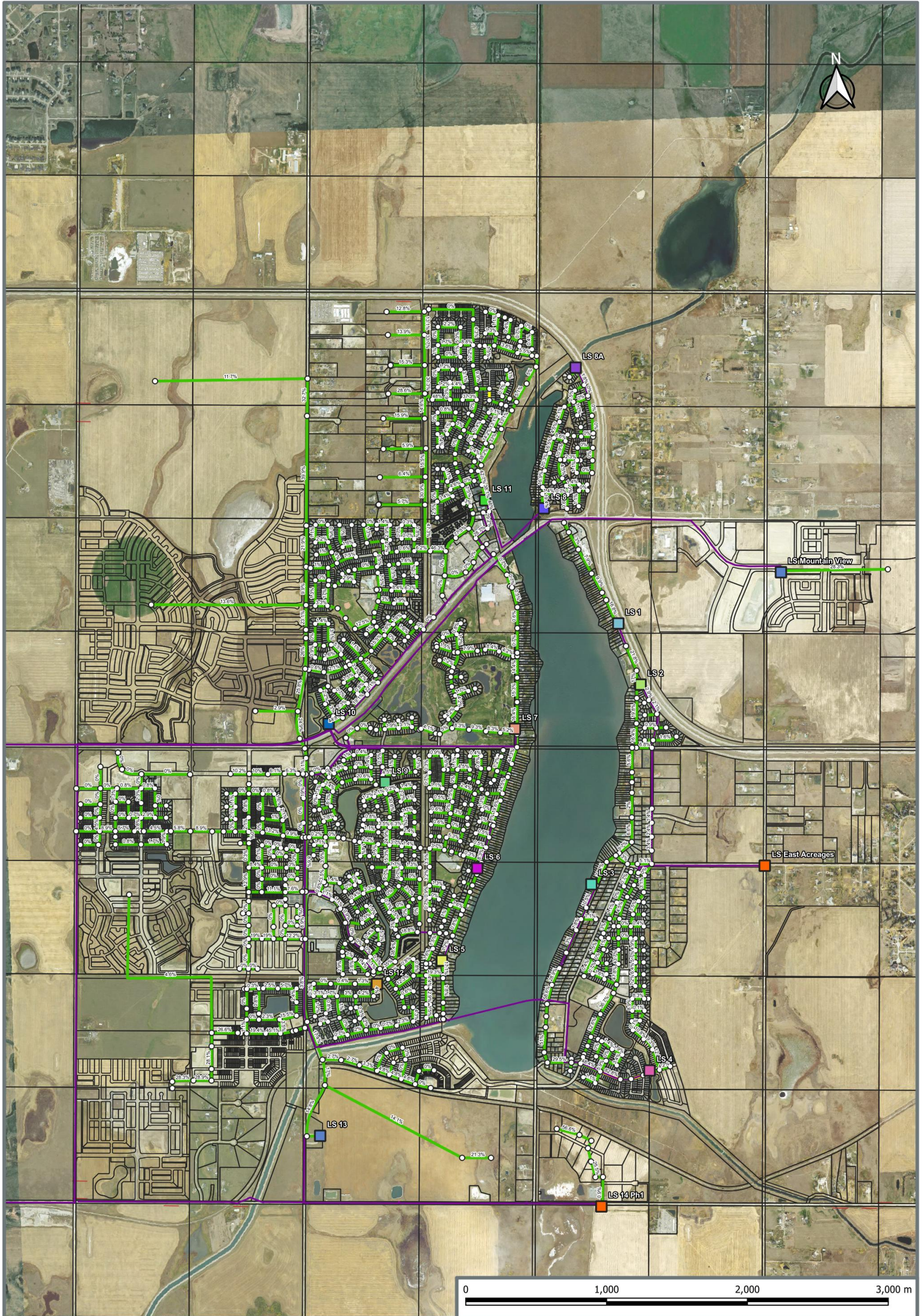


Figure 4.8 - 25 Year Horizon PWWF Results

Scale 1:25,000

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Hydraulic Capacity

- 0% - 80%
- >100%
- Forcemains
- 80% - 90%
- Pipe is Surcharging
- Lift Stations (Various Colours)
- 90% - 100%

Figure 4.8 - 25 Year PWWF



Under the 25-Year Horizon, minimal additional offsite collection system infrastructure is required to support future growth. Primarily, the next two to three phases of the RRST will be necessary by the end of the horizon, dependant on development requirements.

RRST Phase 4, which is north of Chestermere Blvd, is required to service the Bridgeport and North Waterbridge areas. In the interim it is connecting to Lift Station 10, however as discussed in Section 4.6.1 Lift Station 10 will reach its capacity limit after approximately 195 ha of development or 11,800 additional people in the Bridgeport and North Waterbridge developments. Prior to that limit being reached, or to Lift Station 10 being required to discharge to Calgary due to discharge constraints, RRST Phase 3 will be initiated. This phase connects from north of Chestermere Blvd to the current upstream extents of the RRST.

Construction of RRST Phase 5, which in the northernmost section of the trunk line, will be dependant on local development pressures.

4.6.4 Collection System Analysis - Full Buildout

The collection system for the Full Buildout Horizon was reviewed under the Peak Wet Weather flow scenario, with particular focus on the peak flows during the day. The results during the peak flows, showing pipe flows and any surcharging pipes can be found in Figure 4.9.

Under the Full Buildout horizon, the remaining offsite collection system infrastructure is the East Chestermere Gravity Trunk Line, which supports the eastern offsite levy areas, conveying their flows to Lift Station 14. In addition, once Lift Station 10 is decommissioned, a gravity connection from the old lift station site to the RRST will be required.

This future trunk line will largely be triggered by local development pressures to enable servicing.



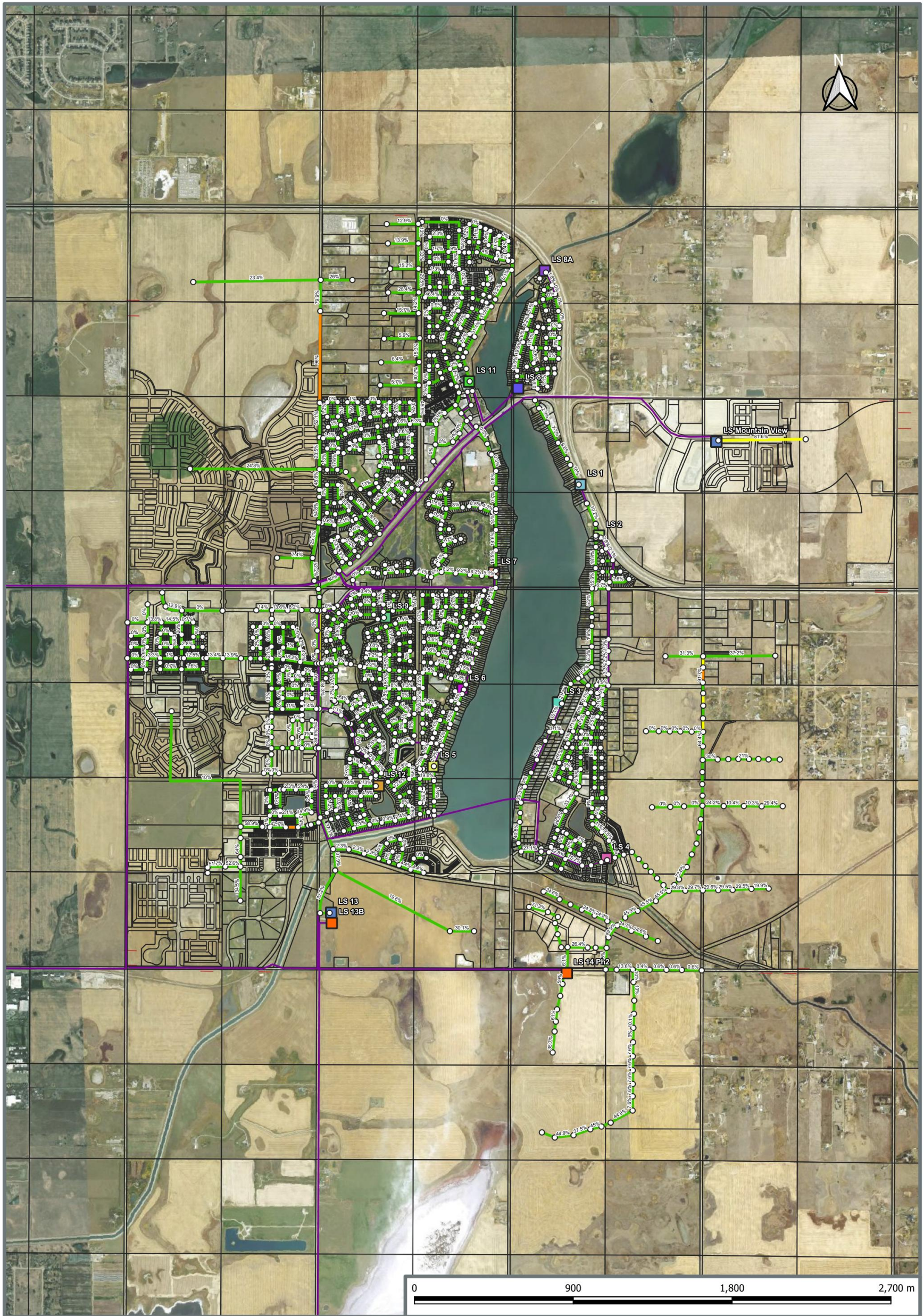


Figure 4.9 - Full Buildout Horizon PWWF Results

Scale 1:30,000

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Figure 4.9 - Full Buildout PWW



5. Capital Projects

The following section provides an overview of the planned water infrastructure projects required to support future growth in Chestermere. These projects have been designed to address the increased water demand and pressure requirements as the city's population expands, particularly in areas located at higher elevations. The projects include new reservoirs, pump stations, supply mains, and upgrades to existing facilities, each with specific triggers and benefitting areas. The goal of these projects is to ensure that Chestermere's water distribution system continues to provide reliable service while accommodating the needs of future developments.

5.1 Capital Projects and Cost Estimates

The intent of this report is to identify capital projects that resolve existing deficiencies in the water and wastewater system, and capital projects that allow for growth and development in the City. Cost estimates will be prepared for the capital projects.

Capital projects were identified by assessing the water and wastewater models for the existing system and the 25 year and Full Buildout growth horizons. Under each scenario, when deficiencies in the infrastructure were identified projects were recommended. Operational improvements and lifecycle improvements were also considered.

Cost estimates for each capital project were developed by assessing the overall scope of the project, breaking the project down into major line items. These may include length of pipe, reservoir volume, pump capacity, allowance for care of water, or other line items pertaining to the project. Project line items were assigned a unit rate cost based on recent similar projects, industry experience, and consulting with contractors and City staff.

A 13% allowance for engineering and planning were included in the project cost, along with a 30% contingency.

The cost estimates are considered Class 5 estimates as per the AACE Cost Estimate Classification System. All cost is provided in 2024 dollars. Cost estimates are available in Appendix E.



5.2 Water Projects Summary

Project Name	Project Triggers				Total Project Cost
	Development/Construction Area Criteria	System-wide ADD (L/s)	Population	Development Area (ha)	
W1 - NW Reservoir and Pump Station Phase 1	Development at or above 1045 meters	148	52,000	467	\$18,330,000
W2 - NW Reservoir Supply Main	Development at or above 1045 meters, NW Reservoir construction	148	52,000	467	\$4,560,000
W3 - Main Pump Station Upgrade Phase 2	-	120	42,000	296	\$2,430,000
W4 - Main Pump Station Upgrade Phase 3	-	295	105,000	1338	\$500,000
W5 - NW Reservoir and Pump Station Phase 2	-	295	103,000	1305	\$16,600,000
W6 - New Water Supply Main from Calgary	Construction of NW Reservoir	180	65,000	680	\$4,020,000
W7 - SE Reservoir and Pump Station Phase 1	Nearby development, fire flow deficiencies	220	78,000	894	\$18,330,000
W8 - SE Reservoir and Pump Station Phase 2	-	364	127,000	1700	\$16,600,000
W9 - Distribution Trunk in Rainbow Road	Construction of SE Reservoir, south/east Chestermere development	-	-	-	\$3,500,000
W10 - Distribution Trunk in Twp Rd 240 Phase 2	Construction of SE Reservoir, south/east Chestermere development	-	-	-	\$3,430,000
W11 - Distribution Trunk in Twp Rd 240 Phase 3	Construction of SE Reservoir, southwest Chestermere development	-	-	-	\$3,650,000
W12 - Distribution Trunk in RR 281	Construction of SE Reservoir, east Chestermere development	-	-	-	\$7,700,000



5.3 Water Projects

5.3.1 Project W1 - NW Reservoir and Pump Station Phase 1



Project Description

An 6,000 m³ Potable Water Reservoir and a 300 L/s Pump Station designed to support the 25-Year Horizon storage requirements and development in the upper pressure zone. The pump station also addresses the MDD+FF pumping needs.

Project Details

- 6000 m³ Potable Water Reservoir (two cells)
- 300 L/s Pump Station
- Supports 25-Year Horizon storage requirements
- 1 ha (2.5 acres) of land for ultimate reservoir

Project Triggers

- Development at or above 1045 meters elevation
- System-wide ADD of 148 L/s
- Population of 52,000 people

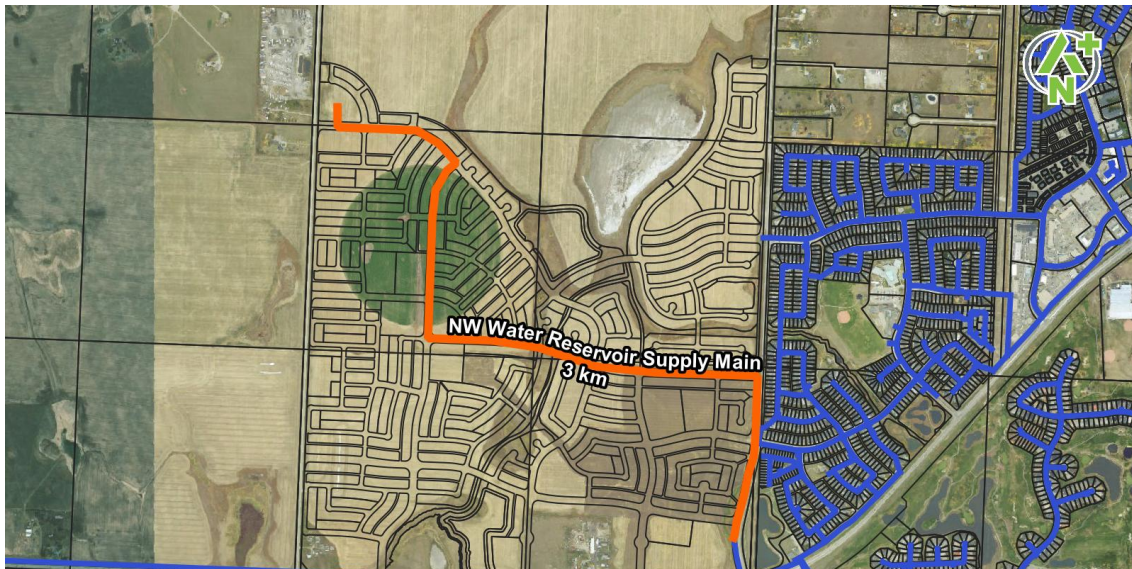
Benefiting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$1,622,000
Construction	12,480,000
Contingency	\$4,230,000
Total	\$18,330,000

5.3.2 Project W2 - NW Reservoir Supply Main



Project Description

3 km of 400 mm diameter waterline to supply the NW reservoir with water from the Calgary supply lines.

Project Details

- 3 km of 400 mm diameter waterline
- Supplies NW Reservoir with water from Calgary
- Supports 25-Year Horizon water requirements

Project Triggers

- Development at or above 1045 meters elevation
- NW Reservoir construction
- System-wide ADD of 148 L/s
- Population of 52,000 people

Benefitting Areas

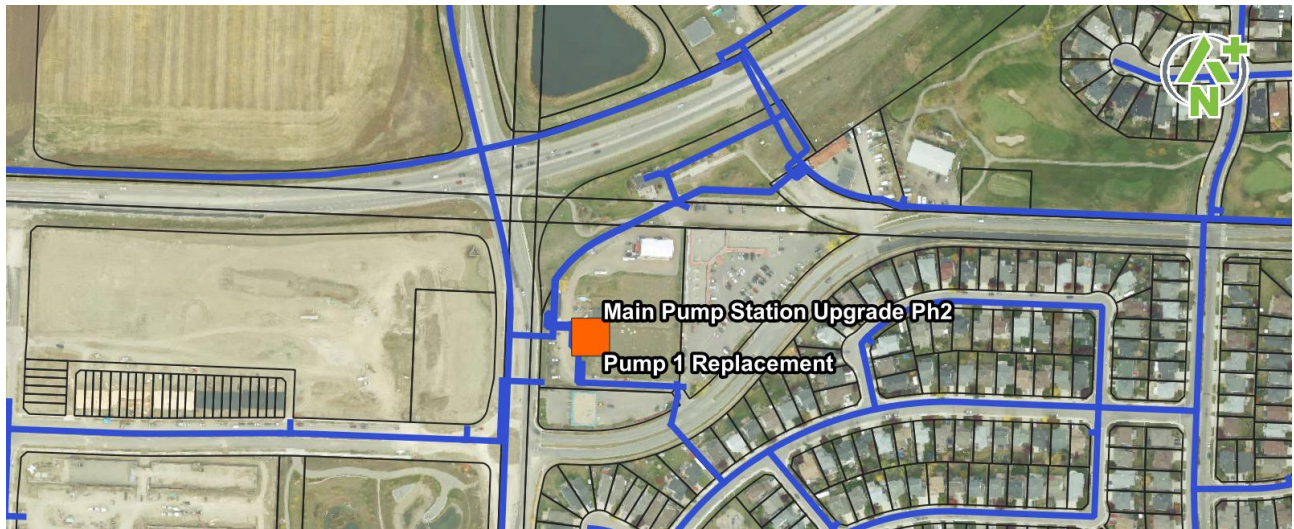
Water projects are considered to benefit all new development.

Project Cost

Engineering	\$400,000
Construction	\$3,110,000
Contingency	\$1,050,000
Total	\$4,560,000



5.3.3 Project W3 - Main Pump Station Upgrade Phase 2



Project Description

Replace Pump 1 (30 hp pump) with a 150 hp pump to support 25-Year Horizon MDD+FF pumping requirements and increase pumping capacity to 578 L/s.

Project Details

- Replace 30 hp pump with 150 hp pump
- Increases pumping capacity to 578 L/s
- Supports 25-Year Horizon pumping needs

Project Triggers

- System-wide ADD of 179 L/s
- Supporting a population of 42,000 people
- Development of 657 ha

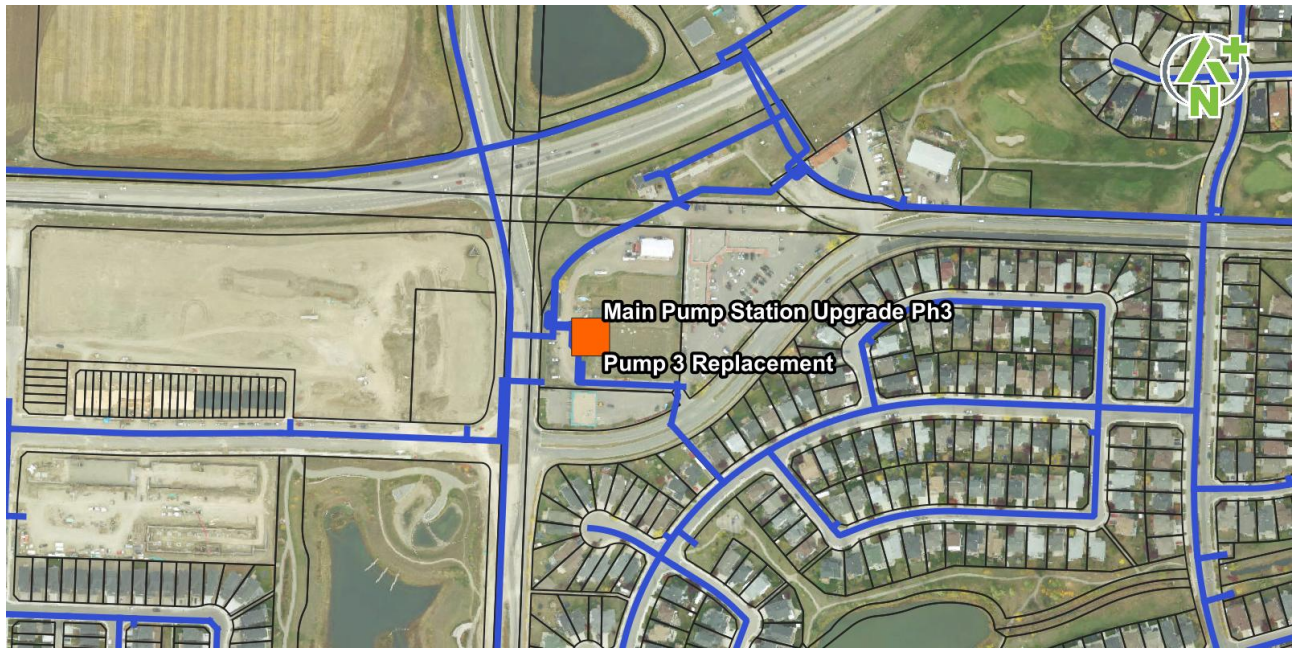
Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$220,000
Construction	\$1,650,000
Contingency	\$560,000
Total	\$2,430,000

5.3.4 Project W4 - Main Pump Station Upgrade Phase 3



Project Description

Replace Pump 3 (75 hp pump) with a 150 hp pump to support Full Buildout MDD+FF pumping requirements and increase pumping capacity to 664 L/s.

Project Details

- Replace 75 hp pump with 150 hp pump
- Increases pumping capacity to 664 L/s
- Supports Full Buildout MDD+FF pumping needs

Project Triggers

- System-wide ADD of 295 L/s
- Supporting a population of 105,000 people
- Development of 1338 ha

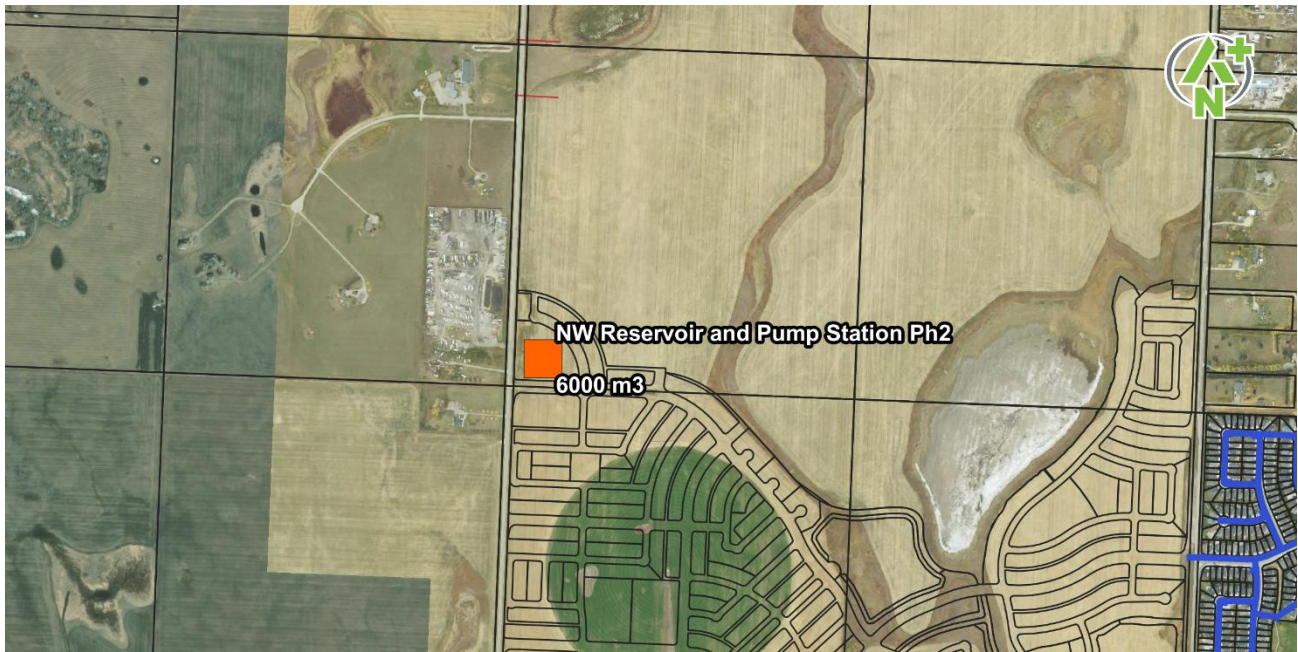
Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$40,000
Construction	\$340,000
Contingency	\$120,000
Total	\$500,000

5.3.5 Project W5 - NW Reservoir and Pump Station Phase 2



Project Description

Additional 6000 m³ Potable Water Reservoir and +210 L/s Pumping Capacity to support Full Buildout storage requirements and development in Chestermere.

Project Details

- Additional 6000 m³ Potable Water Reservoir
- +210 L/s Pumping Capacity
- Supports Full Buildout storage and development

Project Triggers

- System-wide ADD of 295 L/s
- Supporting a population of 103,000 people
- Development of 1,305 ha

Benefiting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$1,470,000
Construction	\$11,300,000
Contingency	\$5,300,000
Total	\$16,600,000

5.3.6 Project W6 - New Water Supply Main from Calgary



Project Description

1.8 km of 500 mm diameter waterline to supply the NW reservoir from the planned Calgary supply line. Supports full buildout water supply.

Project Details

- 1.8 km of 500 mm diameter waterline
- Supplies NW Reservoir from planned Calgary supply line
- Supports full buildout water supply

Project Triggers

- System-wide ADD of 180 L/s
- Population of 65,000 people
- 549 ha of development

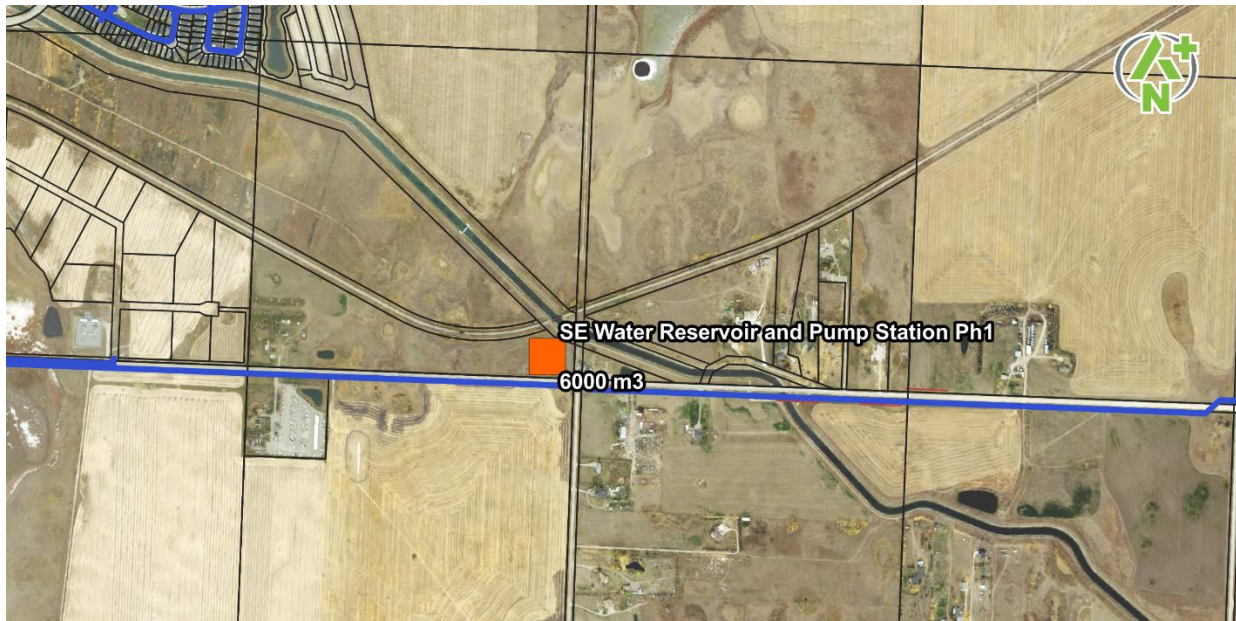
Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$360,000
Construction	\$2,730,000
Contingency	\$930,000
Total	\$4,020,000

5.3.7 Project W7 - SE Reservoir and Pump Station Phase 1



Project Description

6000 m³ Potable Water Reservoir and 300 L/s Pump Station to support 25-Year Horizon storage and development in Chestermere.

Project Details

- 6000 m³ Potable Water Reservoir
- 300 L/s Pump Station
- Supports 25-Year Horizon storage and development
- 1 ha (2.5 acres) of land for ultimate reservoir

Project Triggers

- Nearby development and fire flow deficiencies in east Chestermere
- System-wide ADD of 220 L/s
- Population of 78,000 people and 894 ha of development

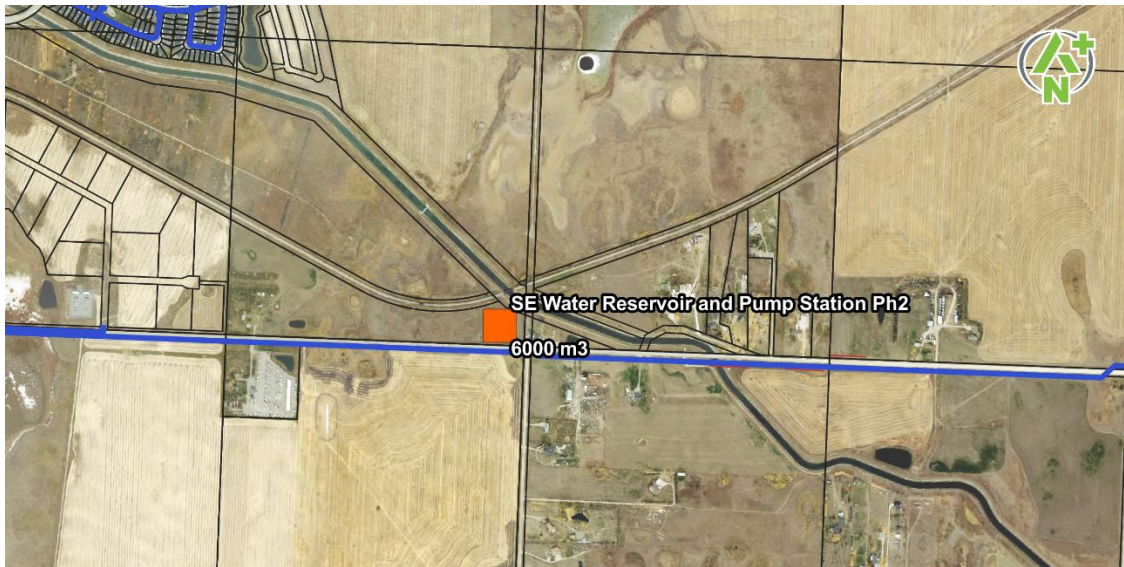
Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$1,622,000
Construction	12,480,000
Contingency	\$4,230,000
Total	\$18,330,000

5.3.8 Project W8 - SE Reservoir and Pump Station Phase 2



Project Description

Additional 6000 m³ Potable Water Reservoir and +210 L/s Pumping Capacity to support Full Buildout storage and pumping requirements in the Chestermere Water Distribution System.

Project Details

- Additional 6000 m³ Potable Water Reservoir
- +210 L/s Pumping Capacity
- Supports Full Buildout storage and pumping requirements

Project Triggers

- System-wide ADD of 365 L/s
- Population of 127,000 people
- Development of 1,700 ha

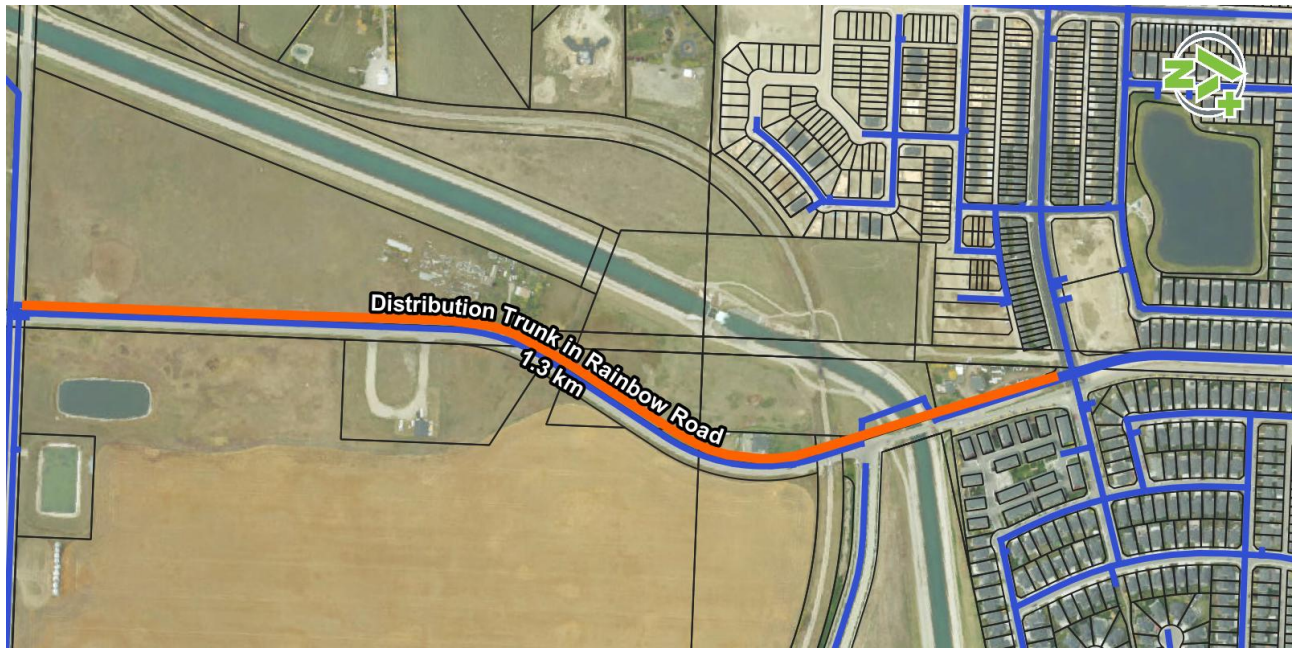
Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$1,470,000
Construction	\$11,300,000
Contingency	\$3,830,000
Total	\$16,600,000

5.3.9 Project W9 - Distribution Trunk in Rainbow Road



Project Description

1.3 km of 500 mm Water Distribution Main to connect the Water Transfer Station to the distribution trunk along Twp Rd. 240.

Project Details

- 1.3 km of 500 mm Water Distribution Main
- Connects Water Transfer Station to distribution trunk along Twp Rd. 240

Project Triggers

- Construction of the SE Reservoir
- Development in the south and east parts of Chestermere

Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$310,000
Construction	\$2,380,000
Contingency	\$810,000
Total	\$3,500,000

5.3.10 Project W10 - Distribution Trunk in Twp Rd 240 Phase 2



Project Description

1.2 km of 500 mm Water Distribution Main to connect the existing stub on Twp Rd 240 to RR 281 and the proposed SE Reservoir.

Project Details

- 1.2 km of 500 mm Water Distribution Main
- Connects the existing stub on Twp Rd 240 to RR 281 and SE Reservoir

Project Triggers

- Construction of the SE Reservoir
- Development in the south and east parts of Chestermere

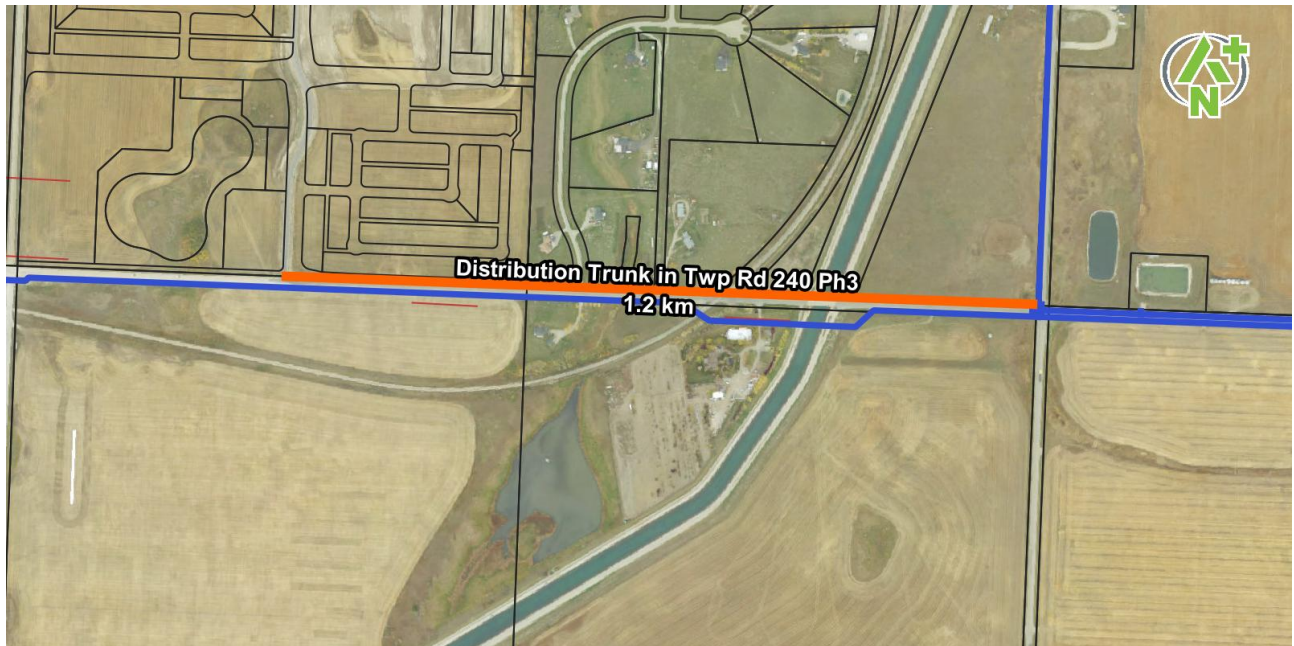
Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$300,000
Construction	\$2,340,000
Contingency	\$790,000
Total	\$3,430,000

5.3.11 Project W11 - Distribution Trunk in Twp Rd 240 Phase 3



Project Description

1.2 km of 400 mm Water Distribution Main to connect the existing stub on Twp Rd 240 to Waterbury Rd.

Project Details

- 1.2 km of 400 mm Water Distribution Main
- Connects the existing stub on Twp Rd 240 to Waterbury Rd

Project Triggers

- Construction of the SE Reservoir
- Development in the southwest parts of Chestermere

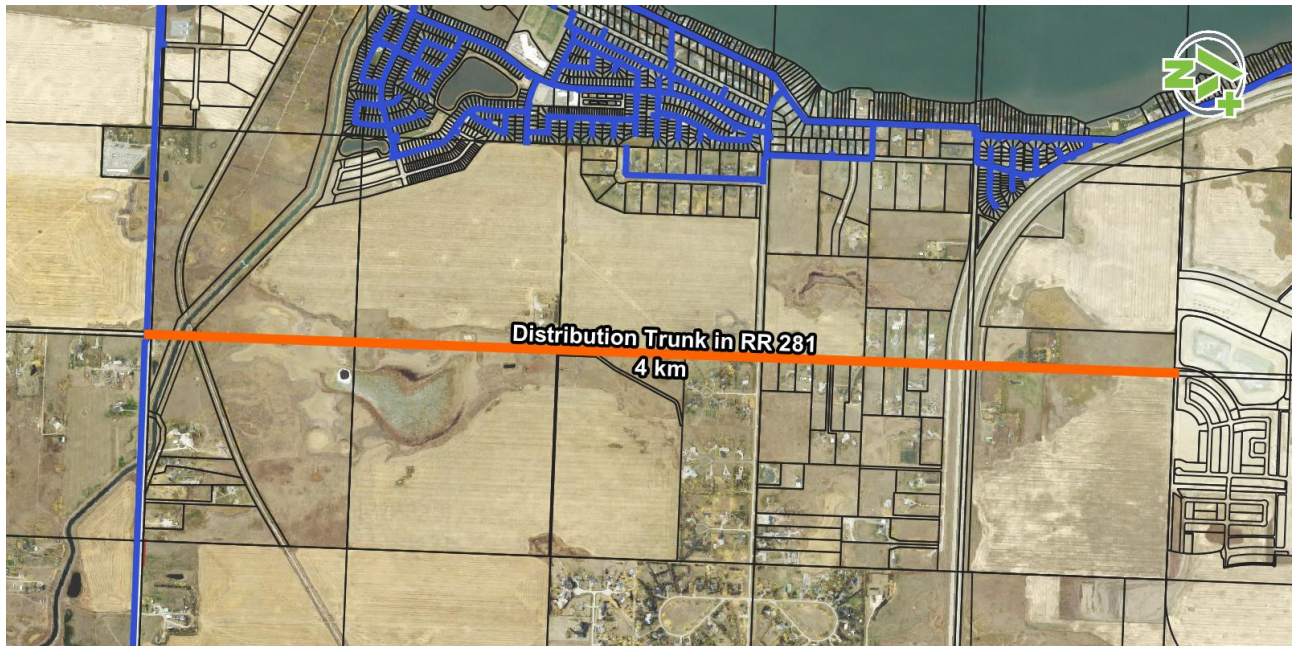
Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$320,000
Construction	\$2,490,000
Contingency	\$840,000
Total	\$3,650,000

5.3.12 Project W12 - Distribution Trunk in RR 281



Project Description

4 km of 400 mm Water Distribution Main to connect the distribution trunk on Twp Rd 240 to the Clearwater development along RR 281.

Project Details

- 4 km of 400 mm Water Distribution Main
- Connects distribution trunk on Twp Rd 240 to Clearwater development along RR 281

Project Triggers

- Construction of the SE Reservoir
- Development in east Chestermere

Benefitting Areas

Water projects are considered to benefit all new development.

Project Cost

Engineering	\$680,000
Construction	\$5,240,000
Contingency	\$1,780,000
Total	\$7,700,000

5.4 Wastewater Projects Summary

Project Name	Project Triggers				Total Project Cost
	Development/Construction Area Criteria	PWWF (L/s)	Population	Development Area (ha)	
S1 - East Acreages Interim Lift Station	Development in East Acreages OSL area	-	-	-	\$3,740,000
S2 - Lift Station 13 Pump Upgrade		250 L/s	31,000	100	\$1,390,000
S3 - RRST Phase 3	Capacity limitations at Lift Station 10, discharge limit at Discharge #4 reached	250 L/s (LS 10)	11,800 (In Bridgeport / Waterbridge)	195	\$9,550,000
S4 - RRST Phase 4	Development in Bridgeport	-	-	-	\$1,170,000
S5 - RRST Phase 5	Development along alignment	-	-	-	\$3,540,000
S6 - East Chestermere Gravity Trunk Line	Development along alignment Capacity limitations at LS4 Population growth in East Acreages and Sierra Vista	-	-	-	\$9,800,000
S7 - Lift Station 14 Phase 1	Population growth in East Acreages and Sierra Vista	-	-	-	\$4,200,000
S8 - Lift Station 13 Twinning	NO remaining discharge capacity to Calgary	620 L/s	80,000	935	\$12,050,000
S9 - Lift Station 14 Phase 2	Population growth in Southeast OSL	80 L/s	9,000	-	\$6,390,000
S10 - Lift Station 14 FM Twinning	Population growth in Southeast OSL	180 L/s	20,000	-	\$5,290,000
S11 - New Discharge FM to Calgary	Population growth in Chestermere	620 L/s	80,000	935	\$19,530,000
S12 - Lift Station 10 to Discharge #2 Modifications	Discharge limit reached to Discharge #4	450 L/s	58,000	580	\$590,000
S13 - Lift Station 10 Decommissioning	New discharge forcemain to Calgary	620 L/s	80,000	935	\$3,020,000



5.5 Wastewater Projects

5.5.1 Project S1 - East Acreages Interim Lift Station



Project Description

A new 30 L/s Lift Station with a storage cell/wet well and 1 km of 150 mm forcemain to support development in the East Acreages area until the Sierra Vista trunk and LS 14 are completed.

Project Details

- 30 L/s Lift Station
- 1 km of 150 mm forcemain
- Storage cell/wet well with 650 m³ capacity
- 0.25 ha (0.65 acres) of land

Project Triggers

- Development in the East Acreages OSL area

Benefitting Areas

East Acreages OSL area.

Project Cost

Engineering	\$330,000
Construction	\$2,550,000
Contingency	\$860,000
Total	\$3,740,000

5.5.2 Project S2 - Lift Station 13 Pump Upgrade



Project Description

Install one additional pumps to support the 25-Year Horizon Peak Wet Weather Flows (PWWFs) at Lift Station 13.

Project Details

- One additional pump for LS 13
- Supports 25-Year Horizon PWWFs
- Generator interlock for only 2 pumps

Project Triggers

- PWWF of 300 L/s
- Supporting a population of 42,000 people
- Development of 200 ha

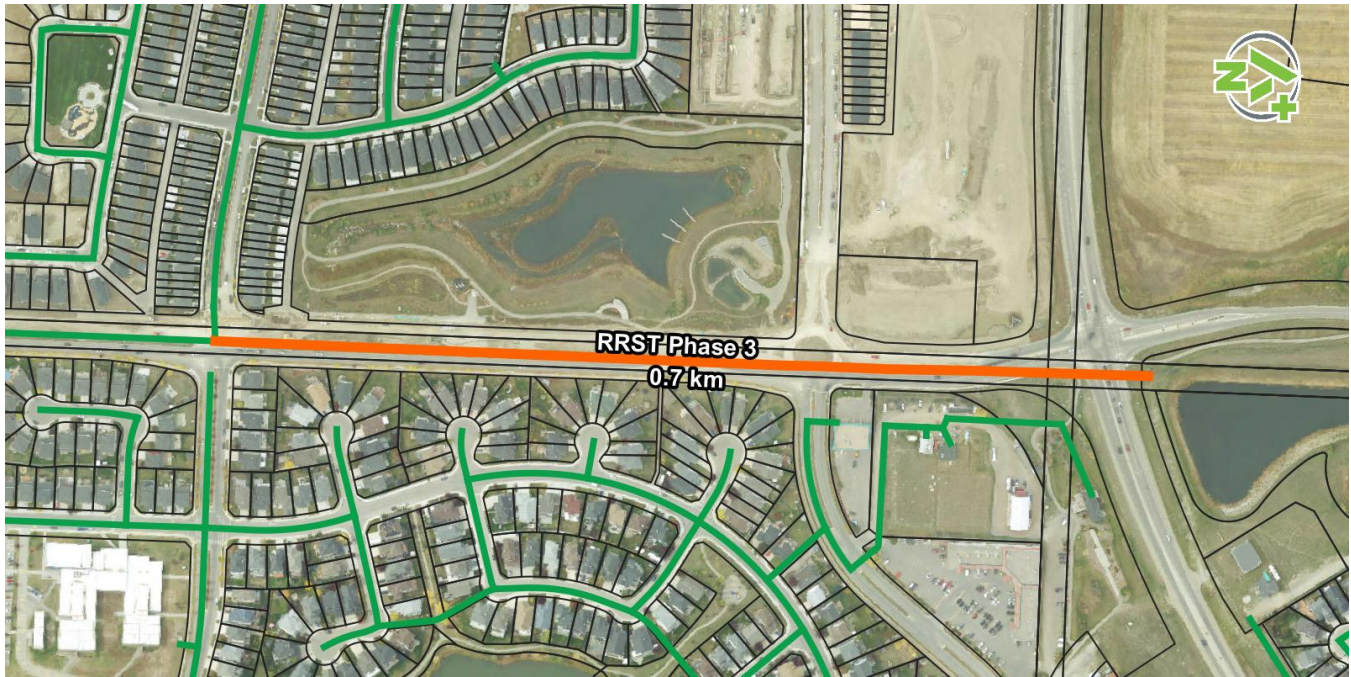
Benefitting Areas

Full system

Project Cost

Engineering	\$120,000
Construction	\$950,000
Contingency	\$320,000
Total	\$1,390,000

5.5.3 Project S3 - RRST Phase 3



Project Description

0.7 km of 900 mm gravity wastewater line to support the 25-Year Horizon collection system requirements for the north portion of Chestermere.

Project Details

- 0.7 km of 900 mm gravity wastewater line
- Supports 25-Year Horizon collection system requirements

Project Triggers

- Capacity limitations at Lift Station 10

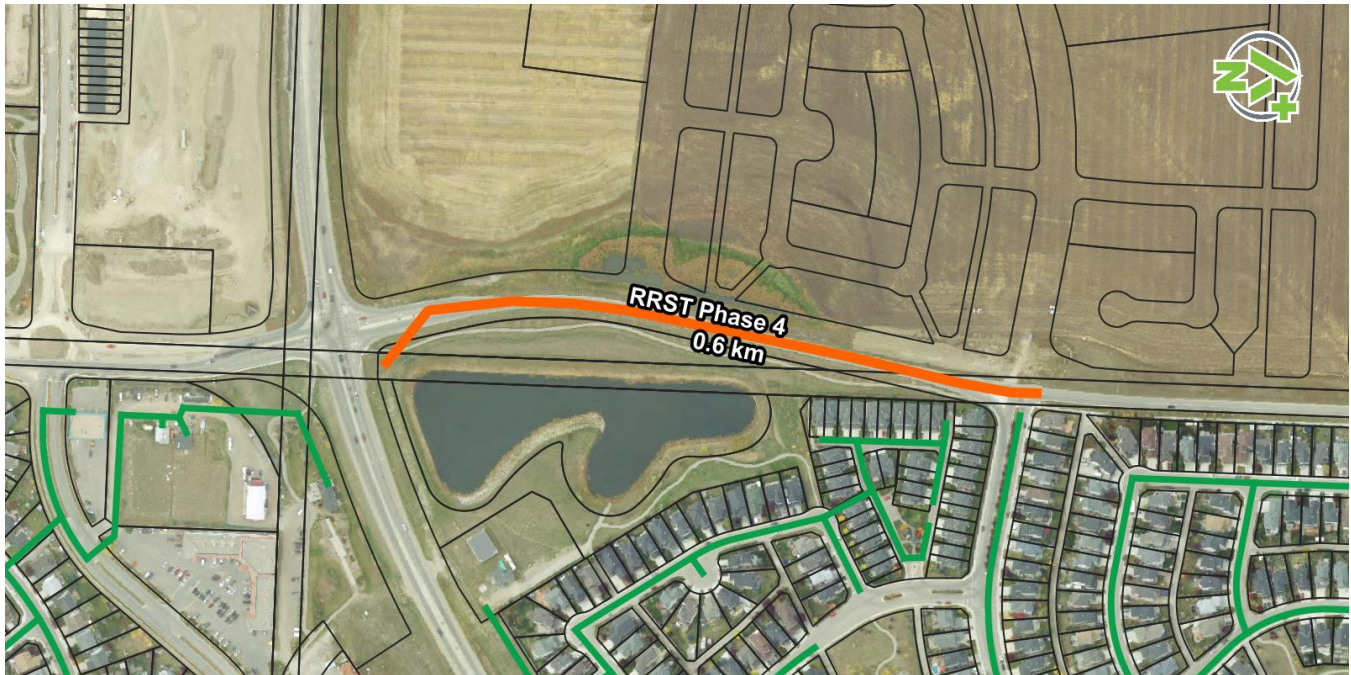
Benefitting Areas

Bridgeport, Bridgeport East, North Waterbridge, North Acreages, and Mountain View Park

Project Cost

Engineering	\$850,000
Construction	\$6,500,000
Contingency	\$2,200,000
Total	\$9,550,000

5.5.4 Project S4 - RRST Phase 4



Project Description

0.6 km of 675 mm gravity wastewater line to support the 25-Year Horizon collection system requirements for the northwest portion of Chestermere.

Project Details

- 0.6 km of 675 mm gravity wastewater line
- Supports 25-Year Horizon collection system requirements

Project Triggers

- Development in Bridgeport (2024)

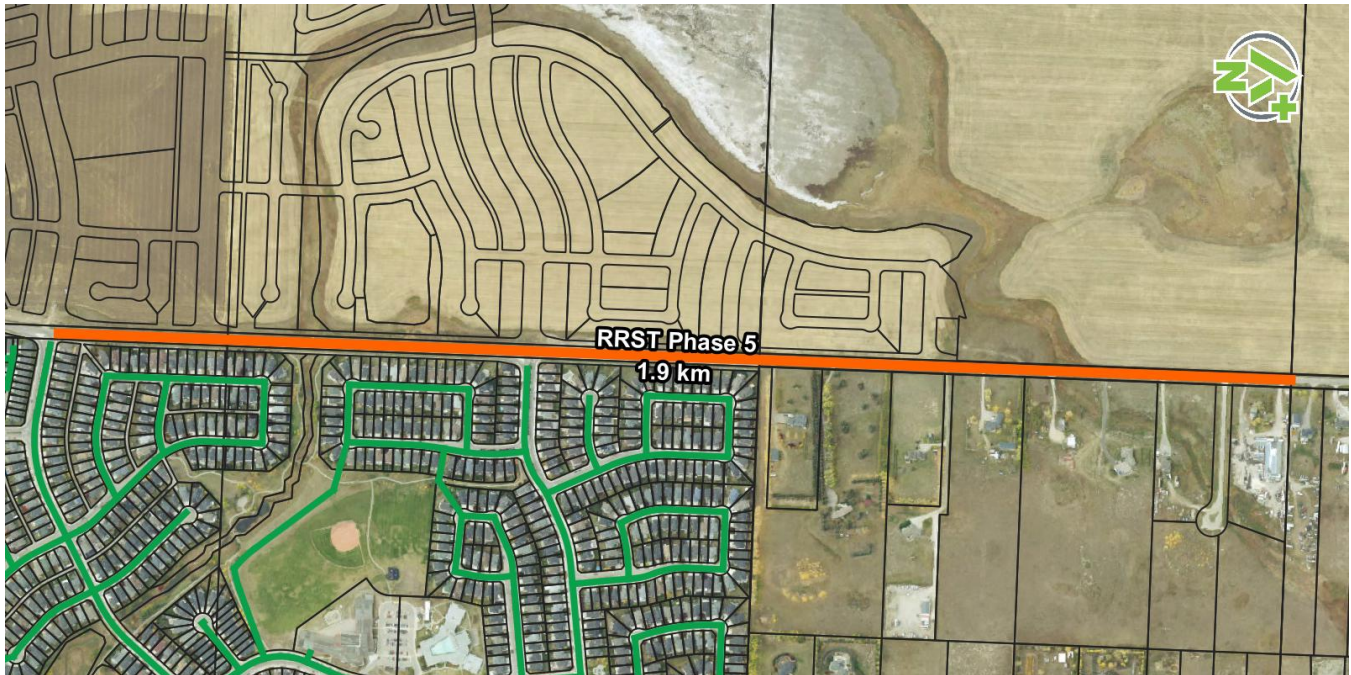
Benefitting Areas

Birdgeport, Bridgeport-East and North Waterbridge, North Acreages

Project Cost

Engineering	\$100,000
Construction	\$800,000
Contingency	\$270,000
Total	\$1,170,000

5.5.5 Project S5 - RRSST Phase 5



Project Description

1.9 km of gravity wastewater line sized from 375 mm to 675 mm to support Full Buildout collection system requirements for the east side of Chestermere.

Project Details

- 1.9 km of gravity wastewater line (375 mm to 675 mm)
- Supports Full Buildout collection system requirements

Project Triggers

- Development along the alignment

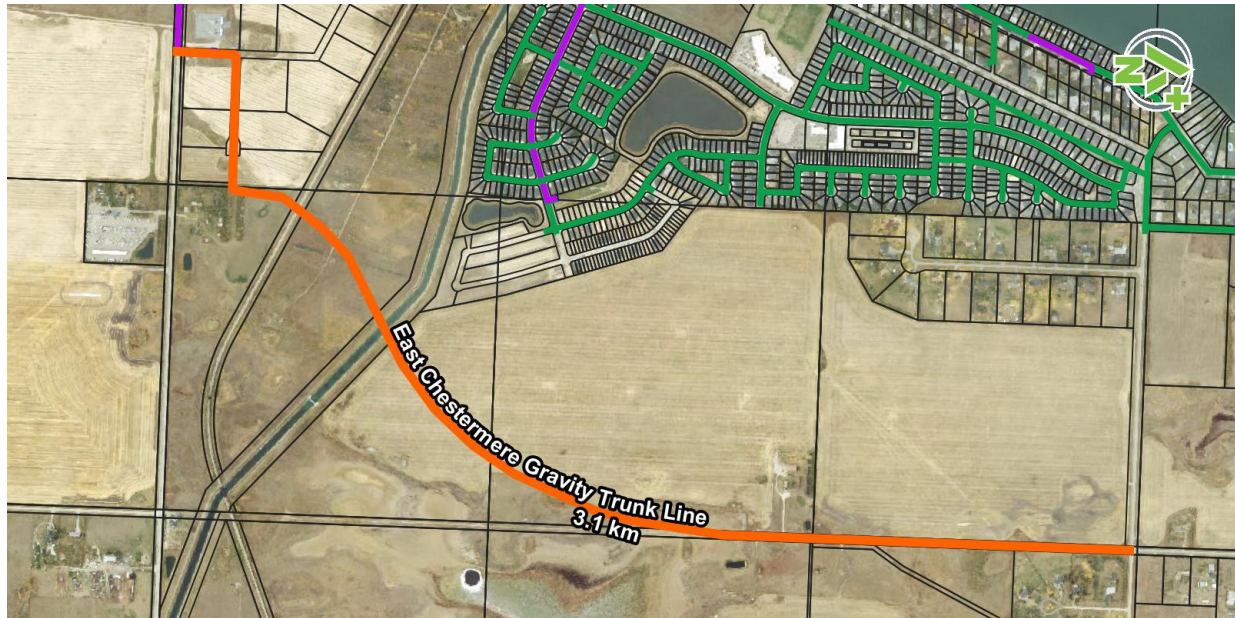
Benefitting Areas

North Waterbridge, North Acreages

Project Cost

Engineering	\$310,000
Construction	\$2,410,000
Contingency	\$820,000
Total	\$3,540,000

5.5.6 Project S6 - East Chestermere Gravity Trunk Line



Project Description

3 km of gravity wastewater line sized from 375 mm to 900 mm to support 25-Year Horizon and Full Buildout collection system requirements for the east side of Chestermere.

Project Details

- 3 km of gravity wastewater line (375 mm to 900 mm)
- Supports 25-Year Horizon and Full Buildout collection system requirements

Project Triggers

- Development along the alignment
- Capacity limitations at Lift Station 4
- Population growth in East Acreages and Sierra Vista

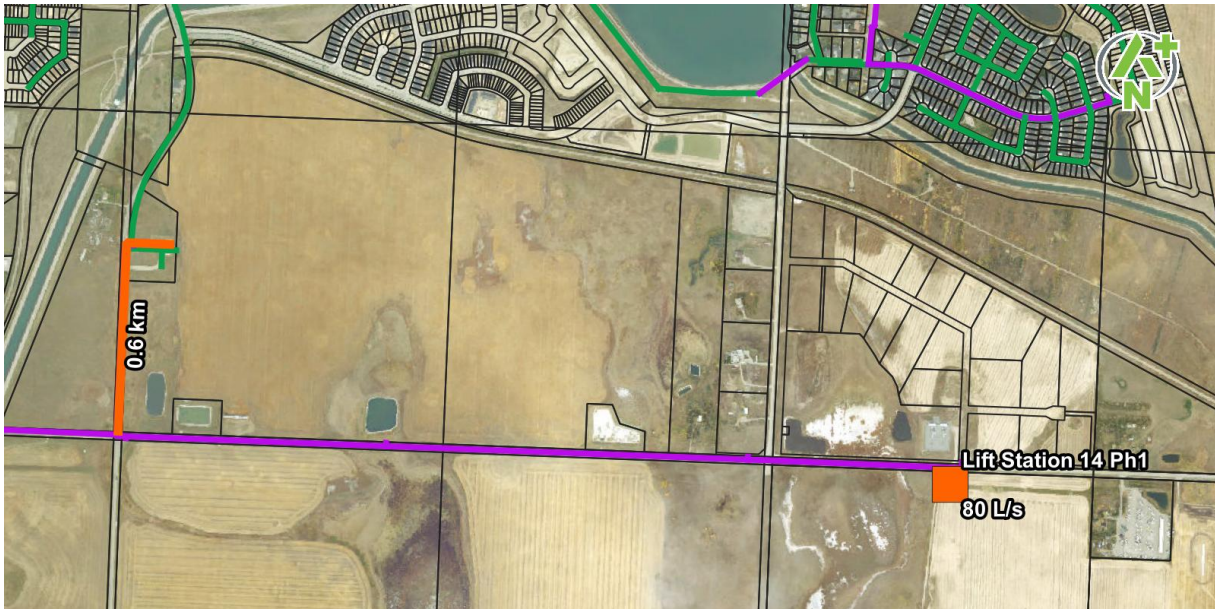
Benefitting Areas

East Acreages, Sierra Vista. Webster, Southeast Chestermere

Project Cost

Engineering	\$870,000
Construction	\$6,670,000
Contingency	\$2,260,000
Total	\$9,800,000

5.5.7 Project S7 - Lift Station 14 Phase 1



Project Description

A new 80 L/s Lift Station near Twp Rd 240 and RR 282 to support the 25-Year Horizon PWWF for the southeast and east OSL areas.

Project Details

- New 80 L/s Lift Station
- Supports 25-Year Horizon PWWF
- 0.5 ha (1.25 acres) of land for ultimate lift station

Project Triggers

- Lift Station 4 at capacity
- Population growth in Webster, East Acreages and Sierra Vista

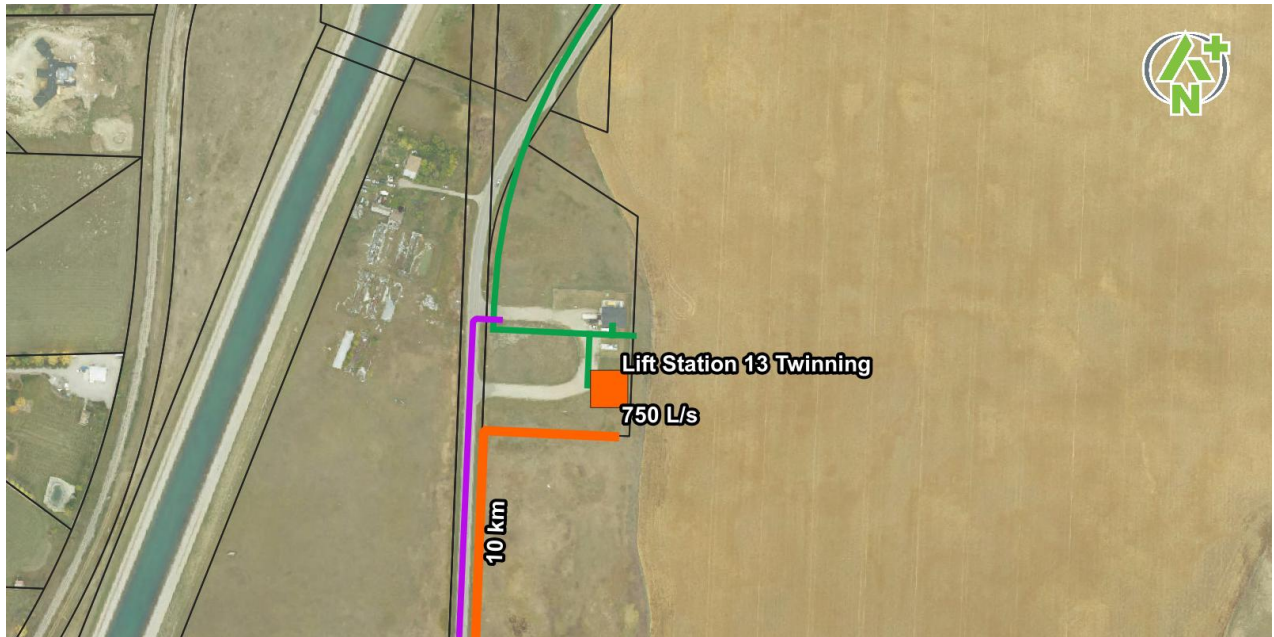
Benefitting Areas

Webster, South Industrial, Southeast Chestermere, Sierra Vista, East Acreages

Project Cost

Engineering	\$370,000
Construction	\$2,860,000
Contingency	\$970,000
Total	\$4,200,000

5.5.8 Project S8 - Lift Station 13 Twinning



Project Description

A new/twinned 750 L/s Lift Station at the LS 13 site to support Full Buildout PWWF for the southeast and east OSL areas.

Project Details

- New/Twinned 750 L/s Lift Station
- Supports Full Buildout PWWF

Project Triggers

- PWWF of 450 L/s
- Supporting a population of 80,000 people
- Construction of a new discharge forcemain

Benefitting Areas

Full System

Project Cost

Engineering	\$1,070,000
Construction	\$8,200,000
Contingency	\$2,780,000
Total	\$12,050,000

5.5.9 Project S9 - Lift Station 14 Phase 2



Project Description

Additional 240 L/s pumping capacity at Lift Station 14 to support Full Buildout PWWF for the southeast and east OSL areas.

Project Details

- Additional 240 L/s pumping capacity at LS 14
- Supports Full Buildout PWWF

Project Triggers

- PWWF in southeast of 80 L/s
- Population growth of 9,000 people in the southeast OSL areas

Benefitting Areas

Webster, South Industrial, Southeast Chestermere, Sierra Vista, East Acreages

Project Cost

Engineering	\$570,000
Construction	\$4,350,000
Contingency	\$1,470,000
Total	\$6,390,000

5.5.10 Project S10 - Lift Station 14 FM Twinning



Project Description

2.7 km of 350 mm forcemain from LS 14 to LS 13 to support Full Buildout PWWF for the east side of Chestermere.

Project Details

- 2.7 km of 350 mm forcemain
- Supports Full Buildout PWWF

Project Triggers

- PWWF in southeast of 180 L/s
- Population growth of 20,000 people in the southeast OSL areas

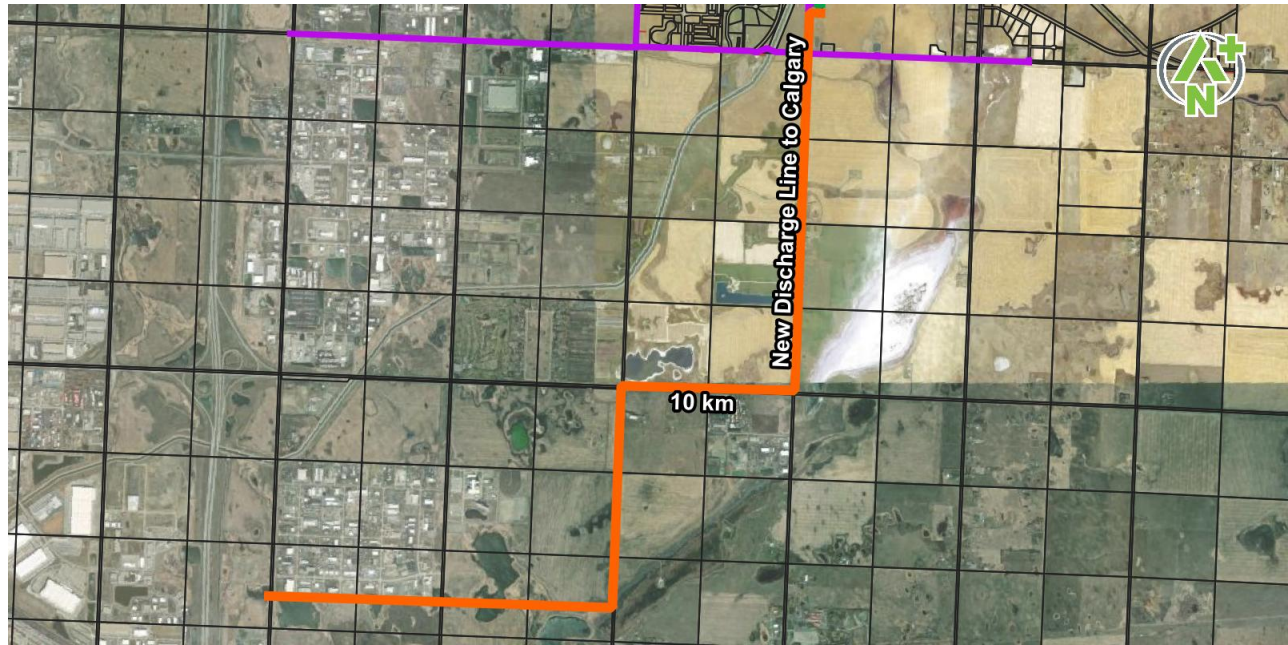
Benefitting Areas

Webster, South Industrial, Southeast Chestermere, Sierra Vista, East Acreages

Project Cost

Engineering	\$470,000
Construction	\$3,600,000
Contingency	\$1,220,000
Total	\$5,290,000

5.5.11 Project S11 - New Discharge FM to Calgary



Project Description

Approximately 11 km of 750 mm forcemain to Calgary, required to support Full Buildout PWWF for Chestermere.

Project Details

- 11 km of 750 mm forcemain to Calgary
- Required to support Full Buildout PWWF

Project Triggers

- PWWF in Chestermere of 620 L/s
- Population of 80,000 people
- Development of 935 ha

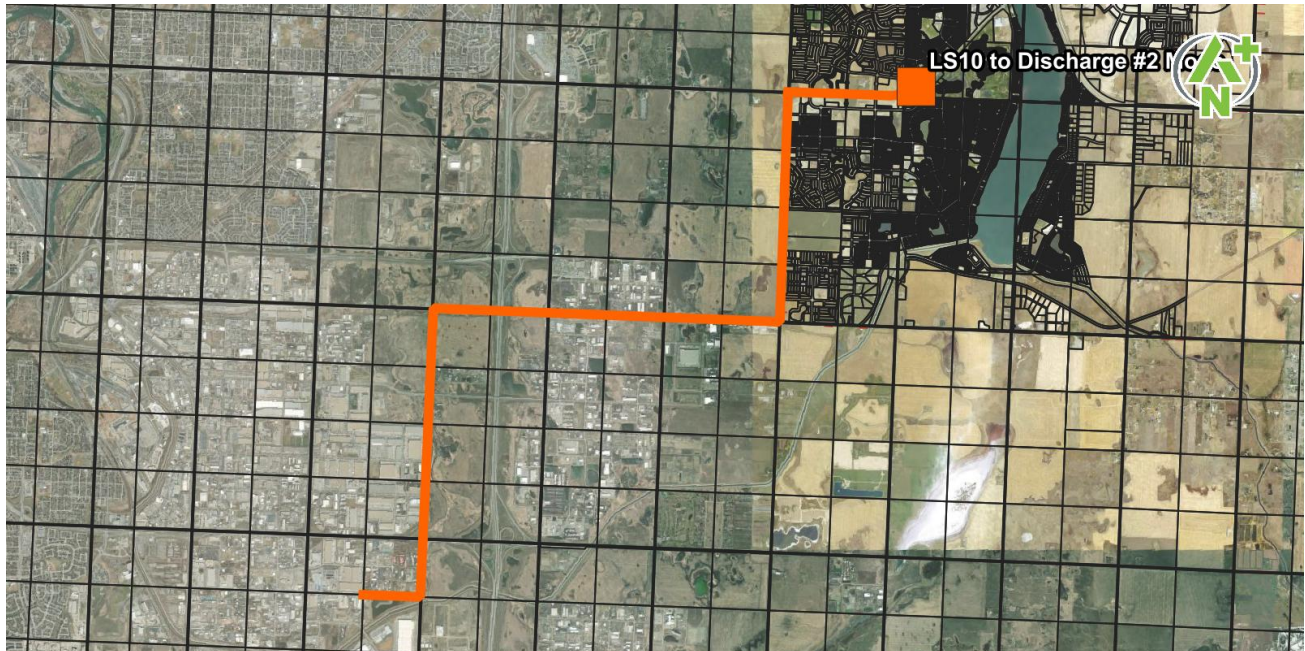
Benefitting Areas

Full System

Project Cost

Engineering	\$1,730,000
Construction	\$13,290,000
Contingency	\$4,510,000
Total	\$19,530,000

5.5.12 Project S12 - LS10 to Discharge #2 Modifications



Project Description

Reinstate and update the H2S mitigation system in Lift Station 10 and perform maintenance on the 450 mm forcemain to Discharge Location #2 in order to make Discharge Location#2 operational

Project Details

- H2S Mitigation System update
- Pigging of 450 mm forcemain
- ARV inspection and maintenance on 450 mm forcemain

Project Triggers

- PWWF in Chestermere of 450 L/s
- Population of 58,000 people
- Development of 580 ha

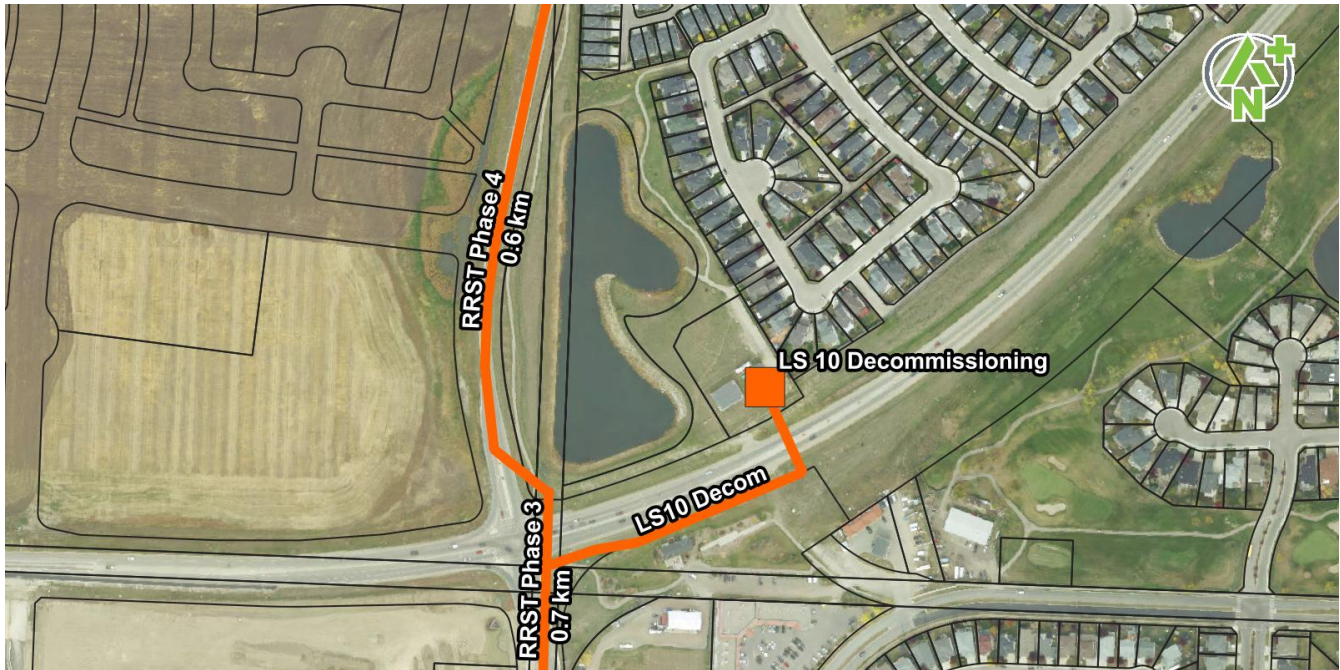
Benefitting Areas

Full System

Project Cost

Engineering	\$50,000
Construction	\$350,000
Contingency	\$100,000
Total	\$590,000

5.5.13 Project S13 - LS10 Decommissioning



Project Description

Decommission Lift Station 10 and install gravity bypass line from old lift station location to RRST Ph3.

Project Details

- Decommission LS10
- 300 m of 600 mm gravity line from LS10 to RRST Ph3

Project Triggers

- Construction of new discharge to Calgary
- Construction of LS 13 Twinning

Benefiting Areas

Bridgeport, Bridgeport East, North Waterbridge, North Acreages, North East Westmere, Mountainview Park

Project Cost

Engineering	\$270,000
Construction	\$2,050,000
Contingency	\$700,000
Total	\$3,020,000



A

Appendix A Design Basis Memo

December 11, 2023

City of Chestermere

Subject: Chestermere Utility Master Plan – Design Basis Technical Memorandum
Ref. CA001027

This technical memo has been prepared in support of the ongoing Utility Master Plan (UMP) for the City of Chestermere, as one of the initial key deliverables. The intent of this technical memo is to establish the design basis that will be used to assess the existing and future systems, primarily in relation to anticipated water demands and wastewater flow generation, both for the existing and future systems, along with establishing metrics to assess the performance of the system. This includes water supply, storage and distribution, and wastewater collection and conveyance.

A high level assessment of the risks of adopting this design basis is also included.

WATER SYSTEM

The design basis will determine the water demands through various scenarios. These existing and future demands will influence any upgrades or projects required to support the City's growth. These demand scenarios are consistent with industry standards and the City's Engineering and Design Guidelines.

Water demands will have three demand scenarios:

- + Average Day Demand (ADD) – This is the average daily water demand through the course of a year
- + Maximum Day Demand (MDD) – This is the maximum water demand expected during a single day through the course of a year
- + Peak Hour Demand (PHD) – This is the peak water demand expected in the water system, that occurs over the period of one hour



Existing Water Demands

Existing average day water demands will be developed by assessing the total volume of water distributed to the City over a period of several years, in order to develop the Average Daily Demand. These will then be assigned to the hydraulic model through geolocated customer water meters data, which has been scaled such that the total volume of consumption is equivalent to the total volume of distribution. This accounts for any water losses in the water distribution system, or any unaccounted-for flows.

This approach is more granular than the previous UMP, which assigned the average water demands evenly across the system. This mitigates some risks present in the previous approach, as it will more accurately represent the distribution of demands across the system. Higher demand areas can be more accurately assessed against the level of service to determine if there are any existing deficiencies.

The following table shows the system wide average day demand.

Year	Annual Use (m ³)	Average Day (m ³)	Average Day (L/s)
2020	1,962,501	5,362	62.1
2021	2,061,510	5,648	65.4
2022	2,071,288	5,675	65.7
Average	2,031,766	5,562	64.4

Existing Peaking Factors

Maximum day water demands will be developed by reviewing SCADA data and daily water distribution records to find the day with the highest volume of water distributed, and the peak hour. This maximum day, divided by the average day, will determine the Maximum Day Demand peaking factor for the existing system and will only be applied to existing demands. The SCADA system transmits and records historical flows, pressures, and other relevant information from facilities in Chestermere, and was processed and distributed by EPCOR. Data from the Water Transfer Station was used for this assessment.

Peak hour water will be developed similarly to the maximum day demands, through review of the SCADA data to determine the peak hour.

The MDD peaking factor from the previous UMP was 2x ADD, and the PHD peaking factor was 4x ADD. The following table shows the calculated MDD and PHD peaking factors over the previous three years.

Year	Average Day (L/s)	Max Day (L/s)	Peak Hour (L/s)	MDD PF	PHD PF
2020	62.1	113.0	199.0	1.82	3.21
2021	65.4	134.0	239.0	2.05	3.66
2022	65.7	120.0	209.0	1.83	3.18



The recommended peaking factors from the SCADA assessment for existing demands will be:

- + Maximum Day Demand: 2x ADD
- + Peak Hour Demand: 3.7x ADD

This will result in the same peaking factor for MDD, and a slightly lower peaking factor for PHD. Revising this from the previous UMP will result in a less conservative assessment of the peak flows, which can mitigate the timing of future pump station upgrades. The risk of this is the possibility of higher than anticipated peak flows in the future, which could accelerate the timing of future pump station upgrades, or underestimate the size of an upgrade.

Future Water Demands

Future water demands will be assessed using a per capita unit demand, which will act as a composite demand for all land uses. Population projections for each development area will determine the water demands.

The population of Chestermere for the previous three years was provided by the City. Dividing the average daily demand by the current population results in the per capita demand, which will be used to project future demands.

Year	Average Day (m ³)	Population	Per Capita (L/c/day)	From UMP (L/c/day)
2020	5,362	21,372	251	290
2021	5,648	22,166	255	
2022	5,675	23,626	240	
Average	5,562	22,388	249	

The recommended per capita unit rate for future water demands is 250 L/c/day. Per capita generation rates have been trending downward over time, but there is a small chance that future water generation rates are greater than the current rates.

Water Supply Requirements

The water supply from Calgary should be able to support the Maximum Day Demand flows with all water lines in service.

There are two water supply lines from Calgary; a 300 mm water line along 17th Ave entering the City from the west, and a 750mm/900mm water line (the ECRW) entering from the south.

The smaller water line will have a capacity of 145 L/s. Previously this line had a capacity of 110 L/s and has been recently increased. The larger has a current maximum allotment of 272 L/s, for a total capacity of 417 L/s. The current agreement with the City of Calgary allows for 192 L/s from the larger line for years 2023 - 2026, for a current capacity of 337 L/s. As such, the agreement between Chestermere and the Calgary



would have to be revised prior to a population of 58,000 people, and additional water capacity would have to be acquired prior to a population of 72,000 people.

Population	ADD (L/s)	MDD (L/s)
23,626 (Current)	66	132
58,000	168	336
72,000	208	417

There are no changes from the previous design criteria. The primary risk in maintaining this requirement is in the possibility of a disruption to one of the supply lines, such that MDD can no longer be provided. This risk will be mitigated through water reservoir storage requirements.

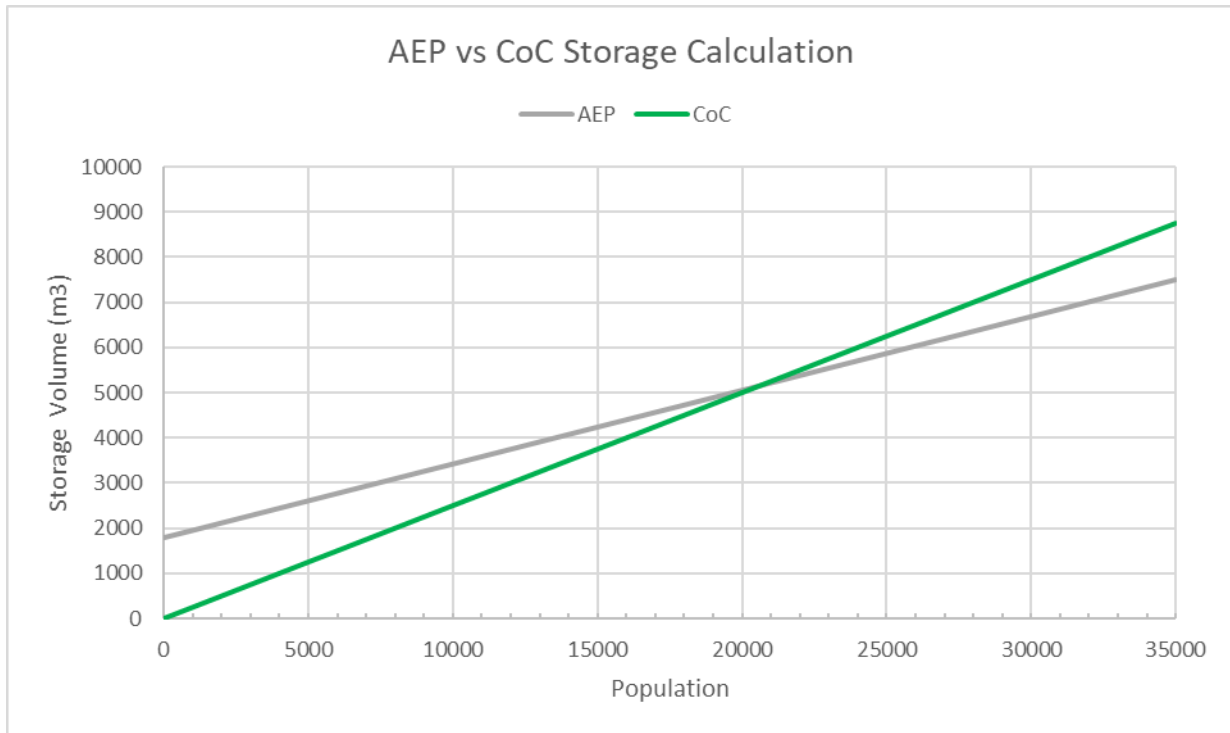
Water Storage Requirements

The current water storage requirements set out in the 2016 UMP utilize the Alberta Environment and Parks guidelines water storage reservoir calculation, which recommend the storage requirements where the supply of treated water is only capable of satisfying the maximum daily design flow.

For a storage facility to meet these recommendations it must be sufficiently sized to store the sum of the following, using the formula $S = A + B + C$. Fire storage in this case is 200 L/s for 2.5 hours, or 1,800 m³.

- + A - Fire storage (As per fire flow requirements)
- + B - Equalization storage (25% MDD)
- + C - Contingency storage (15% ADD)

In comparison, the City of Calgary utilizes the requirement of 1x ADD when assessing reservoirs. In general, the AEP storage calculation is more conservative for smaller populations, as the bulk of the storage requirement is for fire storage. City of Calgary is more conservative for larger populations with higher demands. When projecting the City of Chestermere demands, these cross over at a population of approximately 20,000 people.

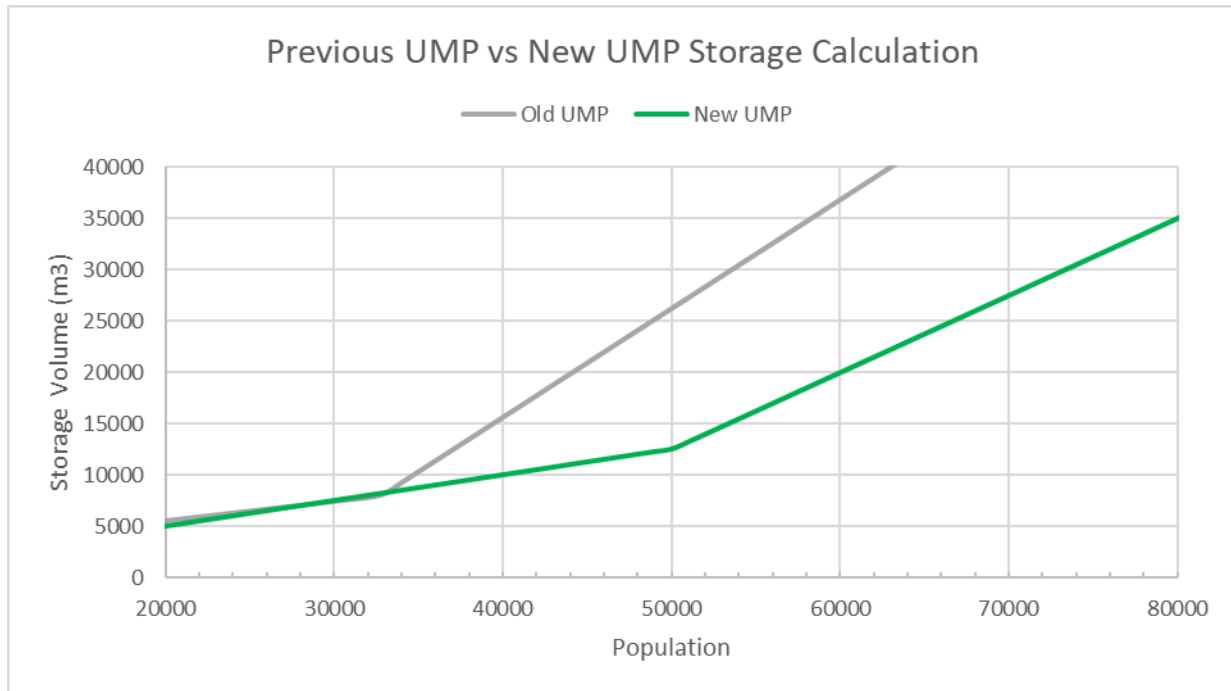


It is recommended to adopt the City of Calgary standard of 1x ADD when assessing storage reservoirs.

An additional reservoir capacity should be required to mitigate the risks of a supply line disruption when ADD flows exceed the capacity of the 300 mm supply line. The additional reservoir capacity should have a volume of 2x the deficit of flows. This will give the City an effective 2x ADD of combined storage and water supply when the largest supply line is out of service. The storage requirement would be similar to Strathmore's, which requires 2x ADD storage and has no redundant water supply line. After a population of approximately 50,000 people, this additional storage would be necessary.

As an example, the smaller supply line has a capacity of 145 L/s. If the ADD is 160 L/s, then two times the 15 L/s deficit would result in an additional required capacity of 2,600 m³ in the storage reservoir alongside the 1x ADD.

In comparison, the previous UMP design criteria required the AEP storage calculation plus 3x the deficit of ADD and the capacity of the water supply with the largest line out of service. When comparing the previous UMP storage calculations to the revised design criteria, significantly less storage is required.



The primary risk in this revised methodology is less redundancy in the event of a break in the larger water supply main. The updated requirements are in line with other municipalities such as Strathmore, and can be further mitigated if the capacity in the 300 mm supply line can be increased in the future.

Level of Service Requirements

The following are the level of service requirements for the water distribution system. There are no revisions from the previous UMP, and are in line with the Engineering and Design Guidelines.

- + Minimum system pressure: 275 kPa (40 psi)
- + Maximum system pressure: 550 kPa (80 psi)
- + Maximum velocity in system: 3.0 m/s

Available Fire Flow Requirements

The following are the available fire flow requirements. The water distribution system should be able to support these fire flows for each land use under MDD conditions.

- + Residential areas without Multi-Family unit dwellings: 83 L/s for 2.0 hours
- + Residential areas with Multi-Family unit dwellings: 120 L/s for 2.5 hours
- + Industrial, Commercial and Institutional (ICI) land uses: 200 L/s for 2.5 hours
- + Minimum residual pressure of 140 kPa (20 psi) during fire flow



These are consistent with the previous UMP, with the exception of the reduction of the future ICI fire flow requirement from 300 L/s. In order to mitigate the risk of the current ICI requirement of 200 L/s being inadequate, exceptional developments such as large recreational centres or other larger than normal structures should be assessed under the Fire Underwriters Survey (FUS). If the available fire flow provided by the City is found to be inadequate after an FUS assessment, then additional mitigation measures will have to be proposed during the development process.

The following shows a comparison of the fireflow requirements of other municipalities.

Population	Single Family	Multi Family	Commercial	Institutional	Industrial
City of Airdrie	76 L/s	114 L/s - 227 L/s	265 L/s	227 L/s	227 L/s
Town of Okotoks	60 L/s	110 L/s	150 L/s	180 L/s	225 L/s
Town of Canmore	85 L/s	120 L/s - 300 L/s	200 L/s	200 L/s	200 L/s

WASTEWATER SYSTEM

The design basis will determine the wastewater demands through various scenarios. These existing and future demands will influence any upgrades or projects required to support the City’s growth. These demand scenarios are consistent with industry standards and the City’s Engineering and Design Guidelines.

Wastewater demands will have two demand scenarios.

- + Dry Weather Flows – These are the typical flows expected during dry weather periods
- + Peak Wet Weather Flows – These are the peak flows expected in the system, which occur during and immediately after significant rainfall events

Existing Wastewater Demands

Existing dry weather wastewater flow generation will be developed by assessing the total volume of effluent being conveyed through the lift stations to Calgary over a period of several years to develop the Average Dry Weather Flow (ADWF). Demands will be assigned to the hydraulic model in the same way as the water system, by scaling customer water meter volumes to the total wastewater volumes conveyed through the lift stations.

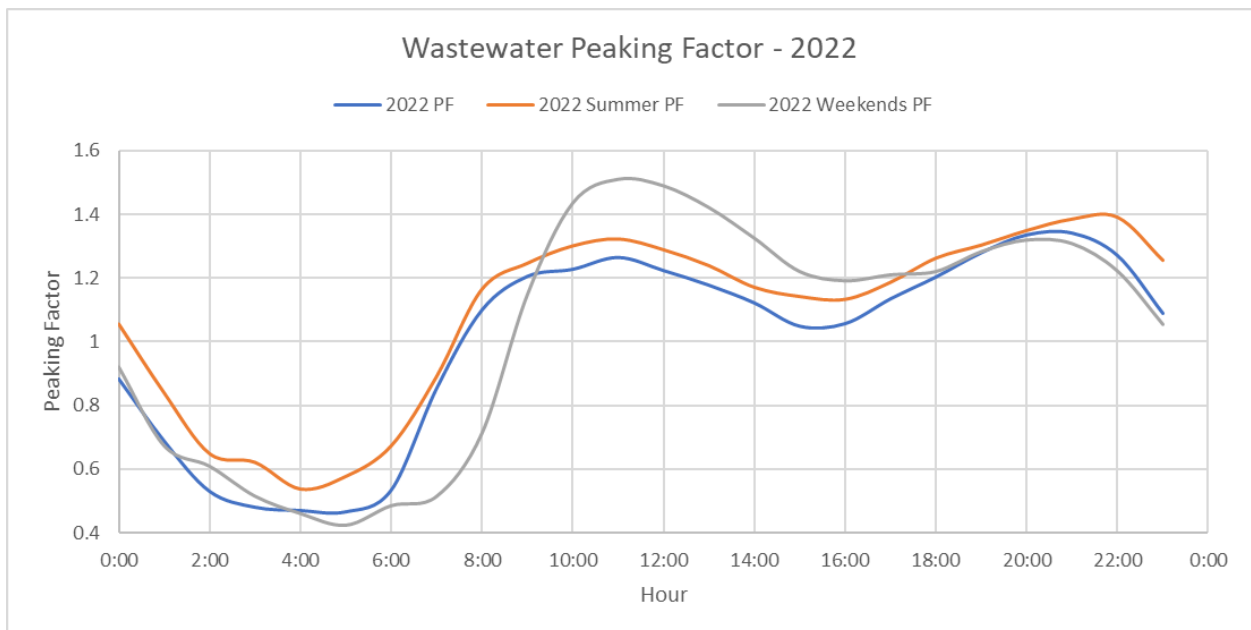
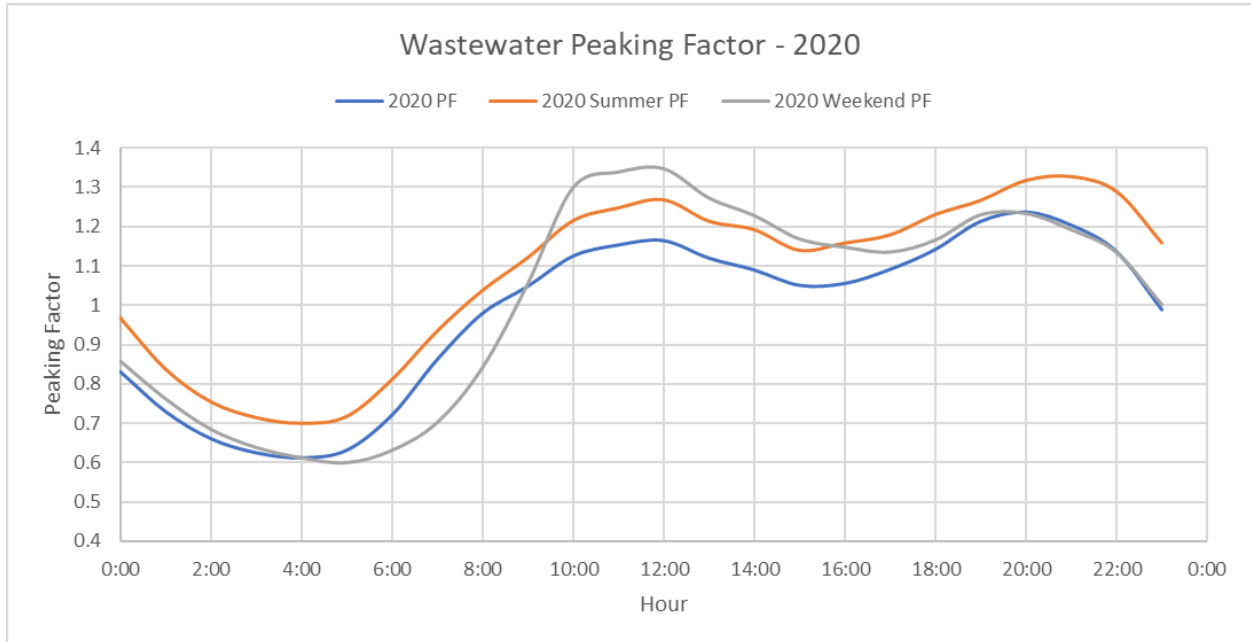
Peaking Factors

Peaking factors will be developed by analysing the SCADA data to develop diurnal flow patterns which can be applied to the average dry weather flow. This will act as a dynamic peaking factor that will fluctuate throughout the day and scale the flows to their measured values. This data will also be used to assess background infiltration rates in each of the wastewater catchment areas.



This differs significantly from the previous method of determining peaking factors used in the last UMP and in the Engineering and Design Guidelines, which is Harmon's Peaking Factor. Harmon's is an empirical formula which estimates the peaking factor based off of the cumulative population of the catchment area. Using Harmon's, the minimum peaking factor is 2.5x ADWF, and the maximum can be above 4x ADWF.

Flows out of Lift Station 13 were used to develop diurnal patterns which represent the daily flow patterns of the entire City, in order to demonstrate the variance between peak factors using observed flows and Harmon's. Data from 2020 and 2022 were used.





As this shows, daily peaks are on average closer to 1.5x ADWF. The following table shows a comparison of using diurnal peaking factors versus Harmon’s peaking factors for Peak Dry Weather Flows:

Year	Average Day (L/s)	Weekend PF	PDWF (L/s)
Diurnal Peaking Factors			
2020	60.4	1.4	81.5
2022	59.8	1.5	89.7
Harmon's Peaking Factors			
2020	60.4	2.6	158.4
2022	59.8	2.6	154.2

As this shows, using Harmon’s results in peak flows 1.7 – 1.8 times greater than using diurnal patterns, and likely significantly overestimates peak dry weather flows in the existing system.

It is recommended to use the diurnal patterns to develop the dry weather flows for the existing system. Separate diurnal patterns can be developed for each lift station catchment area that has sufficient data to develop the patterns.

The primary risk for this methodology is underestimating unusually high peak flows that occur in tandem with wet weather events. This can be mitigated by assessing measured peak dry weather flows and comparing them against modelled flows, and adjusting the diurnal patterns for each catchment if necessary.

Wet Weather Flow Generation

Wet weather flows will be assessed by calibrating the model against the observed flow data during rainfall events. A 1:50 Year or 1:100 Year storm event will then be applied to the model to determine the peak wet weather flows. This, in concert with the diurnal patterns for dry weather flows, result in dynamic peak flows in system, that should more closely resemble both the overall peaks, and the total volume of flows entering the system.

This is another significant variation from the previous UMP and the City’s engineering and design criteria. Previously wet weather flows were determined by adding a static inflow and infiltration (I&I) rate based on sewer catchment area, at 0.28 L/s/ha as recommended by Alberta Environment.

As a comparison, the peak flows during the largest stormwater events in 2020 and 2022 were compared against the calculated PWWF using Harmon’s peaking factor and the static I&I rate. Chestermere was estimated as having an existing sewer catchment area of 640 ha.



Year	PDWF (L/s)	PWWF (L/s)	I&I Rate (L/s/ha)
Diurnal Peaking Factors			
2020	81.5	141.0	0.09
2022	89.7	197.0	0.17
Harmon's Peaking Factors			
2020	158.4	337.6	0.28
2022	154.2	333.4	0.28

While the observed rainfall events are likely not the same scale as a true 1:50 or 1:100 year storm event, as this table shows using the static peaking factors and I&I rate results in nearly double the peak flows as those observed in the system during a 70+ mm rainfall event.

It is recommended to use the dynamic storm loading to assess the peak wet weather flows. The benefit is significantly reducing the projected peak flows, which can result in a major reduction of capital costs for future development, including pipe size upgrades and lift station flow upgrades. The primary risk is underestimating the peak flows. This can be mitigated by utilizing the dynamic model to leverage the possibility of temporary storage in the collection system. Lift Station 13 has a very deep 1200 mm pipe upstream of it, which can temporarily manage significantly higher inflows than the pump capacity of the lift station. The dynamic model can aid in assessing the scale of this.

Future Wastewater Demands

Future wastewater demands will be assessed using a per capita unit demand, which will act as a composite demand for all land uses. Population projections for each development area will determine the wastewater demands.

The population of Chestermere for the previous three years was provided by the City. Dividing the average daily demand by the current population results in the per capita demand, which will be used to project future demands.

Year	Population	Daily Use (m ³)	Per Capita (L/c/day)	From UMP (L/c/day)
2020	21,372	5,215	244	250
2021	22,166	4,784	216	
2022	23,626	5,164	219	
Average	22,388	5,054	226	

The recommended per capita future wastewater generation rate is 240 L/c/day, which is lower than the maximum of the three years, but higher than the average. The main risk of this is if future wastewater generation rates are greater than the current rates, which have been trending downwards.



Level of Service Requirements

The following are the existing level of service requirements from the previous UMP.

- + Minimum pipe velocity – 0.6 m/s at design flow
- + Maximum pipe velocity – 3.0 m/s at design flow
- + Pumping capacity – Peak Wet Weather Flow with the largest pump out of service
- + Maximum flow in pipes no greater than the pipe's hydraulic capacity

In addition to these requirements, with the implementation of the dynamic wastewater model, pipe capacity can be assessed using alternative criteria. In the general collection system where depths are less than 4 m, pipe capacity can be reviewed against the maximum hydraulic grade line (HGL) as opposed to flow capacity, where the maximum HGL must remain at or below the invert of the pipe.

In areas deeper than 4 m, particularly upstream of lift stations, temporary surcharging during peak flow events may be acceptable. The maximum allowable HGL will vary between each lift station, however this shall be no higher than the working platform elevation at each lift station. This elevation will need to be determined through review of each lift station in order to assess a safe maximum surcharge level. Maximum surcharging in the collection system shall be no greater than 3 m below ground level.

This will allow of attenuation of peak flows using existing wet well and upstream pipe volumes, particularly at Lift Station 13, which has a 10+ m deep, 1200 mm diameter sewer line upstream of it. Using this revised assessment criteria may allow for significantly reduced peak pumping requirements at lift stations, potentially reducing the scope and timing of future capital works projects.

The primary risk in this is underestimating the peak flows during a major storm event, which could result in surcharge levels higher than those estimated.

Subdivision Design Requirements

Subdivision collection systems shall be designed using the Alberta Environment and Parks Standards and Guidelines. This includes, but is not limited to:

- + Peak dry weather flows calculated using Harmon's peaking factor
- + Inflow and Infiltration rates calculated using 0.28 L/s/ha
- + Minimum pipe slopes:
 - o 200 mm – 0.40%
 - o 250 mm – 0.28%
 - o 300 mm – 0.22%
 - o 375 mm – 0.15%
 - o 450 mm – 0.12%
 - o 525 mm – 0.10%
 - o 600 mm – 0.08%
- + Minimum pipe slopes shall be designed to meet 0.6 m/s self cleaning velocity of a half full pipe.



- + The top leg of sewer systems shall be designed with 2 times the minimum slope due to City of Chestermere operational requirements.
- + The minimum slopes for curved sewers shall be 50 percent greater than the minimum slopes required for straight runs; this requirement will be waived if the designer submits calculations to demonstrate that increased slope is not required to achieve self-cleansing velocity.

Trunk lines of the collection system, particularly in those that connect multiple future development areas, shall be assessed and sized using the wastewater modelling software by the City or their consultants.

The revisions to the minimum pipe slopes will help minimize overall pipe depth and reduce the number of lift stations required to service development areas, while the additional considerations for minimum velocities and increased slopes on the top legs will help ensure satisfactory operational conditions.

SUMMARY

When adopting the revised design basis for water, future water usage is approximately 85% of the previous UMP, and storage requirements at a population of 50,000 are approximately 50% of the previous UMP. Existing peak dry weather and peak wet weather wastewater flows are approximately 60% of the flows estimated using the previous UMP design criteria.

With these design guidelines, the City of Chestermere will be able to plan for resilient water and wastewater systems that can accommodate future growth, while maintaining reasonable capital costs and development timelines by mitigating extremely conservative design considerations.

Regards,

Jamie Purdy, C.E.T
Lead Technologist

JP/sd

Steven Dawe, P. Eng
Partner / Lead Engineer Infrastructure

B

Appendix B East Acreages Servicing Assessment

July 31, 2024

Mark Ruault
Senior Engineer
City of Chestermere

Subject: East Chestermere / East Acreages Servicing Assessment

Mr. Ruault,

CIMA+ was retained to perform a servicing assessment for the Water and Wastewater systems of the proposed East Chestermere development area in the East Acreages offsite levy zone in east Chestermere. The proposed area is approximately 148 ha in area, bordered by East Lakeview Rd and East Merganser Dr.

The purpose of this assessment is to determine the serviceable area of the development when connecting to the existing Chestermere wastewater system through gravity, identifying the potential for interim servicing through off-peak wastewater pumping, and highlighting the ultimate servicing.

This servicing assessment is being performed in parallel with the City of Chestermere's Utility Master Plan Update, and will utilize the updated and calibrated Wastewater computer model that was developed for that project.

The scope of this assessment is as follows:

- Wastewater System
 - Determining Average Dry Weather Flows and Peak Wet Weather Flows for the service area
 - Identifying potential tie in locations
 - Assessing available capacity at lift stations downstream of tie in locations, and determining serviceable area with regards to the available capacity at the lift stations
 - Assessing high level serviceable area that can collect by gravity into the existing system

The following figure shows the proposed development area:

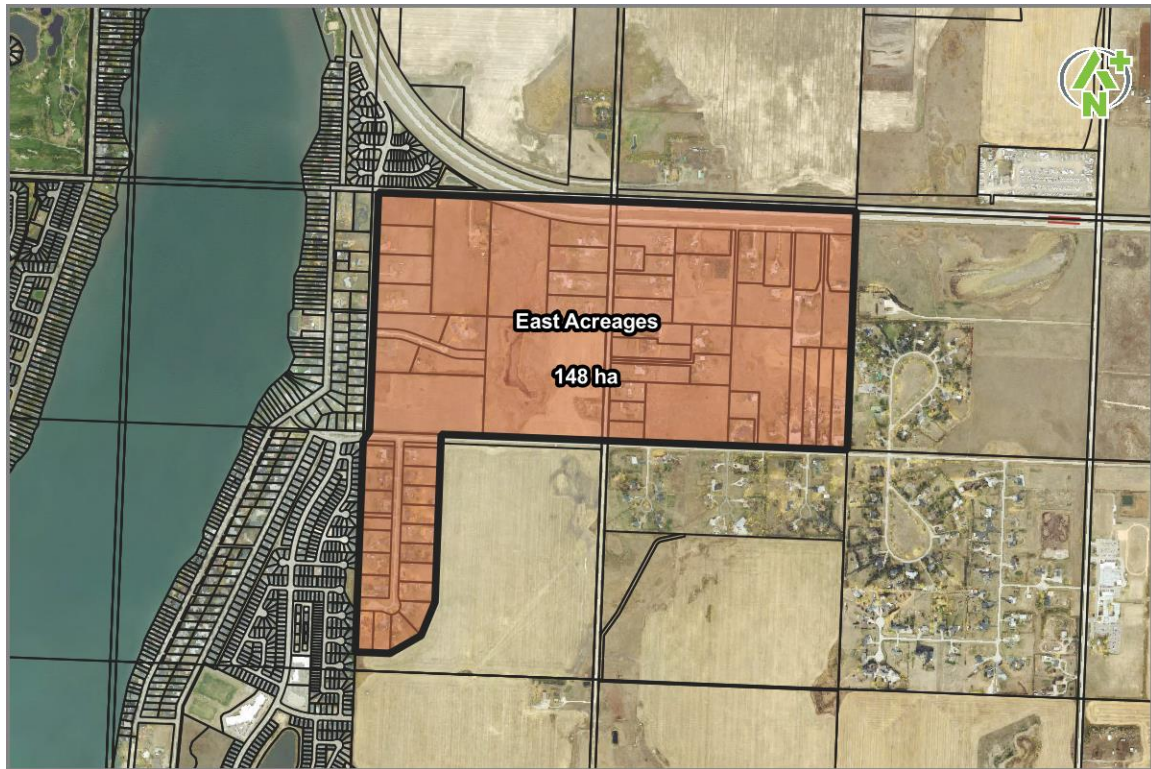


Figure 1 – East Acreages Development Area

DESIGN CRITERIA

The following is the design criteria used for the water and wastewater servicing assessment, which are in line with those used for the Utility Master Plan, as developed in the “November 2023 Chestermere Utility Plan – Design Basis Technical Memorandum” by CIMA+.

Growth Areas

All growth in the City is represented as residential population units, with a prescribed population density of 19 residential units per hectare, and 3.2 people per unit. This results in a population density of 60.8 people per hectare and a total buildout population of 9000 people in the 148 ha development area.



Wastewater System

The following are the design criteria for the wastewater system, with respect to wastewater generation, peak wet weather flows, level of service requirements and minimum pipe slopes.

- **Wastewater Demands**
 - Per capita wastewater demand of 240 L/c/day for Average Dry Weather Flow (ADWF)
 - Peaking factor based on system wide diurnal pattern applied in the time based model. Maximum peak of approximately 1.3 times ADWF
 - Peak wet weather flow based on calibrated storm event using catchment area of development.
- **Level of Service Requirements**
 - Minimum pipe velocity – 0.6 m/s at design flow
 - Maximum pipe velocity – 3.0 m/s at design flow
 - Pumping capacity – Peak Wet Weather Flow with the largest pump out of service
 - Maximum flow in pipes no greater than the pipe's hydraulic capacity

Wastewater Demands

In order to determine the peak wastewater flows for the full buildout of the east acreages area, the dynamic wastewater model developed for the City was used, as it is a time based model with variable peaking factors and rain derived inflow and infiltration (RDII) values.

The full 148 ha catchment area was input into the model tying into a large diameter pipe separated from the existing system. The model was run to determine the RDII value of the catchment area, using the storm event and rainfall runoff data set calibrated for the future growth areas. The 9,000 people was also input into the model, using the per capita wastewater generation rate of 240 L/c/day. The future growth diurnal pattern which has a maximum peaking factor of approximately 1.3x ADWF was assigned to these demands.

Overall, the peak wet weather flow for the full buildout with the above inputs was 80 L/s. This works out to a peak flow rate of approximately 0.54 L/s/ha. This value will be used to assess serviceable area when reviewing the capacity of the existing system.

Lift Stations Capacity and Serviceable Area

Lift Station 4 is a duplex pumping station, which alternates the duty pump each cycle. As per the design criteria, the firm pumping capacity of the lift station is the pumping capacity of the station with the largest pump offline.



SCADA data of the flow meter on the discharge of Lift Station 4 was reviewed to determine firm pumping capacity. A snapshot of the SCADA data can be seen in Figure 4 below.

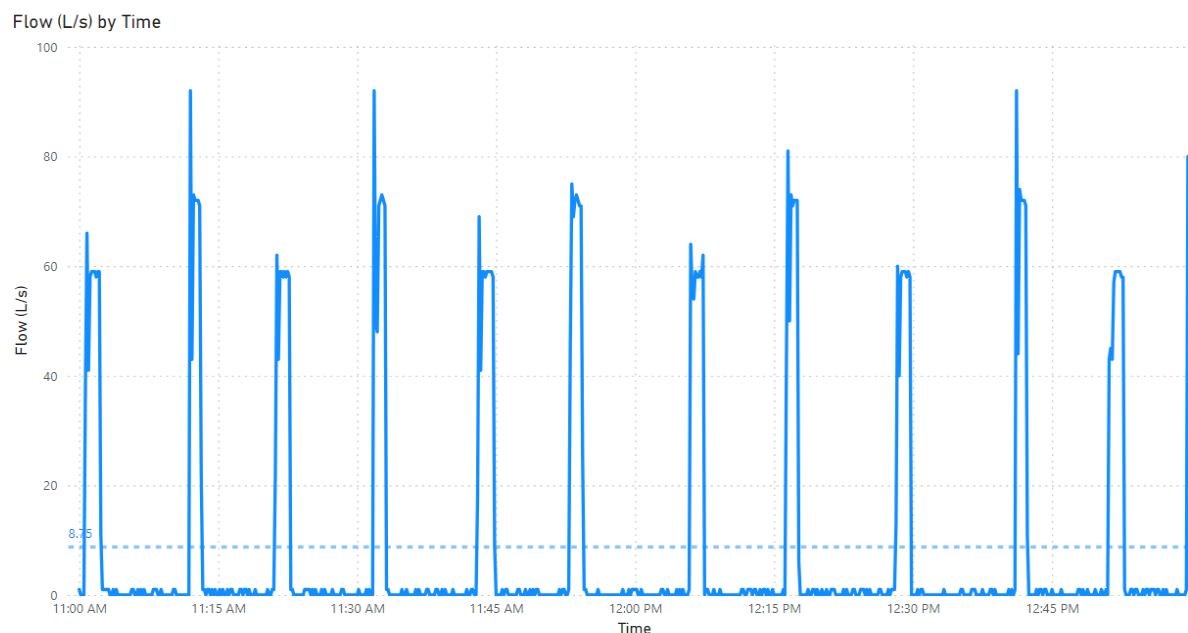


Figure 2 - Lift Station 4 Flow Data

As the data shows, the two pumps have different flow rates. The pump with the lower flow rate operates at approximately 60 L/s. This will be considered the pumping capacity of the lift station for the purpose of this assessment.

The existing model was then run in order to determine the peak incoming flows into the lift station. The last phase of Kinniburgh was assumed to be built out, as it is in active development.

In total, the peak incoming flow into Lift Station 4 was calculated to be 49 L/s. This means that there is 11 L/s of available capacity for future development. This equates to approximately 20 ha of development, using the 0.54 L/s/ha peak flow rate calculated earlier. This would be sufficient to service the area that was assessed to be serviceable through gravity.

As there is one pump with a lower capacity in the lift station, this is a limiting factor that could likely be easily remedied with a repair or replacement to the pump. The second pump operates at approximately 72 L/s. Assuming a pump repair or replacement could result in both pumps operating at 72 L/s, this would result in 23 L/s of available pumping capacity, or approximately 43 ha of serviceable area.

It should be noted that there are additional developments that may want to use a portion of the available capacity at Lift Station 4. An agreement of how to share capacity would have to be reached through both developers and the City of Chestermere.



Off Peak Pumping

In order to potentially service a larger area than gravity connections would allow in the short term, off peak pumping into the existing collection system will be considered by the City of Chestermere on an interim basis until the future trunk main to Lift Station 14 can be constructed.

Following discussions with the City, the following are the design criteria for off peak pumping:

- Pumping hours are between 12:00 am and 6:00 am
- Downstream collection and conveyance system must be able to support pumping rate
- Maximum daily flow rate must be based off of peak discharge rate in off hours. As such maximum daily flow rate is 6/24 (25%) of peak discharge
- There must be an allowance for storing a full day's worth of flows at the maximum daily flow rate.
- No interim or permanent lift station will be considered. As such each service will require their own stepper pump and cistern, pumping to a common header that will discharge into the collection system
- Serviced areas must be designed for future gravity connection to the gravity trunk
- Service area as a function of maximum daily flow rate will be considered using the averaged flows of the 48 hour period that the design storm event occurs in.

Downstream Capacity

The collection system downstream of the development area was reviewed to identify the preferred location to discharge the off peak pumping into, and to determine the available capacity for peak pumping rates.

The 250 mm line along Kinniburgh Blvd was selected as the preferred discharge location, as it is the largest diameter line in the local collection system and has the highest hydraulic capacity.

A pattern was set up in the model during Average Dry Weather Flow discharging flows into the upstream end of the 250 mm line along Kinniburgh Blvd between 12:00 am and 6:00 am. The flow discharged was increased in an iterative process until the downstream pipe surcharged to the top of pipe. Through this process it was found that the peak allowable discharge for off peak pumping was 30 L/s.

The following figure shows the profile of the 250 mm line along Kinniburgh Blvd with 30 L/s being discharged into it by offpeak pumping.

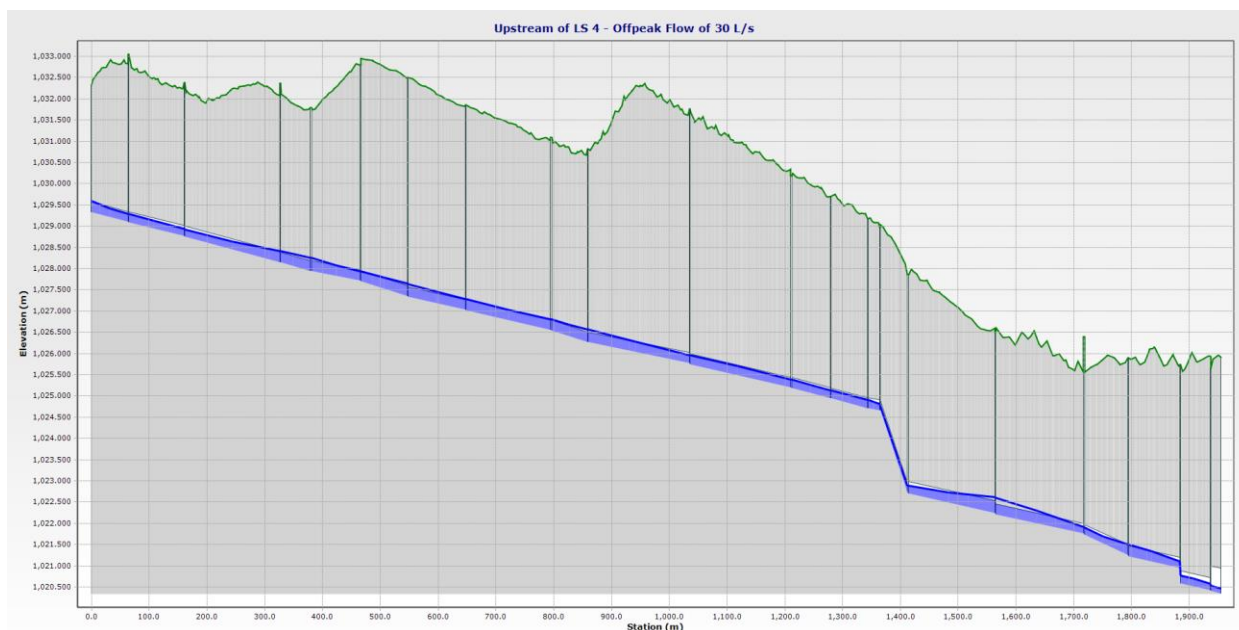


Figure 3 - Kinniburgh Blvd Profile

During the off peak pumping Lift Station 4 has a peak incoming flow of approximately 40 L/s, within the existing firm capacity of the station.

Service Area

The service area that can be supported by offpeak pumping will be assessed by determining the maximum flow during the design storm event for the full buildout of the development area, averaged across the day of the storm and the day after. This accounts for the short lived peak of the storm, which would be attenuated through the on site storage required for the pumping, and captures the elevated flows of the following day. This maximum daily flow, divided by the total area of the development, results in a unit area flow rate that can be applied to the off peak pumping.

Figure 7 shows the output from the model for the 48 hours of the design storm event.

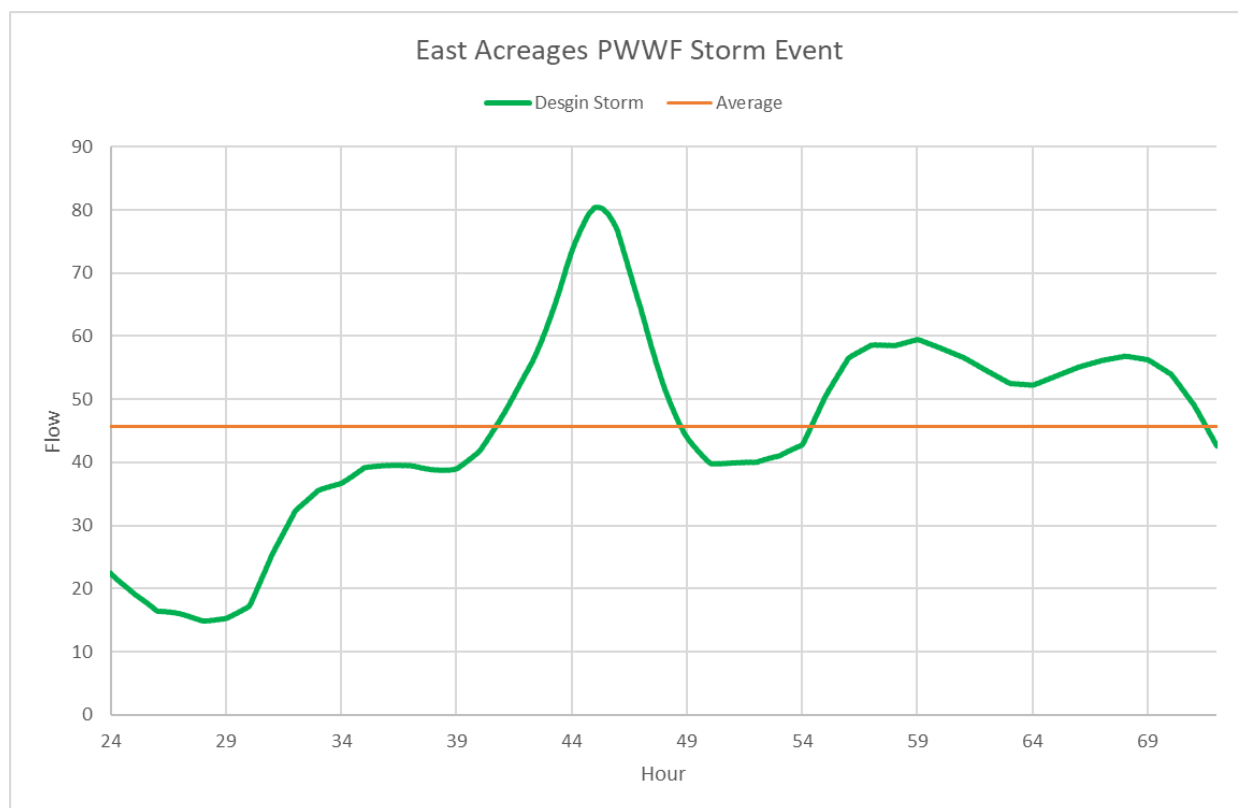


Figure 4 - Design Storm Flows

The average flow across the 48 hours of design storm is 46 L/s. With a total area of 148 ha, the unit area flow rate for maximum daily flows is 0.31 L/s/ha.

With a maximum allowable of peak flow of 30 L/s, the maximum daily flow would be 25% of that, or 7.5 L/s. With a unit area flow rate of 0.31 L/s/ha, the maximum allowable service area for offpeak pumping is 24 ha.

Storage Requirements

The total storage volume required to support offpeak pumping would be a full day's worth of the maximum daily flow. At 7.5 L/s, this results in a total storage volume of 648 m³. With a maximum allowable service area of 24 ha, this results in a storage volume requirement of 27 m³/ha.

Interim Servicing

The proposed interim servicing is through a temporary lift station located at the upstream end of the future trunk main to the proposed Lift Station 14, at approximately Township Rd 241A and Range Rd 281. Flow from development in East Acreages would collect to the lift station by gravity and discharge to the Lift Station 4 collection area at the upstream end of the 250 mm line along Kinniburgh Blvd. Once the future trunk line is constructed the lift station can be decommissioned with no alteration to previously developed infrastructure.



In order to maximize the service area that can be developed in the interim, a mixture of utilizing both the pumping capacity of Lift Station 4 during PWWF and offpeak pumping with storage can be employed.

Lift Station Depth

The bottom of the lift station must be located at sufficient depth to service the East Acreages development area by gravity. This depth will dictate the eventual upstream invert of the future trunk main. To facilitate this a high level review of the major contour lines along the area was performed. It was found that the lowest point of the development area with the furthest distance from the proposed lift station location was an elevation of 1025 m approximately 720 m away. However, as this area is predominantly a wetland and is the likely site of a future storm pond, a low elevation of 1026 m was used.

Using a minimum cover of 2.5 m, and a 250 mm pipe with a minimum slope of 0.28%, a 720 mm gravity starting at an elevation of 1026 m results in a bottom of lift station elevation of 1021.5 m.

The figure below shows the service areas low point and proposed lift station location:

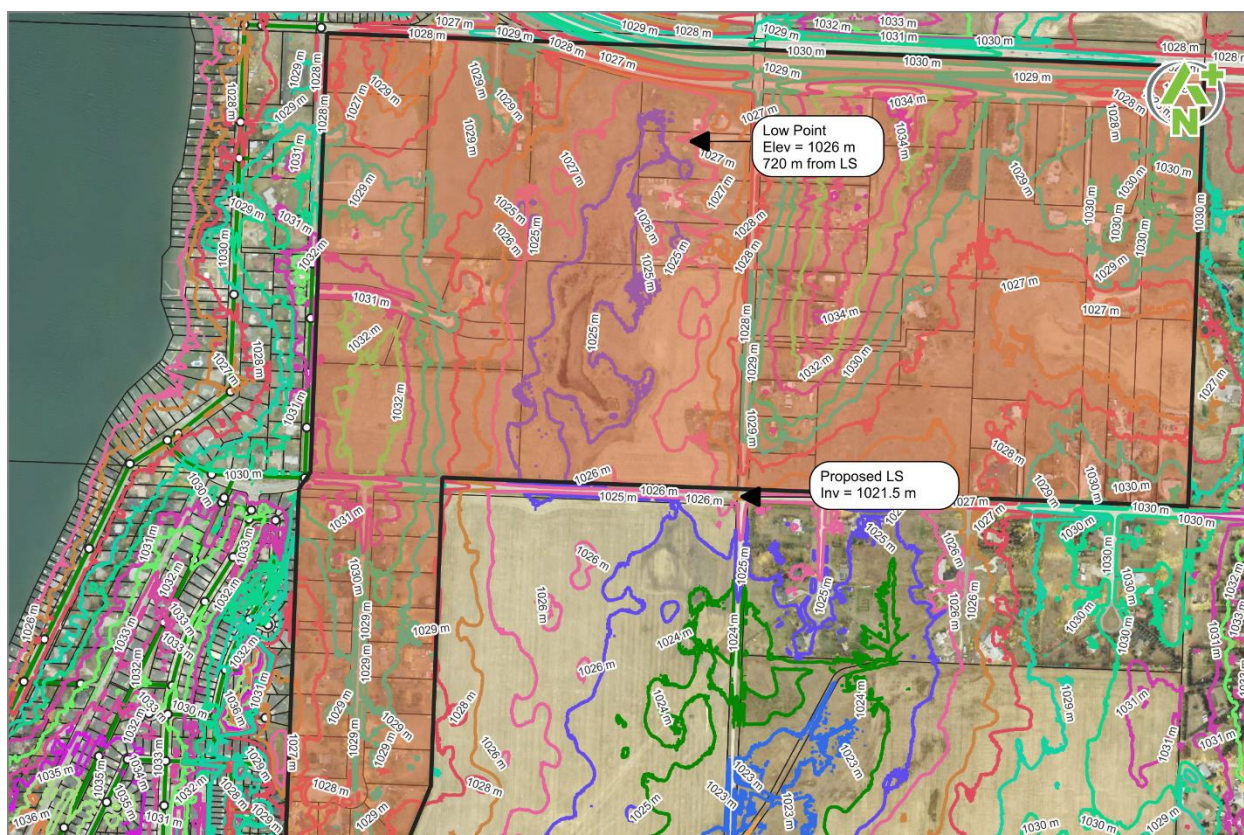


Figure 5 - Lift Station Depth



Service Area

With the pump issue at Lift Station 4 resolved, a total of 43 ha of new development can tie into Lift Station 4 to utilize the available capacity during PWWF. Assuming half of this capacity will be allotted to East Acreages, this amounts to 21.5 ha of land. An additional 24 ha can be developed when utilizing offpeak pumping with 648 m³ of storage, for a total of 45.5 ha of developable land in the interim servicing scenario. This value may change depending on how available capacity at Lift Station 4 is allotted.

Any areas that can tie directly to gravity, such as those bordering East Lakeview Rd, would have to be removed from the total service area of the lift station.

The figure below shows the approximate service and potential gravity main and forcemain configuration:

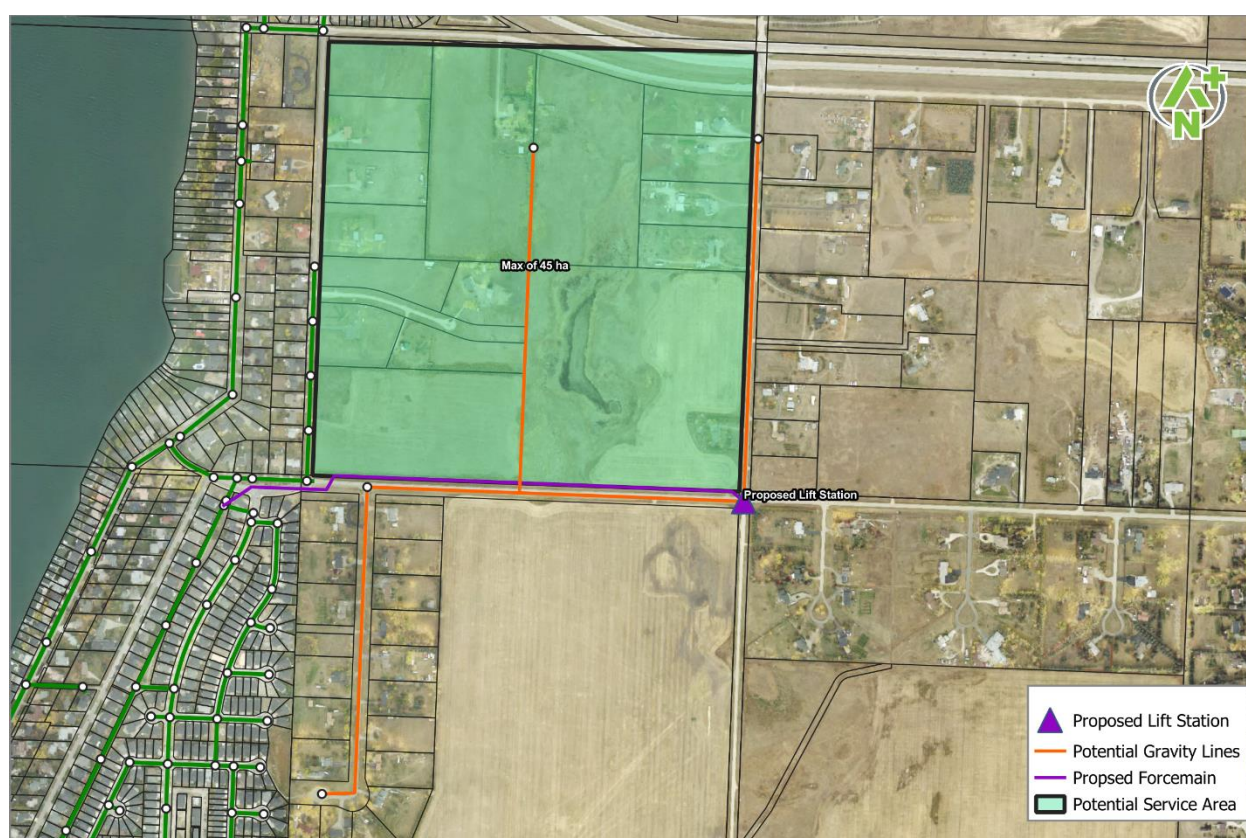


Figure 6 - Anticipated Service Area

Design Considerations

Designing a lift station that will have variable flow rates based on the current flow conditions and time of day may be challenging. The allowance for offpeak pumping creates a lift station with a higher pumping capacity than the current remaining capacity of the downstream lift station during peak flows. The assumptions for offpeak pumping is that peak wet weather flows typically occur during the day, with lower



flows over night, allowing for the storage wastewater to be discharged at a higher flowrate. However, since wet weather events are variable, and may occur overnight, additional precautions should be taken to ensure that the downstream system does not become overwhelmed.

This may come in the form of interlocks between Lift Station 4 and the proposed lift station, to ensure that new lift station is not performing an overnight discharge at maximum capacity while Lift Station 4 is near it's own capacity.

Future Servicing

Future servicing of the site would be through a large diameter gravity trunk line along the eastern side of the site which will terminate at the future Lift Station 14, south of the canal. This trunk line and lift station will be the future servicing solution for the majority of the new lands on the east side of Chestermere.

A high level alignment and grade for the future trunk line was developed, running at minimum slope along the length of the trunk line and allowing for sufficient depth to cross the canal. This high level alignment results in an invert at the north end of the trunk line, along Township Rd 241A, of 1021.9 m.

Figure 8 below shows the high level future servicing concept.

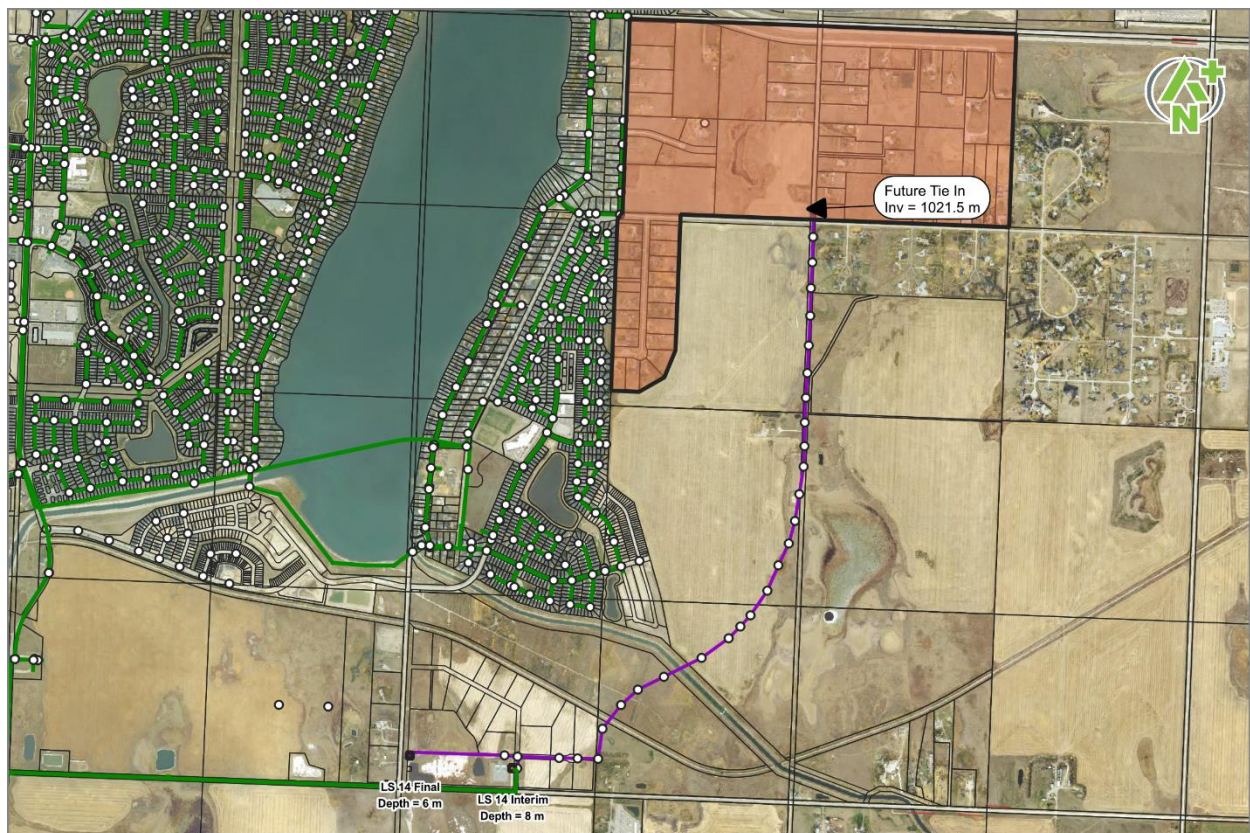


Figure 7 - Future Wastewater Servicing



Conclusion

The capacity of Lift Station 4 was reviewed, and it was found that with the existing pumps the lift station has a capacity of approximately 11 L/s, or about 20 ha of future development. If the pumps were investigated and the lower performing pump was repaired or replaced, such that the capacity of the higher performing pump was reached, this would expand the available capacity to 23 L/s, or approximately 43 ha of future development. Agreements would have to be reached with the City and developers to determine how to share capacity with other upcoming developments.

Off peak pumping was reviewed, and it was found that approximately 30 L/s of peak flow can be supported by the existing collection system. This translates to 7.5 L/s of maximum daily flow, and 24 ha of service area. 648 m³ of storage will be required for the full service area, or 27 m³/ha of developed area.

The proposed interim servicing is to install a temporary lift station at the top end of the future trunk main. This would collect all flows from development in east acreages and discharge it into the Lift Station 4 catchment. This would blend using the available capacity at Lift Station 4 for discharging instantaneous flows up to the allotted capacity, and include a 648 m³ storage cell that would discharge at 30 L/s during offpeak periods.

The future servicing for East Acreages will be through a gravity trunk link that runs along the eastern side of the development area, which collects into Lift Station 14. The northern end of the trunk line will have an invert of approximately 1021.5 m.

Regards,

Jamie Purdy, C.E.T

Lead Technologist

C

Appendix C North Acreages Servicing Assessment

July 31, 2024

Mark Ruault
Senior Engineer
City of Chestermere

Subject: North Acreages Servicing Assessment

Mr. Ruault,

CIMA+ was retained to perform a servicing assessment for the Water and Wastewater systems of the eastern half of the proposed North Acreages offsite levy zone. The proposed area is approximately 62 ha in area, bordered by Township Rd 244 and Paradise Rd.

The purpose of this assessment is to determine the serviceable area of the development when connecting to the existing Chestermere wastewater system through gravity.

This servicing assessment is being performed in parallel with the City of Chestermere's Utility Master Plan Update, and will utilize the updated and calibrated Wastewater computer model that was developed for that project.

The scope of this assessment is as follows:

- Water System
 - Determining Average Day, Max Day and Peak Hour Demands for the service area
 - Identifying potential tie in locations
 - Assessing storage capacity of the existing reservoir
 - Identifying level of service for Maximum Day demand + Fire Flow, and Peak Hour Demand scenarios
- Wastewater System
 - Determining Average Dry Weather Flows and Peak Wet Weather Flows for the service area
 - Identifying potential tie in locations
 - Assessing available capacity at lift stations downstream of tie in locations, and determining serviceable area with regards to the available capacity at the lift stations
 - Assessing high level serviceable area that can collect by gravity into the existing system

The following figure shows the proposed development area:



Figure 1 – North Acreages Development Area

DESIGN CRITERIA

The following is the design criteria used for the water and wastewater servicing assessment, which are in line with those used for the Utility Master Plan, as developed in the “November 2023 Chestermere Utility Plan – Design Basis Technical Memorandum” by CIMA+.

Growth Areas

All growth in the City is represented as residential population units, with a prescribed population density of 19 residential units per hectare, and 3.2 people per unit. This results in a population density of 60.8 people per hectare and a total buildout population of 3770 people in the 62 ha development area.

The development area can be broken into 8 parcels approximately 200 m wide that follow existing property lines.



Water System

The following are the design criteria for the water system, with respect to water demands, reservoir storage capacity, level of service, and available fire flow requirements.

- **Water Demands**
 - Per capita water demand of 250 L/c/day for Average Day Demand (ADD)
 - Maximum Day Demand (MDD) peaking factor of 2x ADD
 - Peak Hour Demand (PHD) of 4x ADD
- **Level of Service Criteria**
 - Minimum system pressure: 275 kPa (40 psi)
 - Maximum system pressure: 550 kPa (80 psi)
 - Maximum velocity in system: 3.0 m/s
- **Available Fire Flow Requirements:**
 - Residential areas without Multi-Family unit dwellings: 83 L/s for 2.0 hours
 - Residential areas with Multi-Family unit dwellings: 120 L/s for 2.5 hours
 - Industrial, Commercial and Institutional (ICI) land uses: 200 L/s for 2.5 hours
 - Minimum residual pressure of 140 kPa (20 psi) during fire flow
- **Pressure Zones**
 - The main pressure zone falls between 1026 m and 1045 m
 - The Westmere pressure zone falls between approximately 1035 m and 1050 m



WATER SYSTEM

The buildout of the water system in the development area was established using a 250 mm line along Paradise Rd, with a network of 200 mm lines within the acreages. A 300 mm water line was placed along the northern boundary of the network, as the northern most tie in point is an existing 300 mm line, and a 300 mm line along the northern boundary of Chestermere will be required as an outcome of the Utility Master Plan. Four connections to the existing system were identified, with the three northern connections in the Westmere pressure zone and the southern connection in the Main pressure zone. The water network was split across these two pressure zones along the 1045 m elevation contour. Elevations were assigned to the proposed network using existing ground elevations from LiDAR data.

The figure below shows the proposed water network and pressure zones for the development area.

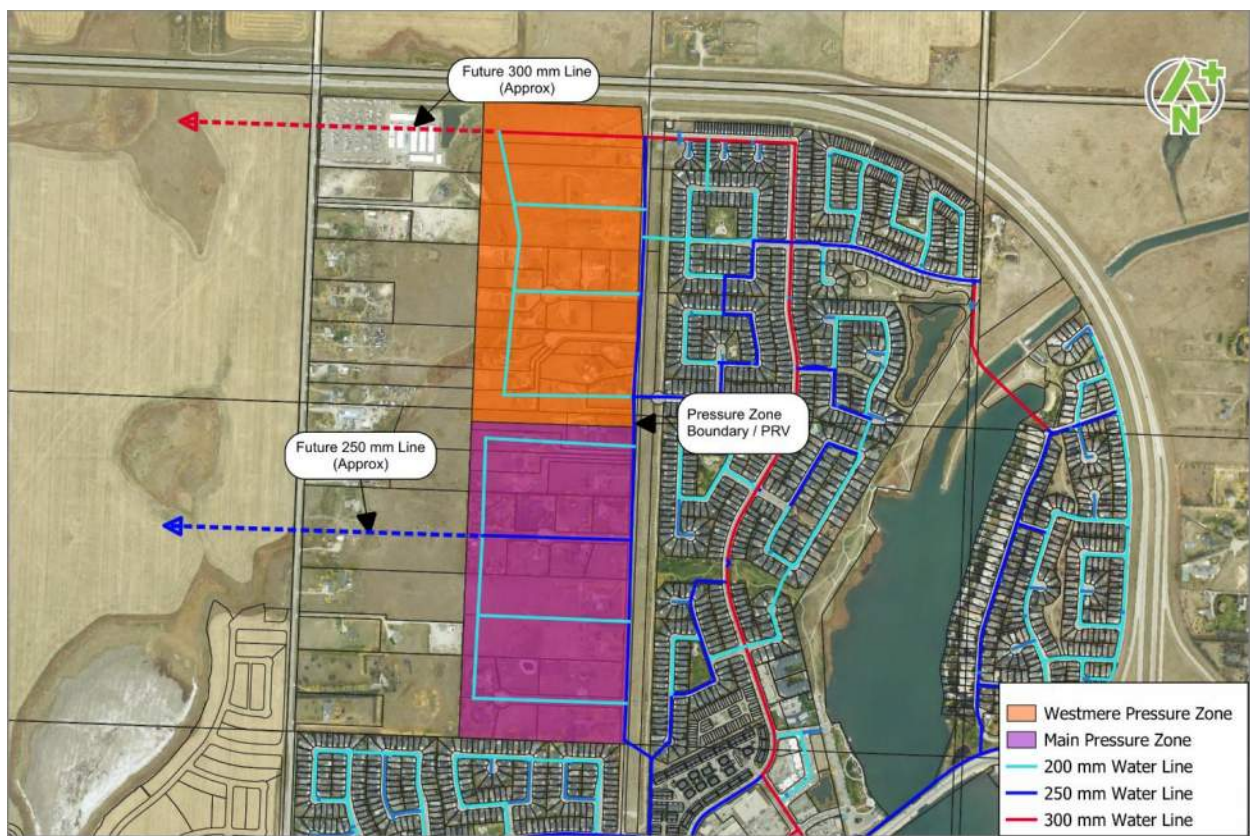


Figure 2 - Proposed Water Network

Water demands for the development area were distributed evenly across the proposed network for analysis in the model under MDD+FF and PHD demand scenarios.



Water Demands

The following are the estimated water demands for the full buildout of the 62 ha of the development area with an estimate population of 3770 people, along with the measured existing demands of the City.

The Westmere pressure zone portion of North Acreages contains approximately 1820 people, and the Main pressure zone portion contains approximately 1950 people.

Table 1 - Phase 1 Water Demands

Scenario	ADD (L/s)	MDD (L/s)	PHD (L/s)
Chestermere Demands	65	131	242
North Acreages Demands	11	22	44
Total	76	153	286

Tie In Locations

There are four viable tie in locations to connect to the existing system.

- Tie In A – On Marina Drive, connects to an existing 300 mm line
- Tie In B – West of Lakepointe Dr through a URW, connects to an existing 200 mm line
- Tie In C – On Aspermere Dr, connect to an existing 250 mm line
- Tie In D – South of Parkmere Dr, connects to an existing 250 mm line

Figure 3 below shows the tie in locations.



Figure 3 - Water Tie Ins

Available Fire Flow

The water model with the proposed pipe network for the development area with the four noted connections to the existing system was run under the MDD demand scenario to assess available fire flow.

Across the proposed network, an available fire flow of approximately 135 L/s in the Westmere pressure zone and 158 L/s in the main pressure zone was calculated in the water model for the full buildout of the development area. This indicates that the existing system can support single family and multi family developments with regards to available fire flow, however industrial, commercial and institutional land uses would be deficient under the design criteria.

As the surrounding existing neighbourhood has similar available fire flows in the model, there are no minor upgrades to the existing system which would significantly increase this level of service. New infrastructure, such as upgrading the Westmere booster station, or future connections to the proposed North reservoir would be required to measurably increase available fire flow in order to adequately service industrial, commercial and institutional land uses.

Figure A attached at the end of the document shows the results of the available fire flow modelling.



Level of Service

The water model was run under the PHD demand scenario to assess service pressures for the development area. Across the proposed network, service pressures ranging from 38 psi to 48 psi were calculated in the water model for the full buildout. Pressures below 40 psi were located largely in the northwest corner of the existing Westemere area. Pressures in the Main pressure zone portion of the buildout area were all above 40 psi. This indicates that the existing Westemere booster station is insufficient to accommodate the buildout of the portion of North Acreages in the Westemere pressure zone, and an upgrade to the booster station will be required.

Further modelling indicated that the existing booster station can support a population of approximately 1000 additional people in the Westemere booster station before the booster upgrade is required. Beyond that, pumps capable of a minimum of 50 L/s at 10 m of head will be needed, which are approximately 15 hp – 20 hp pumps.

The booster station upgrade is estimated to cost \$770,000. Detailed cost estimate is attached at the end of the document.

Figure B attached at the end of the document shows the results of the level of service modelling with the existing booster station. Figure C shows the results of the level of service modelling with the upgraded booster station.

WASTEWATER SYSTEM

The following are the design criteria for the wastewater system, with respect to wastewater generation, peak wet weather flows, level of service requirements and minimum pipe slopes.

- **Wastewater Demands**
 - Per capita wastewater demand of 240 L/c/day for Average Dry Weather Flow (ADWF)
 - Peaking factor based on system wide diurnal pattern applied in the time based model. Maximum peak of approximately 1.3 times ADWF
 - Peak wet weather flow based on calibrated storm event using catchment area of development.
- **Level of Service Requirements**
 - Minimum pipe velocity – 0.6 m/s at design flow
 - Maximum pipe velocity – 3.0 m/s at design flow
 - Pumping capacity – Peak Wet Weather Flow with the largest pump out of service
 - Maximum flow in pipes no greater than the pipe's hydraulic capacity

Wastewater Demands

In order to determine the peak wastewater flows for the full buildout of the North Acreages area, the dynamic wastewater model developed for the City was used, as it is a time based model with variable peaking factors and rain derived inflow and infiltration (RDII) values.

The full 62 ha catchment area was input into the model tying into a large diameter pipe separated from the existing system. The model was run to determine to determine the RDII value of the catchment area, using



the storm event and rainfall runoff data set calibrated for the future growth areas. The 3,770 people was also input into the model, using the per capita wastewater generation rate of 240 L/c/day. The future growth diurnal pattern which has a maximum peaking factor of approximately 1.3x ADWF was assigned to these demands.

Overall, the peak wet weather flow for the full buildout with the above inputs was 33 L/s. This works out to a peak flow rate of approximately 0.54 L/s/ha. This value will be used to assess serviceable area when reviewing the capacity of the existing system.

Tie In Locations for Gravity Servicing

Two potential tie in locations for gravity servicing were reviewed. The first is at the west end of Aspenmere Dr. There is an existing 200 mm line heading east from this tie in location along Aspenmere Dr.

The second is at the south side of the development area, at the Windermere Dr and Paradise Rd. Both tie ins collect to Lift Station 11 and will be assessed to maximize serviceable area by gravity.

- North tie in – Invert of 1041.65 m
- South tie in – Invert of 1030.84 m

Initially the gravity line along Marina Drive at the north end of the development area was considered for a potential tie in, but the invert at the upstream end was too high to even service the parcel immediately west of it. A gravity line extended from Lakepointe Dr at minimum slope to the same location had an invert that was approximately 0.6 m lower.

Figure 2 below shows the tie in locations.



Figure 4 - Wastewater Tie Ins

Gravity Servicing

In general the development area slopes downwards from north to south, with a high point in the northwest corner.

A high level assessment of the area serviceable by gravity into the existing collection system was performed by reviewing the major contour lines of the development area, in 1 m increments, to determine the overall elevations, then determining the maximum possible distance from the tie in point to each elevation. This was done for each tie in location. The ground elevations of the service area ranged from 1044 m to 1048 m. This considers minimum slope of a 200 mm pipe (0.4%), minimum cover (2.5 m), and an initial tie in elevation of 1041.65 m for the north tie in and 1030.84 m for the south tie in.



Table 2 - Maximum Service Distances – North Tie In

Ground Elev (m)	Available Grade (m)	Max Distance (m)
1,044	-0.15	-53.6
1,045	0.85	303.6
1,046	1.85	660.7
1,047	2.85	1017.9
1,048	3.85	1375.0

Table 3 - Maximum Service Distances – South Tie In

Ground Elev (m)	Available Grade (m)	Max Distance (m)
1,044	10.66	3807.1
1,045	11.66	4164.3
1,046	12.66	4521.4
1,047	13.66	4878.6
1,048	14.66	5235.7

The south tie in could service the full development by area, as it has a significantly lower invert than the north tie in. However, to facilitate immediate development with the minimum of offsite servicing required, both tie ins were used to service the area.

200 mm gravity lines were first extended from the north tie in at minimum slope, with a service line entering each of the approximately 200 m wide parcels, terminating near the western side of the parcel. This resulted in one parcel to the south of the tie in, and the remaining four parcels to the north. All parcels were able to be serviced with adequate cover, with the exception of the northernmost, which would need approximately 1.5 m of fill for adequate cover or additional considerations for pipe insulation.

200 mm gravity lines were extended from the south tie in at minimum slope into the remaining three parcels to the south of the development area. All parcels for this tie in were able to be serviced with adequate cover.

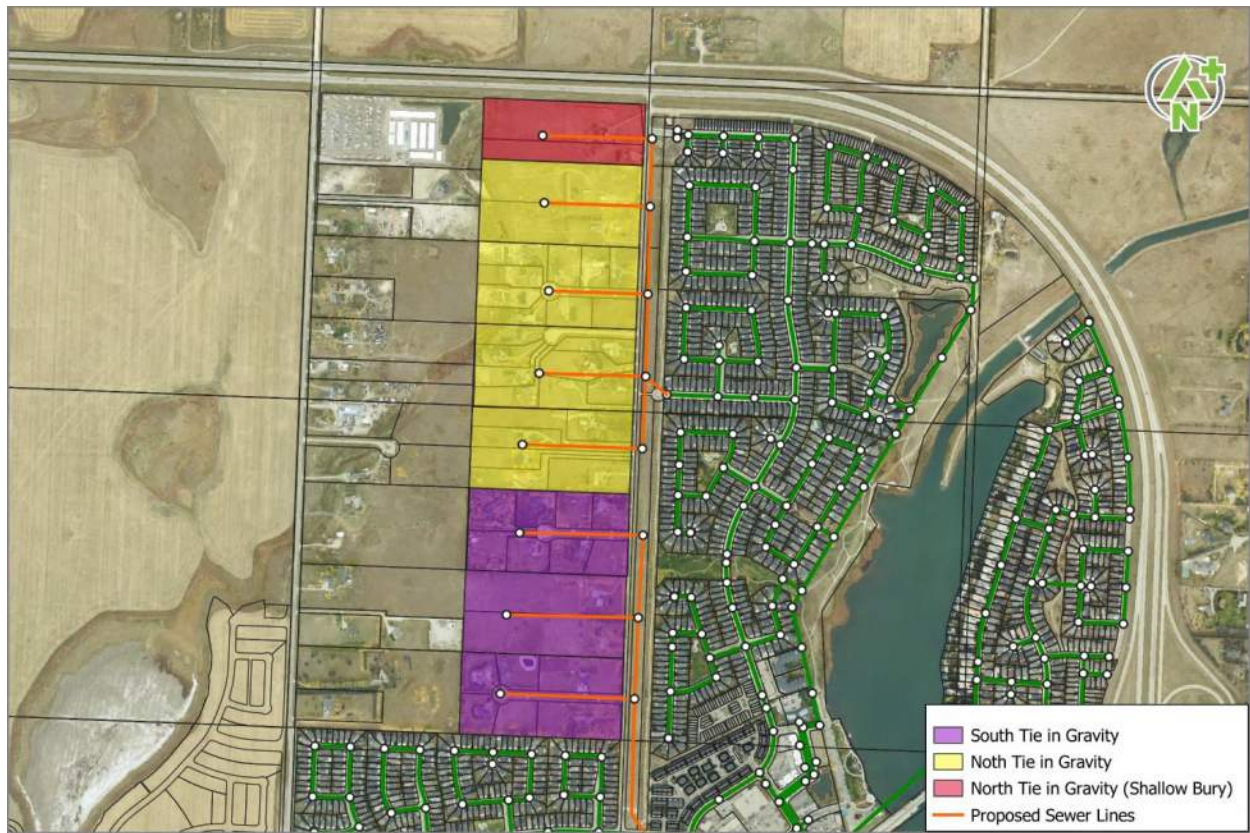


Figure 5 – Gravity Servicing

Lift Station Capacity

Lift station 11 is a duplex pumping stations, which alternates the duty pump each cycle. As per the design criteria, the firm pumping capacity of the lift station is the pumping capacity of the station with the largest pump offline.

SCADA data of the flow meter on the discharge of Lift Station 11 was reviewed to determine firm pumping capacity. As the data shows, Lift Station 11 operates at approximately 80 L/s. A snapshot of the SCADA data can be seen in Figure 6 below

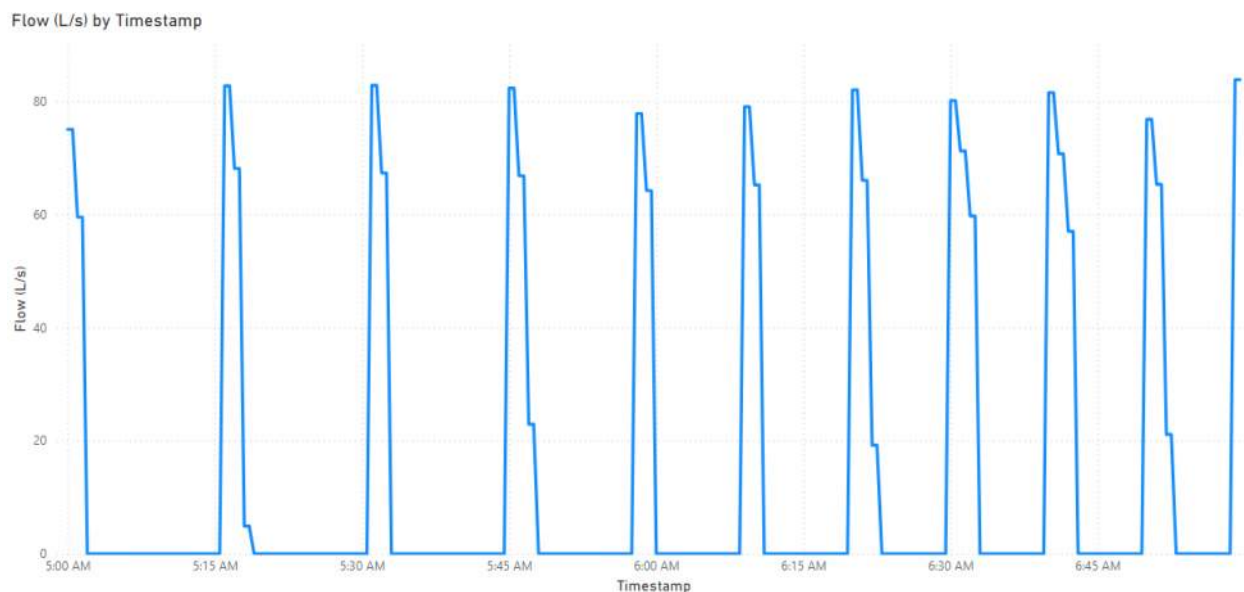


Figure 6 - Lift Station 11 Flows

The existing model was then run in order to determine the peak incoming flows into the lift station. In total, the peak incoming flow into Lift Station 11 was approximately 45 L/s. This means that there is 35 L/s of available capacity for future development. This equates to approximately 65 ha of development, using the 0.54 L/s/ha peak flow rate calculated earlier. This would be sufficient to service the full development area.

Downstream Capacity

The demands for each parcel were input into the wastewater model at the upstream manholes of the proposed collection system based on their respective areas. The model was then run under the PWWF scenario to assess the capacity of the downstream collection system from each tie in location.

The results are that the existing collection system has sufficient capacity for the project peak flows of the development area downstream of each proposed tie location.

The following figures show the profiles of the downstream collection system from each tie in location:

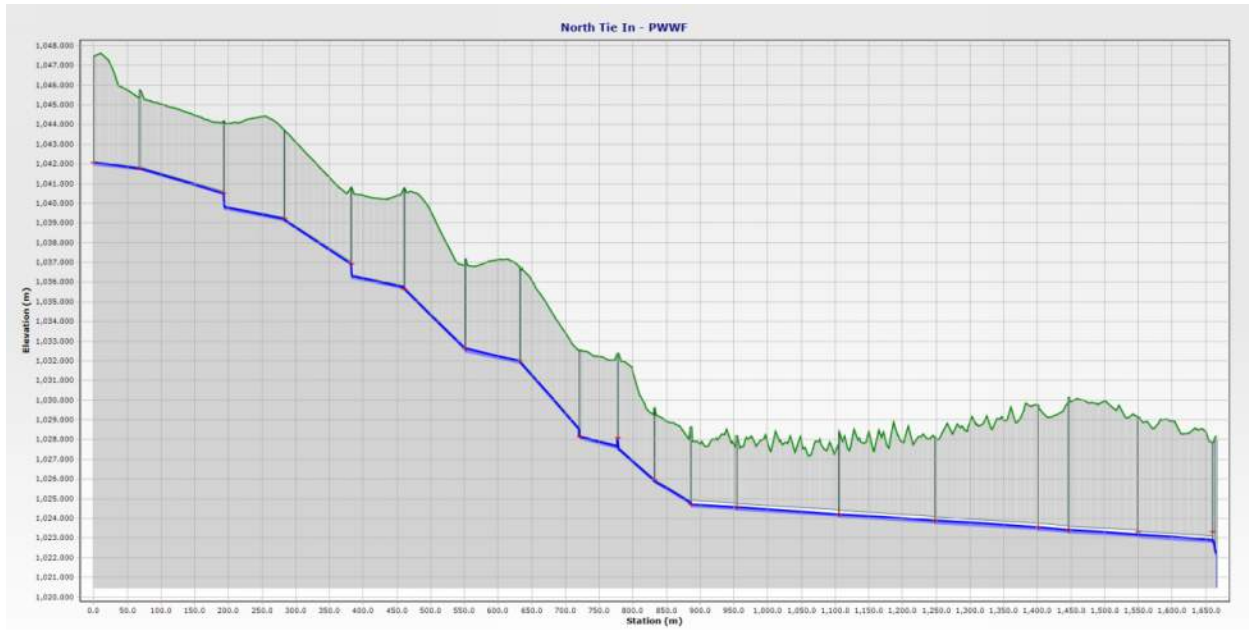


Figure 7 - North Tie In Downstream Profile

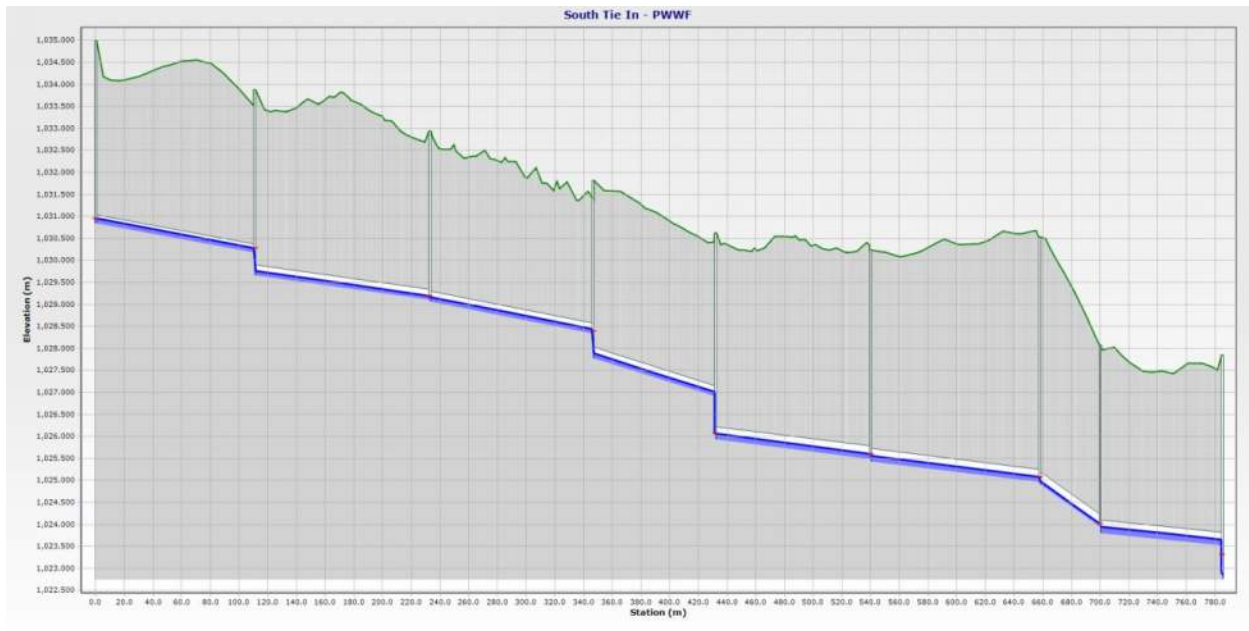


Figure 8 - South Tie In Downstream Profile



CONCLUSION

Water System

The existing water distribution system in Chestermere was assessed for the full buildout of North Acreages, and it was found that the full buildout of development area can not be adequately serviced with regards to existing water distribution pumping capacity.

The level of service that the existing distribution can accommodate was found to be deficient in the Westmere pressure zone, with insufficient pressures during the Peak Hour Demand scenario in the northwest portion of the existing Westmere development. Approximately 1000 additional people can be serviced off of the existing booster, after which the booster station will have to be upgraded to support 50 L/s at 10 m. The cost is estimated at \$770,000.

The available fire flow that the existing system can accommodate was found to be adequate for single family and multi family land uses, with an available fire flow of approximately 137 L/s. Industrial, commercial and institutional land uses would not be able to be adequately serviced for available fire flow. Future water distribution network upgrades would be required in order to reach the available fire flows necessary for those land uses.

Wastewater System

The proposed development area was assessed to determine the approximate area serviceable by gravity into two proposed tie in locations. Using minimum slopes of a 200 mm pipe, 2.5 m of cover, and the ground contours of the area, it was found that all parcels with the exception of the northernmost can be serviced through gravity with adequate ground cover. The northern parcel would be a shallow bury and would require an additional 1.5 m of fill or possibly pipe insulation when developed.

The capacity of Lift Station 11 was reviewed, and it was found that the lift station has an available capacity of approximately 35 L/s, or about 65 ha of future development. This is sufficient capacity to support the full development area.

The downstream collection system was reviewed, and was found to have adequate capacity to support the peak flows downstream of both tie in locations.

Regards,

Jamie Purdy, C.E.T

Lead Technologist

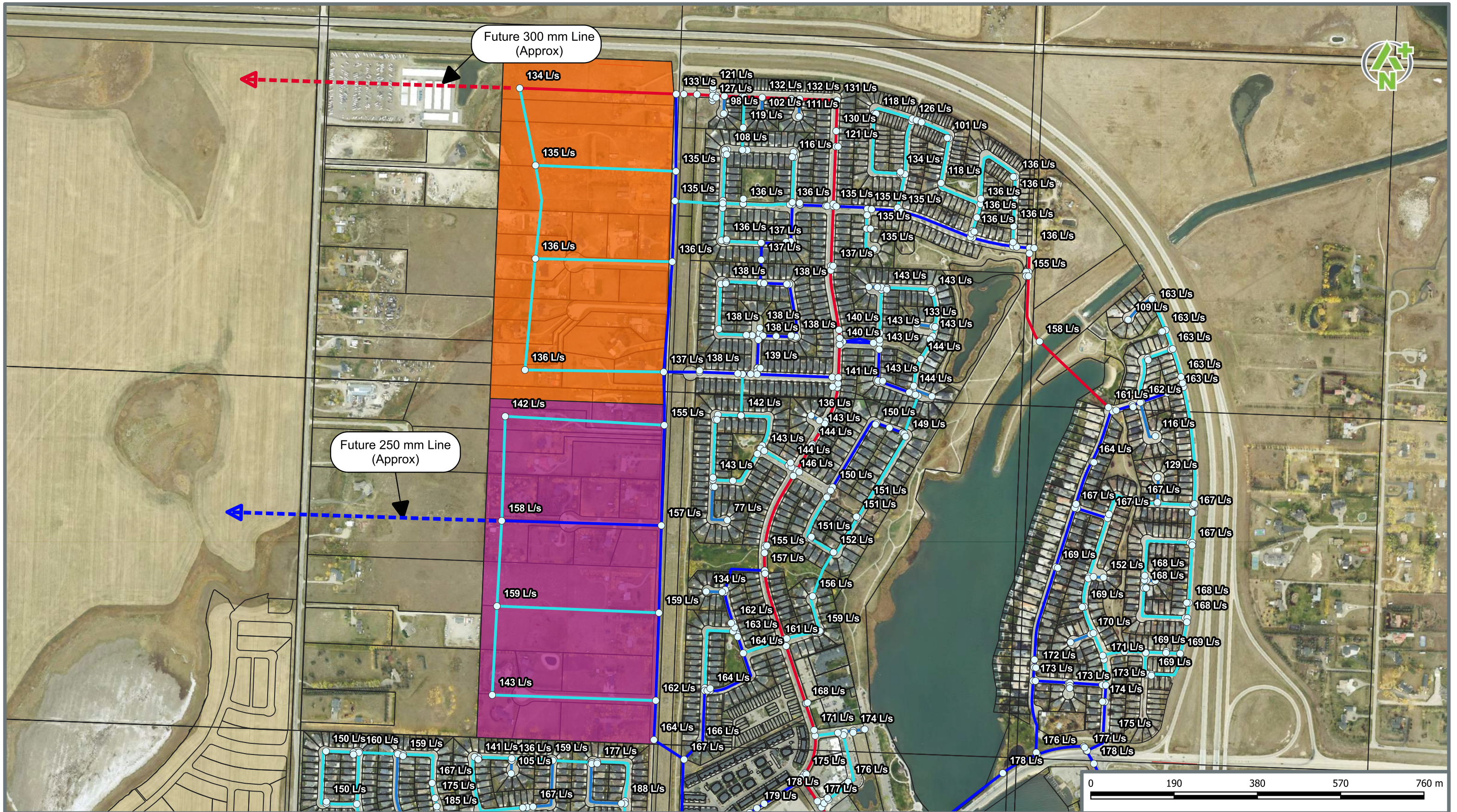


Figure A - North Acres Buildout MDD+FF

Scale 1:8,000



PREPARED FOR CITY OF CHESTERMERE
JULY 2024

- 200 mm Water Line
- 250 mm Water Line
- 300 mm Water Line
- Westmere Pressure Zone
- Main Pressure Zone
- Nodes Showing Available Fire Flow

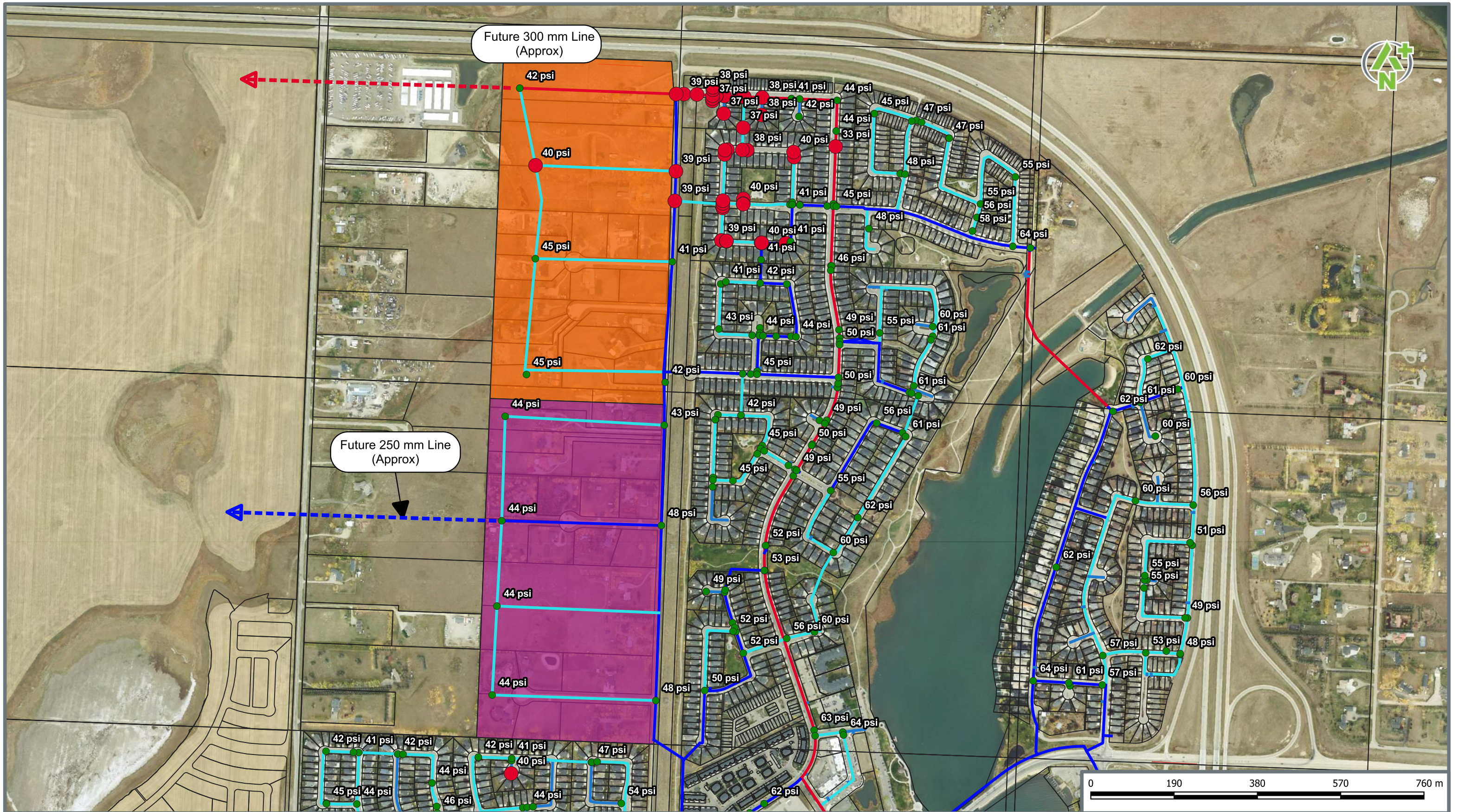


Figure B - North Acres Buildout PHD

Scale 1:8,000



PREPARED FOR CITY OF CHESTERMERE
MARCH 2024

- 200 mm Water Line
- 250 mm Water Line
- 300 mm Water Line
- Westmere Pressure Zone
- Main Pressure Zone
- Nodes Showing Pressure

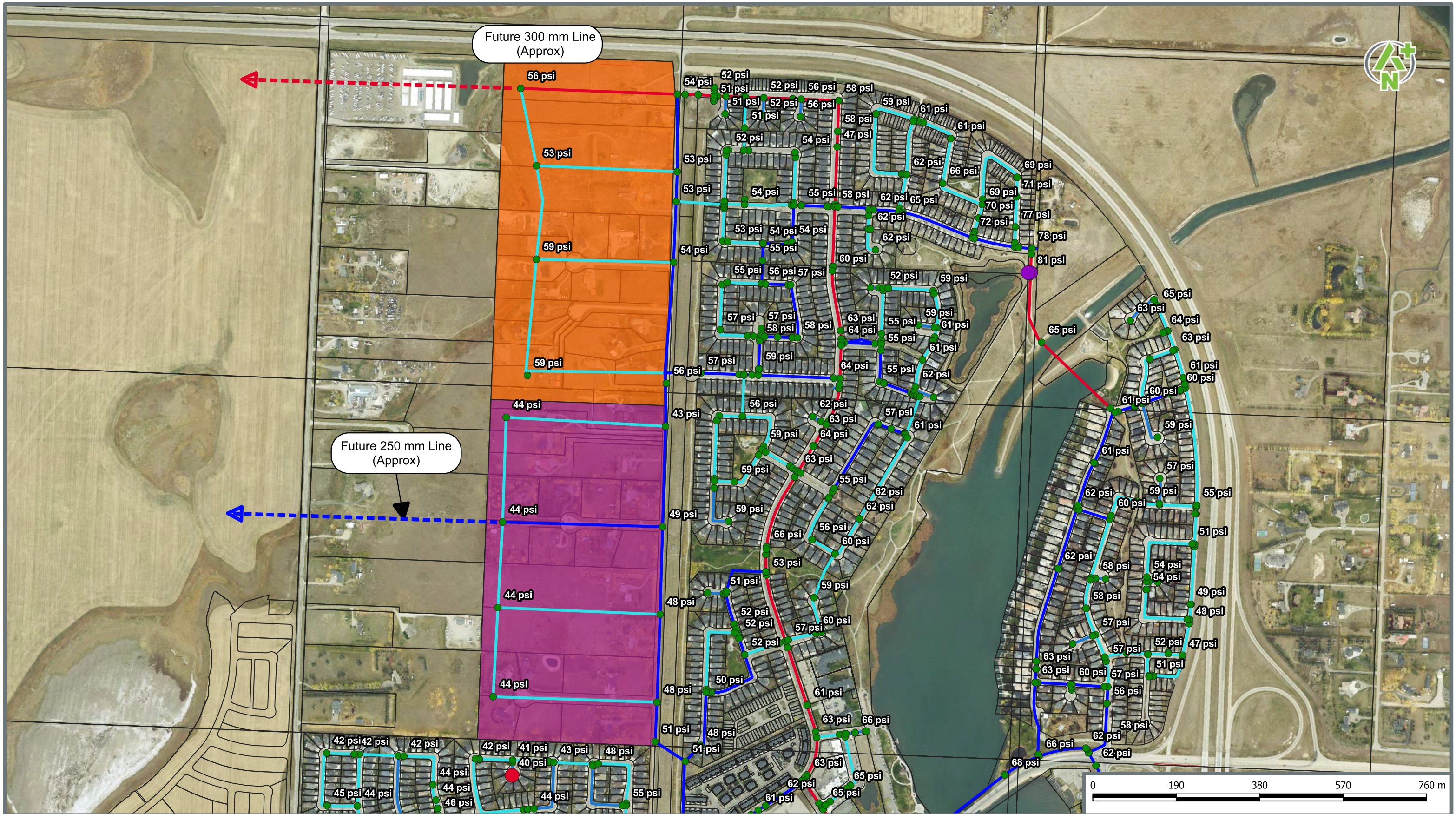


Figure C - North Acreages Buildout PHD (Upgraded Booster)

Scale 1:8,000



- 200 mm Water Line
- 250 mm Water Line
- 300 mm Water Line
- Westmere Pressure Zone
- Main Pressure Zone
- Nodes Showing Pressure



City of Chestermere

Westmere Booster Upgrade Cost Estimate

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 Electrical equipment	1	LS	\$ 100,000.00	\$ 100,000.00
3 Pumps and motors (~50 L/s)	2	EA	\$ 120,000.00	\$ 240,000.00
4 Standby generator	1	LS	\$ 125,000.00	\$ 125,000.00
Subtotal				\$ 520,000.00

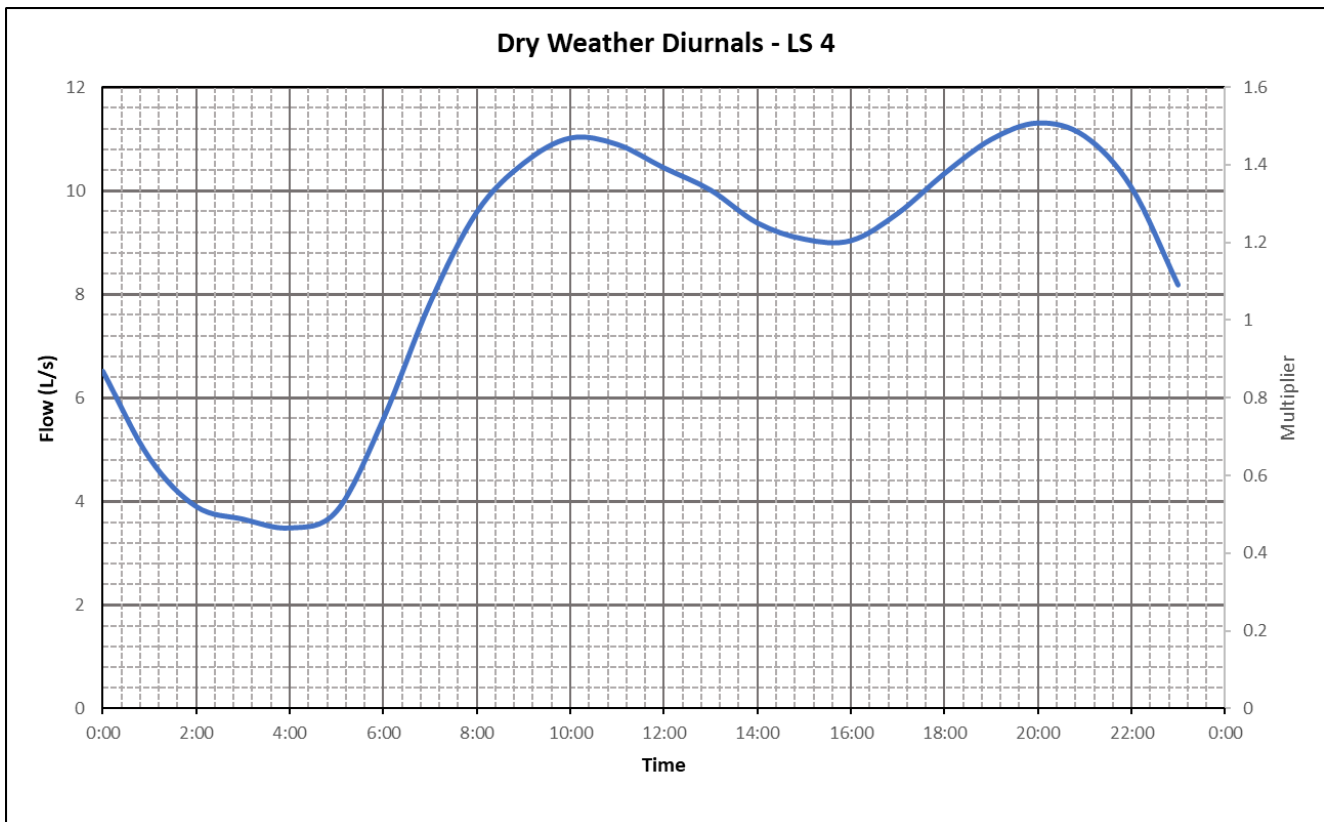
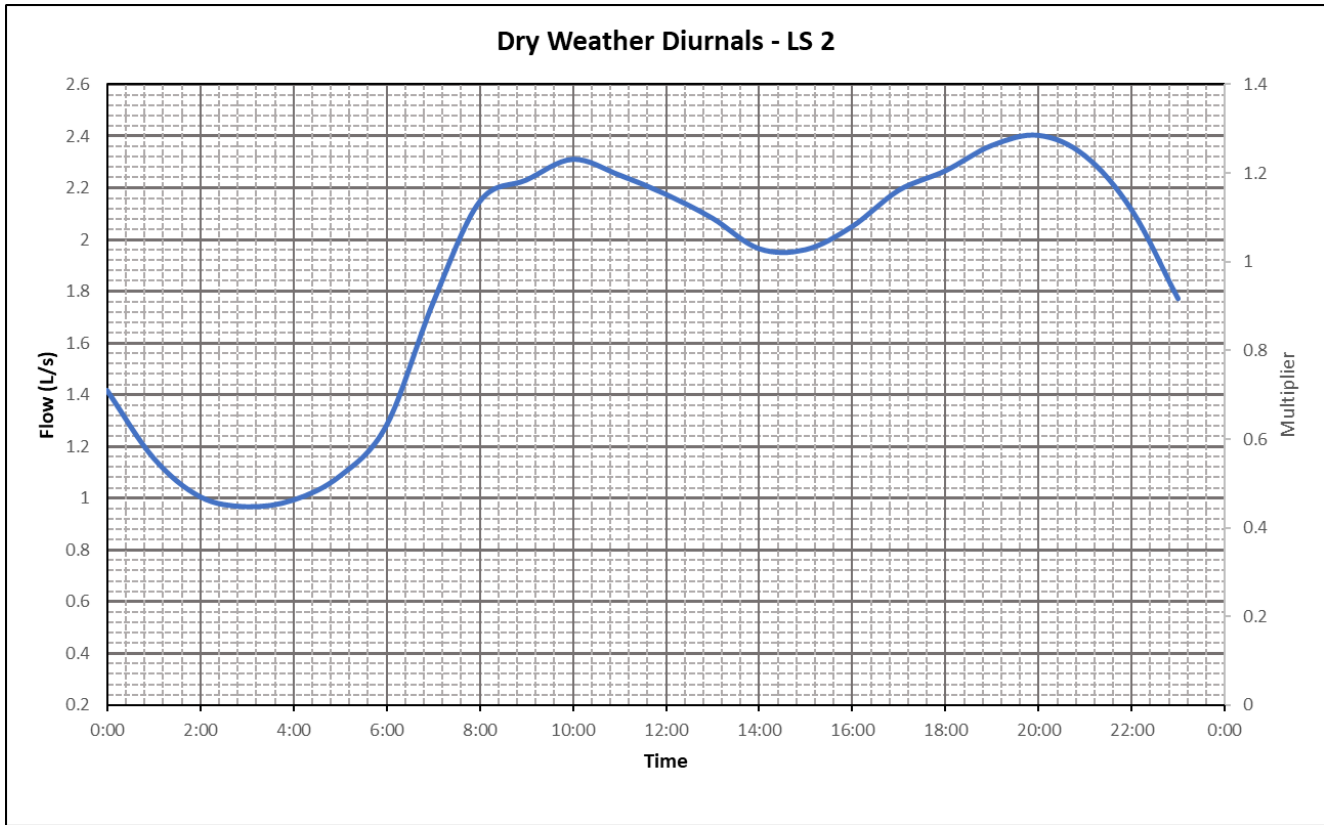
Engineering

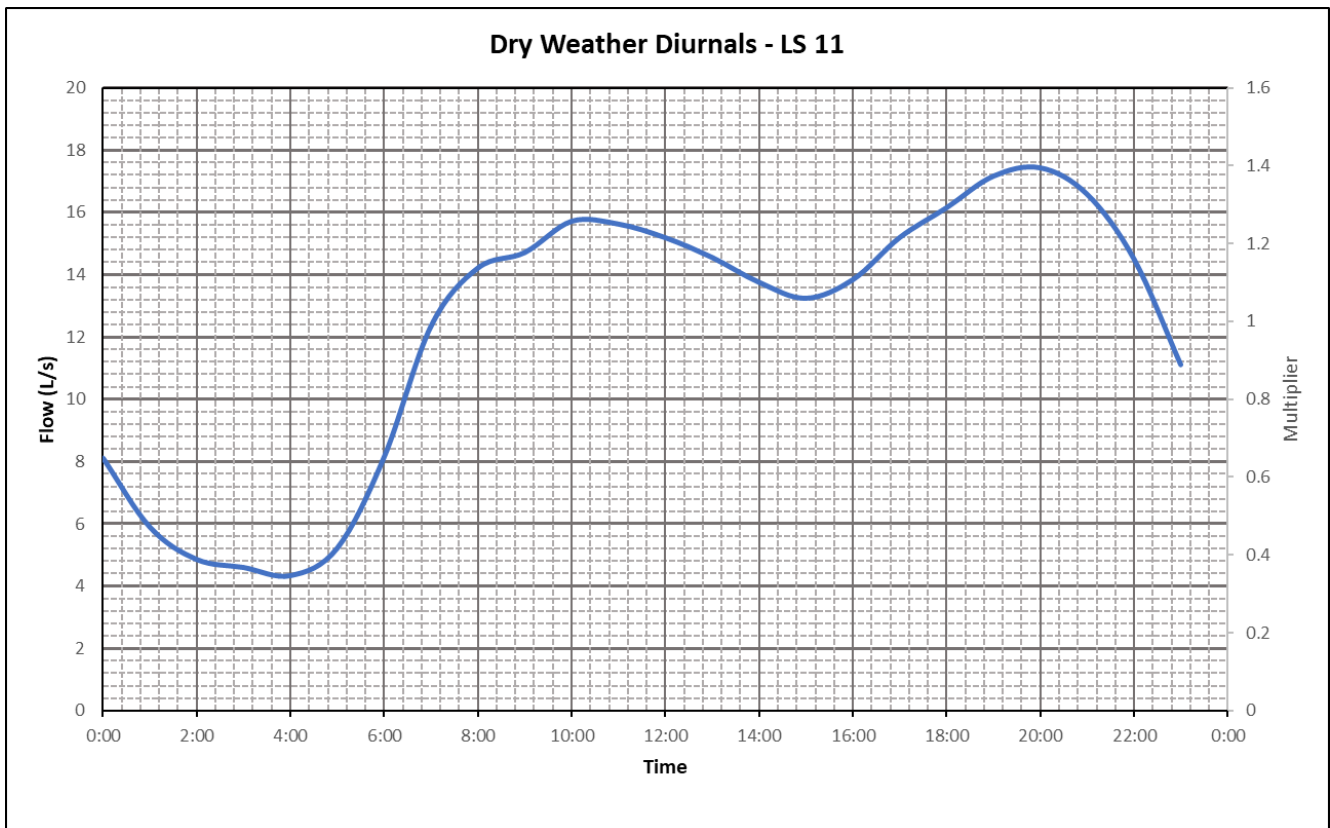
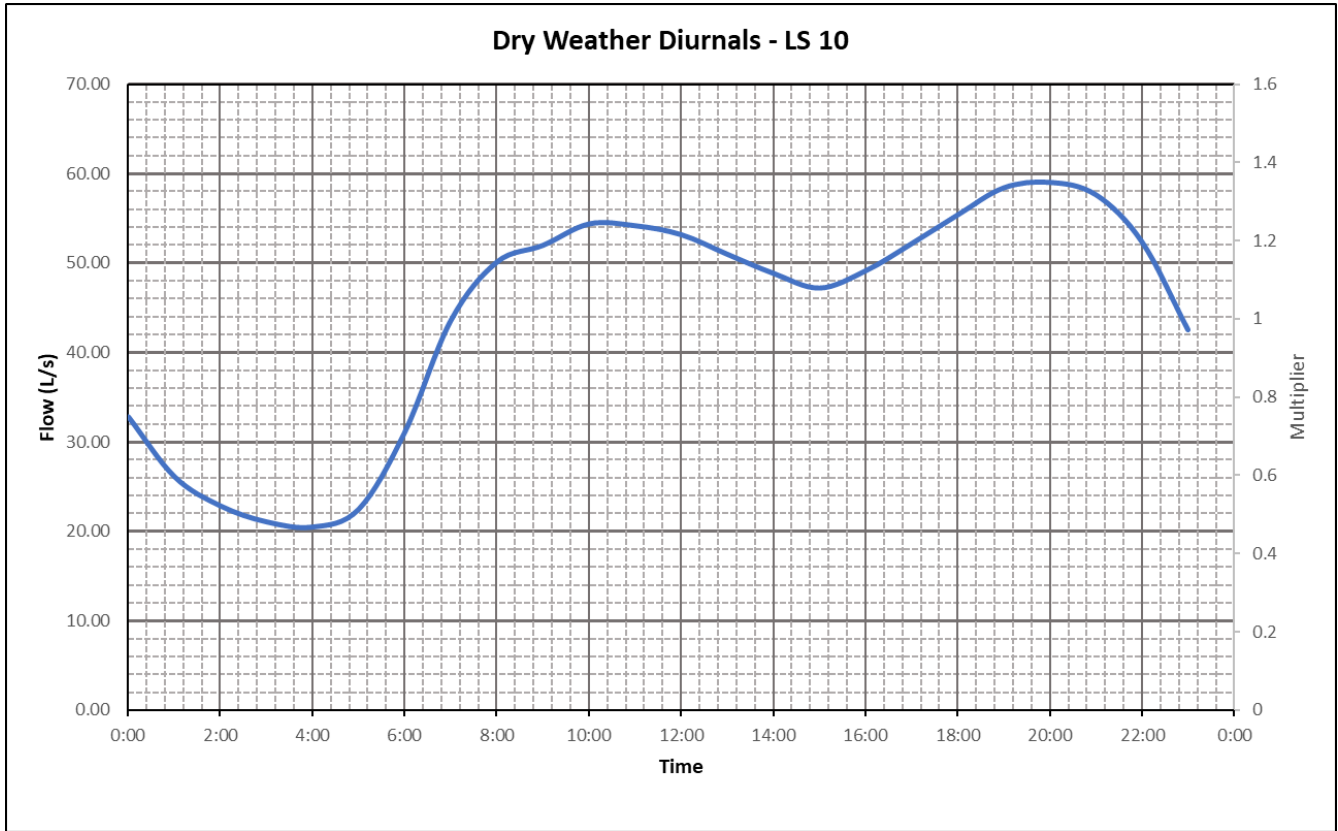
Engineering / QC (13%)	\$	70,000.00
Contingency (30%)	\$	180,000.00
Subtotal		\$ 250,000.00

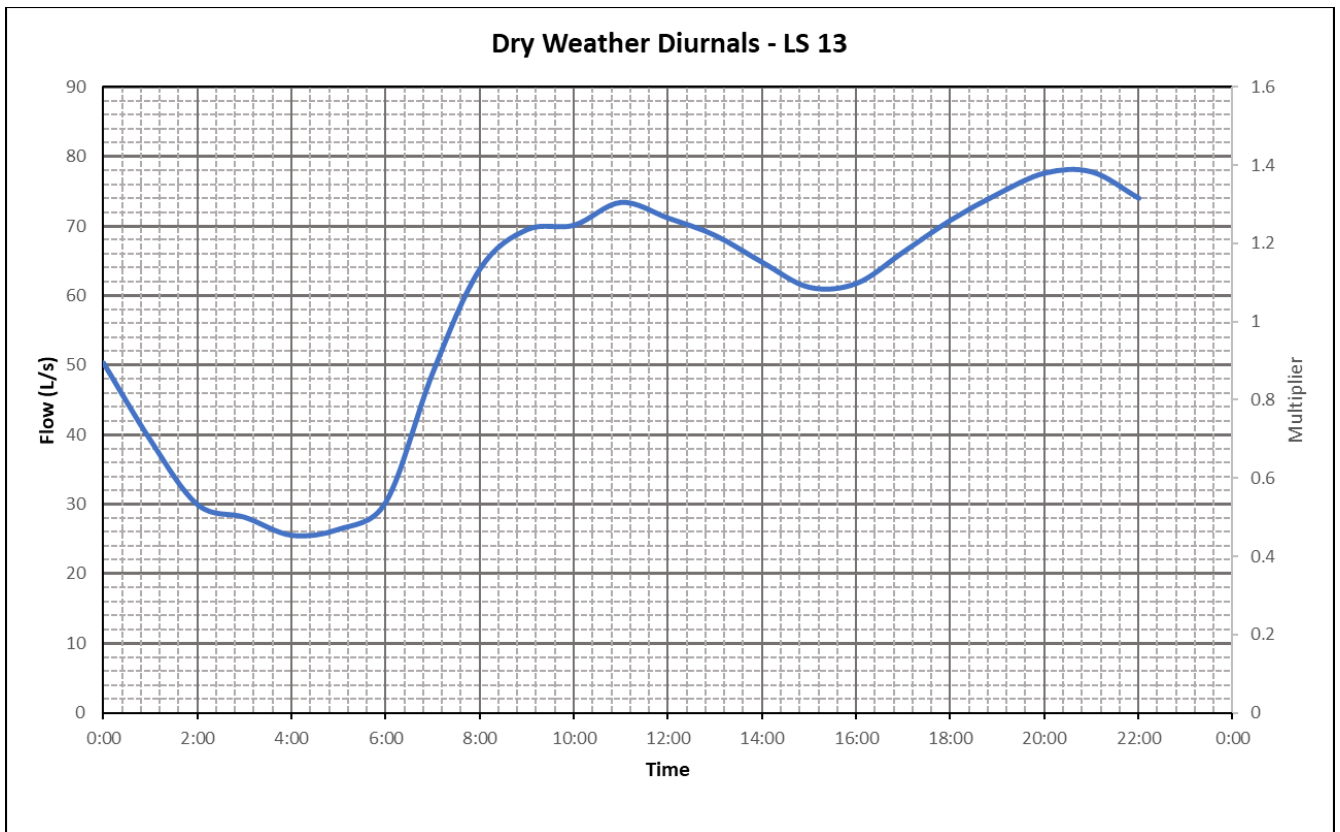
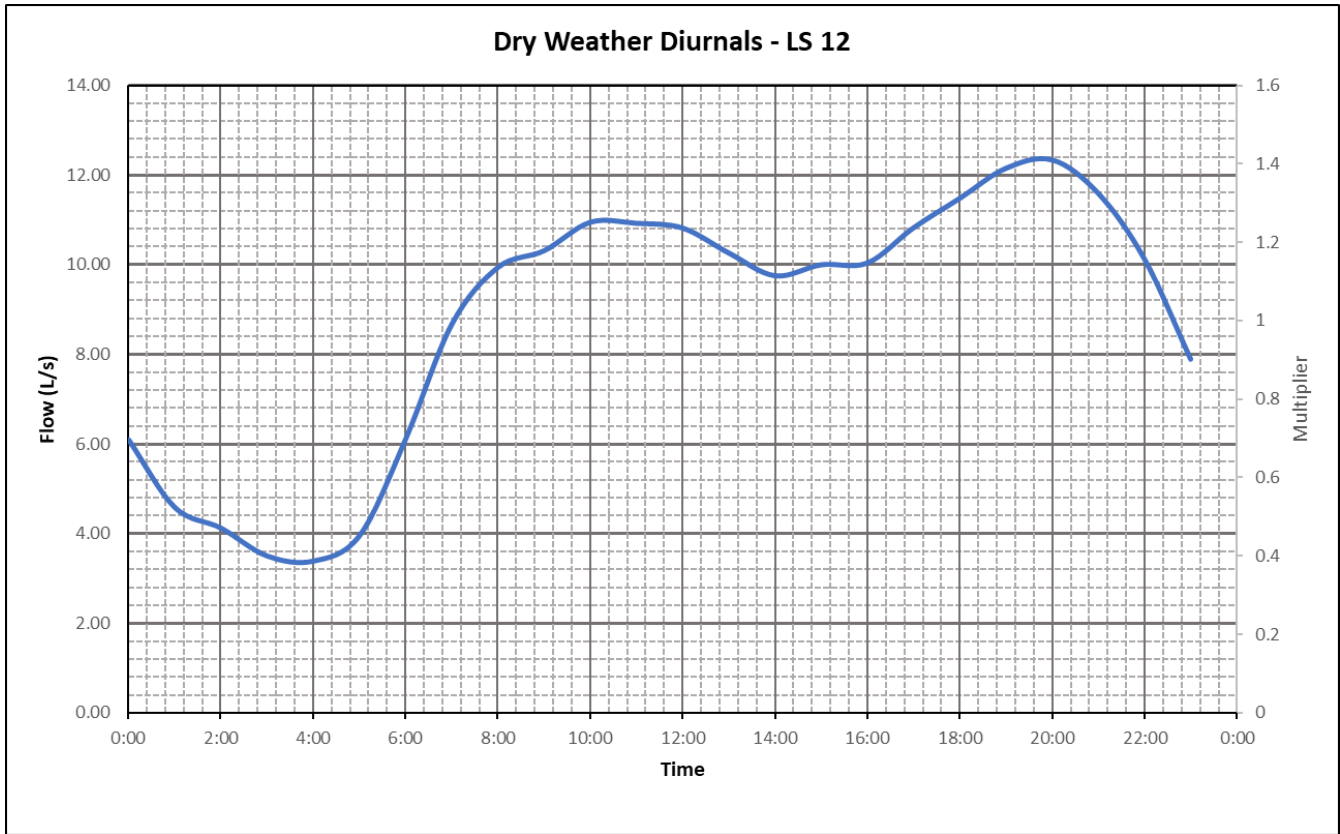
Total \$ 770,000.00

D

Appendix D Lift Station Diurnal Patterns







E

Appendix E Capital Project Cost Estimates

City of Chestermere

W1 - Northwest Reservoir and Pump Station Phase 1

Schedule A

Construction

Item	Description	Quantity	Unit	Unit Price	Total
1	Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2	Storage reservoir	6000	M3	\$ 1,500.00	\$ 9,000,000.00
3	Process equipment and piping	1	LS	\$ 400,000.00	\$ 400,000.00
4	Pumps and motors (300 L/s Firm)	4	EA	\$ 250,000.00	\$ 1,000,000.00
5	Electrical	1	LS	\$ 400,000.00	\$ 400,000.00
6	Standby generator	1	LS	\$ 300,000.00	\$ 300,000.00
7	New Building	1	LS	\$ 400,000.00	\$ 400,000.00
8	Land Requirements	2.5	ac	\$ 350,000.00	\$ 875,000.00

Subtotal \$ 12,480,000.00

Engineering

Engineering / QC (13%)	\$ 1,622,000.00
Contingency (30%)	\$ 4,230,000.00

Subtotal \$ 5,850,000.00

Total \$ 18,330,000.00

City of Chestermere
W2 - Northwest Reservoir Supply Main

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 Supply and Install 400 mm Water Line	3000	LM	\$ 1,000.00	\$ 3,000,000.00
3 Supply and Install Valves	8	EA	\$ 7,500.00	\$ 60,000.00
Subtotal				\$ 3,110,000.00

Engineering

Engineering / QC (13%)				\$ 404,000.00
Contingency (30%)				\$ 1,050,000.00
Subtotal				\$ 1,450,000.00

Total \$ 4,560,000.00

City of Chestermere

W3 - Main Pump Station Upgrade Phase 2

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 Electrical equipment	1	LS	\$ 600,000.00	\$ 600,000.00
3 Process equipment	1	LS	\$ 200,000.00	\$ 200,000.00
4 Pumps and motors (150 hp)	1	EA	\$ 300,000.00	\$ 300,000.00
5 Standby generator	1	LS	\$ 500,000.00	\$ 500,000.00

Subtotal \$ 1,650,000.00

Engineering

Engineering / QC (13%)	\$ 215,000.00
Contingency (30%)	\$ 560,000.00

Subtotal \$ 780,000.00

Total \$ 2,430,000.00

City of Chestermere

W4 - Main Pump Station Upgrade Phase 2

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 40,000.00	\$ 40,000.00
2 Pumps and motors (150 hp)	1	EA	\$ 300,000.00	\$ 300,000.00

Subtotal \$ 340,000.00

Engineering

Engineering / QC (13%)	\$ 44,000.00
Contingency (30%)	\$ 120,000.00

Subtotal \$ 160,000.00

Total \$ 500,000.00

City of Chestermere

W5 - Northwest Reservoir and Pump Station Phase 2

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 storage reservoir	6000	M3	\$ 1,500.00	\$ 9,000,000.00
3 Process equipment and piping	1	LS	\$ 400,000.00	\$ 400,000.00
4 Pumps and motors (300 L/s Firm)	4	EA	\$ 250,000.00	\$ 1,000,000.00
5 Standby generator	1	LS	\$ 600,000.00	\$ 600,000.00
6 New Building	1	LS	\$ 200,000.00	\$ 200,000.00
Subtotal				\$ 11,300,000.00

Engineering

Engineering / QC (13%)	\$ 1,469,000.00
Contingency (30%)	\$ 3,830,000.00
Subtotal	
	\$ 5,300,000.00

Total \$ 16,600,000.00

City of Chestermere

W6 - New Water Supply Main From Calgary

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 Supply and Install 400 mm Water Line	1800	LM	\$ 1,200.00	\$ 2,160,000.00
3 Supply and Install Valves	2	EA	\$ 7,500.00	\$ 15,000.00
4 Supply and Install Water Meter and Chamber	1	LS	\$ 450,000.00	\$ 450,000.00
Subtotal				\$ 2,730,000.00

Engineering

Engineering / QC (13%)				\$ 355,000.00
Contingency (30%)				\$ 930,000.00
Subtotal				\$ 1,290,000.00

Total \$ 4,020,000.00

City of Chestermere

W7 - Southwest Reservoir and Pump Station Phase 1

Schedule A

Construction

Item	Description	Quantity	Unit	Unit Price	Total
1	Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2	Install storage reservoir	6000	M3	\$ 1,500.00	\$ 9,000,000.00
3	Process equipment	1	LS	\$ 400,000.00	\$ 400,000.00
4	Pumps and motors (300 L/s Firm)	4	EA	\$ 250,000.00	\$ 1,000,000.00
5	Electrical	1	LS	\$ 400,000.00	\$ 400,000.00
6	Standby generator	1	LS	\$ 300,000.00	\$ 300,000.00
7	New Building	1	LS	\$ 400,000.00	\$ 400,000.00
8	Land Requirements	2.5	ac	\$ 350,000.00	\$ 875,000.00

Subtotal \$ 12,480,000.00

Engineering

Engineering / QC (13%)	\$ 1,622,000.00
Contingency (30%)	\$ 4,230,000.00

Subtotal \$ 5,850,000.00

Total \$ 18,330,000.00

City of Chestermere

W8 - Southwest Reservoir and Pump Station Phase 2

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 Install storage reservoir	6000	M3	\$ 1,500.00	\$ 9,000,000.00
3 Process equipment	1	LS	\$ 400,000.00	\$ 400,000.00
4 Pumps and motors (+300 L/s Firm)	4	EA	\$ 250,000.00	\$ 1,000,000.00
5 Standby generator	1	LS	\$ 600,000.00	\$ 600,000.00
6 New Building	1	LS	\$ 200,000.00	\$ 200,000.00
Subtotal				\$ 11,300,000.00

Engineering

Engineering / QC (13%)	\$ 1,469,000.00
Contingency (30%)	\$ 3,830,000.00
Subtotal	
	\$ 5,300,000.00

Total \$ 16,600,000.00

City of Chestermere
W9 - Distribution Trunk in Rainbow Rd

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 Supply and Install 500 mm Water Line	1200	LM	\$ 1,100.00	\$ 1,320,000.00
3 Auger bore under canal	80	LM	\$ 6,000.00	\$ 480,000.00
4 Supply and Install 500 mm Valves	6	EA	\$ 36,000.00	\$ 216,000.00
5 Tie ins	3	EA	\$ 20,000.00	\$ 60,000.00
6 Topsoil Rehab	7800	M2	\$ 20.00	\$ 156,000.00
7 Traffic Accomodation	1	LS	\$ 50,000.00	\$ 50,000.00

Subtotal \$ 2,380,000.00

Engineering

Engineering / QC (13%)	\$ 309,000.00
Contingency (30%)	\$ 810,000.00

Subtotal \$ 1,120,000.00

Total \$ 3,500,000.00

City of Chestermere

W10 - Distribution Trunk in Twp Rd 240 Ph2

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 Supply and Install 500 mm Water Line	1200	LM	\$ 1,100.00	\$ 1,320,000.00
4 Supply and Install 500 mm Valves	3	EA	\$ 36,000.00	\$ 108,000.00
5 Tie ins	2	EA	\$ 20,000.00	\$ 40,000.00
6 Road Rehab	7200	M2	\$ 100.00	\$ 720,000.00
7 Traffic Accomodation	1	LS	\$ 50,000.00	\$ 50,000.00
Subtotal				\$ 2,340,000.00

Engineering

Engineering / QC (13%)	\$ 304,000.00
Contingency (30%)	\$ 790,000.00
Subtotal	
	\$ 1,090,000.00

Total \$ 3,430,000.00

City of Chestermere

W11 - Distribution Trunk in Twp Rd 240 Ph3

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 Supply and Install 500 mm Water Line	1200	LM	\$ 1,100.00	\$ 1,320,000.00
3 Auger bore under canal	80	LM	\$ 5,000.00	\$ 400,000.00
4 Supply and Install 500 mm Valves	3	EA	\$ 36,000.00	\$ 108,000.00
5 Tie ins	2	EA	\$ 20,000.00	\$ 40,000.00
6 Road Rehab (gravel)	7800	M2	\$ 60.00	\$ 468,000.00
7 Traffic Accomodation	1	LS	\$ 50,000.00	\$ 50,000.00

Subtotal \$ 2,490,000.00

Engineering

Engineering / QC (13%)	\$ 324,000.00
Contingency (30%)	\$ 840,000.00

Subtotal \$ 1,160,000.00

Total \$ 3,650,000.00

City of Chestermere

W12 - Distribution Trunk in Range Road 281

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 Supply and Install 500 mm Water Line	4000	LM	\$ 1,100.00	\$ 4,400,000.00
3 Auger bore under canal	80	LM	\$ 5,000.00	\$ 400,000.00
4 Supply and Install 500 mm Valves	6	EA	\$ 36,000.00	\$ 216,000.00
5 Tie ins	6	EA	\$ 20,000.00	\$ 120,000.00
Subtotal				\$ 5,240,000.00

Engineering

Engineering / QC (13%)	\$ 681,000.00
Contingency (30%)	\$ 1,780,000.00
Subtotal	
\$ 2,460,000.00	

Total \$ 7,700,000.00

City of Chestermere

S1 - East Acreages Interim Lift Station

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 Electrical equipment	1	LS	\$ 100,000.00	\$ 100,000.00
3 Process equipment	1	LS	\$ 150,000.00	\$ 150,000.00
4 Pumps and motors (30 L/s)	2	EA	\$ 150,000.00	\$ 300,000.00
5 Standby generator	1	LS	\$ 250,000.00	\$ 250,000.00
6 Building	1	LS	\$ 150,000.00	\$ 150,000.00
7 Wet Well / Storage Cell	650	M3	\$ 1,500.00	\$ 975,000.00
8 150 mm Forcemain	1000	M	\$ 350.00	\$ 350,000.00
9 Land Requirements	0.65	ac	\$ 350,000.00	\$ 227,500.00

Subtotal \$ 2,550,000.00

Engineering

Engineering / QC (13%)	\$ 332,000.00
Contingency (30%)	\$ 860,000.00
Subtotal	\$ 1,190,000.00

Total \$ 3,740,000.00

City of Chestermere

S2 - Lift Station 13 Pump Upgrade

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 Electrical equipment	1	LS	\$ 250,000.00	\$ 250,000.00
4 Process equipment	1	LS	\$ 150,000.00	\$ 150,000.00
5 Pumps and motors (150 L/s)	2	EA	\$ 250,000.00	\$ 500,000.00
Subtotal				\$ 950,000.00

Engineering

Engineering / QC (13%)	\$ 124,000.00
Contingency (30%)	\$ 320,000.00
Subtotal	\$ 440,000.00

Total \$ 1,390,000.00

City of Chestermere

S3 - Rainbow Rd Sanitary Trunk Phase 3

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 Microtunnel 900 mm Gravity Line	700	LM	\$ 7,000.00	\$ 4,900,000.00
3 Tunnel Caissons and manholes	3	LS	\$ 500,000.00	\$ 1,500,000.00
Subtotal				\$ 6,500,000.00

Engineering

Engineering / QC (13%)	\$ 845,000.00
Contingency (30%)	\$ 2,200,000.00
Subtotal	\$ 3,050,000.00

Total \$ 9,550,000.00

City of Chestermere
S4 - Rainbow Rd Sanitary Trunk Phase 4

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 675 mm Gravity Line	600	LM	\$ 1,200.00	\$ 720,000.00
3 Manholes	4	LS	\$ 5,000.00	\$ 20,000.00
4 Tie ins	1	LS	\$ 10,000.00	\$ 10,000.00
Subtotal				\$ 800,000.00

Engineering

Engineering / QC (13%)	\$ 104,000.00
Contingency (30%)	\$ 270,000.00
Subtotal	\$ 370,000.00

Total \$ 1,170,000.00

City of Chestermere

S5 - Rainbow Rd Sanitary Trunk Phase 5

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 375 mm to 675 mm Gravity Line	1900	LM	\$ 1,200.00	\$ 2,280,000.00
3 Manholes	13	LS	\$ 5,000.00	\$ 65,000.00
4 Tie ins	1	LS	\$ 10,000.00	\$ 10,000.00
Subtotal				\$ 2,410,000.00

Engineering

Engineering / QC (13%)	\$ 313,000.00
Contingency (30%)	\$ 820,000.00
Subtotal	\$ 1,130,000.00

Total \$ 3,540,000.00

City of Chestermere

S6 - East Chestermere Gravity Trunk

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2 375 mm to 900 mm Gravity Line	3100	LM	\$ 1,400.00	\$ 4,340,000.00
3 Manholes	21	LS	\$ 10,000.00	\$ 210,000.00
4 Rail & Canal Crossing	2	LS	\$ 1,000,000	\$ 2,000,000.00
5 Tie ins	1	LS	\$ 20,000.00	\$ 20,000.00
Subtotal				\$ 6,670,000.00

Engineering

Engineering / QC (13%)	\$ 867,000.00
Contingency (30%)	\$ 2,260,000.00
Subtotal	\$ 3,130,000.00

Total \$ 9,800,000.00

City of Chestermere

S7 - Lift Station 14 Ph1

Schedule A

Construction

Item	Description	Quantity	Unit	Unit Price	Total
1	Mobilization	1	LS	\$ 100,000.00	\$ 100,000.00
2	Electrical equipment	1	LS	\$ 250,000.00	\$ 250,000.00
3	Process equipment	1	LS	\$ 250,000.00	\$ 250,000.00
4	Pumps and motors (80 L/s Firm)	2	EA	\$ 150,000.00	\$ 300,000.00
5	Standby generator	1	LS	\$ 400,000.00	\$ 400,000.00
6	Building	1	LS	\$ 200,000.00	\$ 200,000.00
7	Wet Well	1	LS	\$ 500,000.00	\$ 500,000.00
8	350 mm Forcemain	600	LM	\$ 700.00	\$ 420,000.00
9	Land Requirements	1.25	ac	\$ 350,000.00	\$ 437,500.00

Subtotal \$ 2,860,000.00

Engineering

Engineering / QC (13%)	\$ 372,000.00
Contingency (30%)	\$ 970,000.00
Subtotal	\$ 1,340,000.00

Total \$ 4,200,000.00

City of Chestermere

S8 - Lift Station 13 Twinning

Schedule A

Construction

Item	Description	Quantity	Unit	Unit Price	Total
1	Mobilization	1	LS	\$ 250,000.00	\$ 250,000.00
2	Electrical equipment	1	LS	\$ 750,000.00	\$ 750,000.00
3	Process equipment	1	LS	\$ 1,500,000.00	\$ 1,500,000.00
4	Pumps and motors (150 L/s)	4	EA	\$ 300,000.00	\$ 1,200,000.00
5	Standby generator	1	LS	\$ 1,000,000.00	\$ 1,000,000.00
6	Building	1	LS	\$ 500,000.00	\$ 500,000.00
7	Wet Well	1	LS	\$ 2,500,000.00	\$ 2,500,000.00
8	Tie ins and connections	1	LS	\$ 500,000.00	\$ 500,000.00

Subtotal \$ 8,200,000.00

Engineering

Engineering / QC (13%)	\$ 1,066,000.00
Contingency (30%)	\$ 2,780,000.00
Subtotal	\$ 3,850,000.00

Total \$ 12,050,000.00

City of Chestermere

S9 - Lift Station 14 Ph2

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 200,000.00	\$ 200,000.00
2 Electrical equipment	1	LS	\$ 400,000.00	\$ 400,000.00
3 Process equipment	1	LS	\$ 500,000.00	\$ 500,000.00
4 Pumps and motors (240 L/s Firm)	3	EA	\$ 250,000.00	\$ 750,000.00
5 Standby generator	1	LS	\$ 750,000.00	\$ 750,000.00
6 Building	1	LS	\$ 500,000.00	\$ 500,000.00
7 Wet Well	1	LS	\$ 1,000,000.00	\$ 1,000,000.00
8 Tie ins and connections	1	LS	\$ 250,000.00	\$ 250,000.00

Subtotal \$ 4,350,000.00

Engineering

Engineering / QC (13%)	\$ 566,000.00
Contingency (30%)	\$ 1,470,000.00
Subtotal	\$ 2,040,000.00

Total \$ 6,390,000.00

City of Chestermere

S10 - Lift Station 14 Forcemain Twinning

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 350 mm Forcemain	2700	LM	\$ 700.00	\$ 1,890,000.00
3 Road Rehab	16200	CM	\$ 100.00	\$ 1,620,000.00
4 Tie ins	2	LS	\$ 20,000.00	\$ 40,000.00
Subtotal				\$ 3,600,000.00

Engineering

Engineering / QC (13%)	\$ 468,000.00
Contingency (30%)	\$ 1,220,000.00
Subtotal	\$ 1,690,000.00

Total \$ 5,290,000.00

City of Chestermere

S11 - New Discharge Forcemain to Calgary

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 750 mm Forcemain	11000	LM	\$ 1,200.00	\$ 13,200,000.00
3 Tie ins	2	LS	\$ 20,000.00	\$ 40,000.00
Subtotal				\$ 13,290,000.00

Engineering

Engineering / QC (13%)	\$ 1,728,000.00
Contingency (30%)	\$ 4,510,000.00
Subtotal	\$ 6,240,000.00

Total \$ 19,530,000.00

City of Chestermere

S12 – LS10 to Discharge #2 Modifications

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 H2S Mitigation system update	1	LS	\$ 200,000.00	\$ 200,000.00
3 450 mm FM Pigging and ARV Maintenance	1	LS	\$ 150,000.00	\$ 150,000.00
Subtotal				\$ 400,000.00

Engineering

Engineering / QC (13%)	\$ 52,000.00
Contingency (30%)	\$ 140,000.00
Subtotal	\$ 190,000.00

Total	\$ 590,000.00
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City of Chestermere

S13 – LS10 Decommissioning

Schedule A

Construction

Item Description	Quantity	Unit	Unit Price	Total
1 Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
2 LS 10 Decommissioning	1	LS	\$ 1,500,000.00	\$ 1,500,000.00
3 300 m of 600 mm gravity line	300	LM	\$ 1,500.00	\$ 450,000.00
4 Tie ins	2	EA	\$ 25,000.00	\$ 50,000.00
Subtotal				\$ 2,050,000.00

Engineering

Engineering / QC (13%)	\$ 267,000.00
Contingency (30%)	\$ 700,000.00
Subtotal	
	\$ 970,000.00

Total \$ 3,020,000.00