



35
YEARS



City of Fort Saskatchewan

SERVICING DESIGN BRIEF - ANNEXED LAND

Final Report

February 2023





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Table of Contents

- Executive Summary i
- 1.0 Introduction..... 1**
 - 1.1 Scope of Work.....1
 - 1.2 Study Outline.....2
- 2.0 Development and Growth Projections..... 3**
 - 2.1 Annexation Area.....3
 - 2.2 Anticipated Land Use Breakdown3
 - 2.3 Pre-Annexation Development Projections.....7
 - 2.4 Growth Rates8
- 3.0 Design Standards 9**
 - 3.1 Transportation9
 - 3.2 Stormwater.....9
 - 3.3 Water.....10
 - 3.4 Wastewater11
- 4.0 Transportation12**
 - 4.1 Methodology.....12
 - 4.2 Existing Transportation Network12
 - 4.3 Transportation Network Development12
 - 4.4 Travel Demand Modelling17
 - 4.5 Active Transportation (Walking and Cycling).....26
 - 4.6 Goods Movement.....27
 - 4.7 Traffic Safety.....27
 - 4.8 Off-site Levy Cost Estimates29
 - 4.9 Right-of-Way Requirements31
- 5.0 Stormwater Servicing.....32**
 - 5.1 Existing Drainage32
 - 5.2 Servicing Considerations.....34
 - 5.3 Proposed Stormwater Servicing Concept.....38
 - 5.4 Ross Creek Conveyance Capacity Assessment41
 - 5.5 Staging and Interim Servicing45
 - 5.6 Cost Estimate.....47
- 6.0 Water.....49**
 - 6.1 Existing System Overview.....49
 - 6.2 Proposed Servicing of Pre-Annexation Area.....51
 - 6.3 Future Growth and Demand.....52
 - 6.4 Reservoir Storage Requirements54
 - 6.5 Ultimate Servicing Options55
 - 6.6 Annexation Area Reservoir Location58
 - 6.7 Recommended Water Distribution System.....59
 - 6.8 Interim Servicing60
 - 6.9 Off-Site Levy Cost Estimates61
- 7.0 Wastewater.....62**
 - 7.1 Existing and Planned Wastewater Collection System62
 - 7.2 ACRWC System.....64
 - 7.3 Existing and Future Wastewater Flows66
 - 7.4 Ultimate On-Site System67
 - 7.5 Ultimate Off-Site System72
 - 7.6 Interim Servicing of Annexation Area to ACRWC Syphon.....76
 - 7.7 Interim On-Site System78
 - 7.8 Wastewater Off-site Levy Cost Estimates79



8.0	Stakeholder Engagement	81
9.0	Franchise Utilities	83
10.0	Conclusions and Recommendations.....	84
10.1	Conclusions.....	84
10.2	Recommendations	87

APPENDICES

- Appendix A Transportation Appendices (TMP excerpt, cost estimates)
- Appendix B Ross Creek Hydraulic Assessment Modelling Details
- Appendix C Stakeholder Materials
- Appendix D Wetland Crown Claimability Assessment



TABLES

Table 2.1:	Annexation Area Land Use Statistics by Quarter Section	6
Table 2.2:	Future Development within the Pre-Annexation Municipal Boundary	8
Table 3.1:	Roadway Classifications	9
Table 4.1:	External Traffic Volumes at Entry/Exit Points	18
Table 4.2:	Traffic Control Summary	23
Table 4.3:	Big Picture Checklist Application (abbreviated version)	27
Table 4.4:	Safety and Transportation Plan	28
Table 4.5:	Transportation Off-site Levy Cost Estimates (Corridors)	29
Table 4.6:	Transportation Off-site Levy Cost Estimates	30
Table 4.7:	Right-of-Way Requirements (Arterials).....	31
Table 5.1:	Watershed Catchment Areas	33
Table 5.2:	Conceptual SWMF Key Design Data	40
Table 5.3:	Conceptual SWMF Connectivity and Interconnecting Pipe Data.....	41
Table 5.4:	Estimated Peak 1:100 Year Future Inflows to Ross Creek.....	42
Table 5.5:	Ross Creek Culvert Conveyance Capacities and Performance	44
Table 5.6:	Stormwater Management On-Site System Cost Estimate.....	47
Table 5.7:	Yorkville Ditch Re-Alignment Cost Estimate.....	48
Table 5.8:	Stormwater Management Facility Cost Estimate.....	48
Table 6.1:	Summary of Existing Main Reservoir Pumps	49
Table 6.2:	Summary of Existing Westpark Reservoir Pumps.....	50
Table 6.3:	Annexation Area Demand per Quarter Section	52
Table 6.4:	Population and Growth Projection for Pre-Annexation Area and Annexation Area	53
Table 6.5:	Water Storage Requirements for Pre-Annexation and Full Development Scenarios	54
Table 6.6:	Ultimate Water Servicing Comparison.....	57
Table 6.7:	Ultimate Water Servicing Advantages and Disadvantages	57
Table 6.8:	Hydraulic Analysis Results for Alternate Annexation Area Reservoir Locations.....	58
Table 6.9:	Water Storage Breakdown for Off-Site Ley Purposes	61
Table 6.10:	New Annexation Area Reservoir and Pumphouse Cost Estimate	61
Table 7.1:	Existing Fort Saskatchewan Syphon Properties.....	65
Table 7.2:	Existing and Ultimate Pre-Annexation ADWF	66
Table 7.3:	Wastewater Flows for Annexation Area	67
Table 7.4:	Ultimate On-Site Wastewater Servicing Concept Option 1a – Sewer Design Table	69
Table 7.5:	Ultimate On-Site Wastewater Servicing Concept Option 1b – Sewer Design Table	71
Table 7.6:	Conceptual Cost Estimate per Option	76
Table 7.7:	Population and Growth Projection for Pre-Annexation Area and Annexation Area (update).....	77
Table 7.8:	Interim Servicing Design Flows	78
Table 7.9:	Wastewater System Off-Site Levy Costs.....	80



FIGURES

Following Page

Figure 2.1:	Annexation Area.....	3
Figure 2.2:	Underlying Land Use Assumptions	3
Figure 2.3:	Example Land Use Concept, Appendix 3, City of Fort Saskatchewan Terms of Reference for the Preparation of Area Structure Plans and Neighbourhood Structure Plans (2021).....	4
Figure 4.1:	Existing Annexation Area Roadway Network	15
Figure 4.2:	Proposed Annexation Area Roadway Network	15
Figure 4.3:	Proposed Annexation Area Roadway Network Number of Lanes	15
Figure 4.4:	Roadway Classification (Travel Demand Model).....	16
Figure 4.5:	Number of Lanes Per Direction (Travel Demand Model).....	17
Figure 4.6:	External Entry/Exit Points (RTM).....	18
Figure 4.7:	82,000 Population Horizon Residential Dwellings	19
Figure 4.8:	82,000 Population Horizon Employment	20
Figure 4.9:	Volume to Capacity (82,000 Population Horizon).....	21
Figure 4.10:	Volume to Capacity (82,000 Population Horizon) – Annexation Area	21
Figure 4.11:	Proposed Annexation Area Intersection Controls.....	22
Figure 4.12:	Full Buildout Roadway Classifications (Pre-annexation) Transportation Network	24
Figure 4.13:	Full Buildout Roadway Number of Lanes (Pre-annexation) Transportation Network	25
Figure 4.14:	Full Buildout Volume to Capacity (Pre-annexation) Transportation Network.....	25
Figure 4.15:	Proposed Annexation Area Active Modes Net	26
Figure 5.1:	Existing Drainage – City of Fort Saskatchewan	33
Figure 5.2:	Watershed Plan of Local Creek Systems.....	33
Figure 5.3:	Constructed Wetland Stormwater Management Facility Concept	36
Figure 5.4:	Proposed Boundary Ditch and Realigned Yorkville Ditch.....	39
Figure 5.5:	Proposed Stormwater Servicing Concept.....	39
Figure 5.6:	Ross Creek Plan/Profile – Upper Portion	43
Figure 5.7:	Ross Creek Plan/Profile – Central Portion	43
Figure 5.8:	Ross Creek Plan/Profile – Lower Portion	43
Figure 6.1:	Existing Water Distribution System	50
Figure 6.2:	Storage Staging Based on Population Growth	55
Figure 6.3:	Option 1 – Main Reservoir with Off Site Watermain	56
Figure 6.4:	Option 2 – New Annexation Area Reservoir with Upsized Grid.....	56
Figure 6.5:	Option 2 – New Annexation Area Reservoir Location Option.....	59
Figure 6.6:	Potential Transmission Line Alignment	59
Figure 6.7:	Interim Water Servicing Plan – Stage 1 Max Day Demand with Fire Flow Scenario.....	60
Figure 6.8:	Interim Water Servicing Plan – Stage 2 Max Day Demand with Fire Flow Scenario Available Fire Flow	60
Figure 6.9:	Interim Water Servicing Plan – Stage 3 Max Day Demand with Fire Flow Scenario Available Fire Flow	60
Figure 7.1:	Existing Sanitary System	63
Figure 7.2:	Existing Sanitary System Capacity.....	63



Figure 7.3:	Fort Saskatchewan Syphon Capacity Sensitivity Analysis	65
Figure 7.4:	Ultimate On-Site Wastewater Servicing Concept Option 1a – Ultimate East Lift Station.....	68
Figure 7.5:	Ultimate On-Site Wastewater Servicing Concept Option 1b – Gravity Servicing to the Northeast	70
Figure 7.6:	Ultimate Pre-Annexation Sanitary System Available Capacity for Annexation Area Connection	74
Figure 7.7:	Ultimate City System Capacity with Annexation Area	74
Figure 7.8:	Conceptual Off-Site Sanitary System Option 1 – Gravity Outfall to ACRWC SERTS North.....	74
Figure 7.9:	Conceptual Off-Site Sanitary System Option 2 – Lift Station and Forcemain to ACRWC SERTS North	75
Figure 7.10:	Conceptual Off-Site Sanitary System Option 3 – Lift Station and Forcemain to Existing 1050 mm on 86 Avenue	75
Figure 7.11:	Conceptual Off-Site Sanitary System Option 4 – Gravity Connection to Existing 1050 mm on 86 Avenue	75
Figure 7.12:	Ultimate Pre-Annexation Sanitary System Capacity	78
Figure 7.13:	Conceptual Interim Sanitary System Options.....	78
Figure 8.1:	Photo from the Stakeholder Engagement Event	81

Executive Summary

Land Use Planning

The lands recently annexed by the City of Fort Saskatchewan (the City) comprise a total of 952.3 ha. The City has not yet prepared an official land use concept for these lands as this is to be established through Area Structure Plans (ASP). **Figure 2.2** presents the notional and conceptual land use assumptions that were used in the preparation of this document. The assumptions are intended for the general guidance of the work undertaken in this study, and are not to be used by the City, the development community, or the public to inform their own land-use-related decisions or expectations. The conceptual location and configurations of the neighbourhood commercial nodes were derived from the City's *Terms of Reference for the Preparation of Area Structure Plans and Neighbourhood Structure Plans* (2021), which provides a sample land use concept for a theoretical plan area of a full section or four quarter sections (see **Figure 2.3**).

From the Class IV wetlands identified in the 2015 environmental study conducted in support of the *Fort Saskatchewan Growth Study (2015)*, there were seven wetlands with particularly high environmental values that were initially considered for environmental reserve designation for the purpose of this study. A formal request for Crown claimability assessment was submitted to Alberta Environment and Protected Areas to verify which would be Crown claimable at the beginning of the study, but no response was received until the report was being finalized. On January 12, 2023, eight (8) months after requesting their response and only weeks before finalizing this study, Alberta Environment and Protected Areas indicated that the wetland in SE-1554-W4M does not meet the criteria for a Crown ownership claim. Thus, developers will have the option to maintain or remove (with compensation) the wetland in this quarter section. The implications of this wetland being developed are included in Appendix D.

Transportation

The proposed transportation network for the assumed annexation land uses was developed by extending existing roadways into the annexation area, applying projects already planned in the TMP and off-site levy bylaw, and applying a grid style layout. The alignment of some Southfort ASP roadways were revisited to align with the new City boundary. Proposed transportation alignments for collector and arterial roadways and the required number of lanes are depicted in **Figure 4.2** and **Figure 4.3**. Intersection controls are depicted in **Figure 4.11**.

Through completion of transportation modelling, the proposed transportation network developed for the annexation lands was verified to accommodate the future growth of the annexation area. To understand the impacts of traffic demand generated due to the growth of the annexation lands a full buildout of pre-annexation lands travel model scenario was created and assessed. The findings depicted the importance of the 94 Street, 101 Street and future bypass (Range Road 223/TWP Road 540) for servicing pre-annexation and annexation lands due to congestion levels on Veterans Way. The report discusses the need to monitor the 94 Street corridor as development occurs and the need to improve the 101 Street corridor and future bypass corridors.

The proposed transportation network includes active transportation networks provided along roadways and others along the Yorkville Ditch and west annexation areas. The greenway along the old 92 Street alignment north of Southridge Boulevard is extended into the annexation area and this roadway is expected to provide a shared use path on both sides of the roadway, along with additional public realm features, including potential boulevard trees, benches and improved lighting. Active transportation plans are depicted in **Figure 4.15**.

The proposed transportation network was reviewed against safe system practices applicable at the planning level and found to have general alignment. Several safe systems related policies are recommended as those that could be considered in the development of future ASPs.

Stormwater

The stormwater management concept for the annexation area is summarized herein. A large area of County lands and much of the new annexation area are currently drained through the Yorkville Ditch that routes to Ross Creek. A new boundary ditch, realigned Yorkville ditch, and a 1,650 mm bridge culvert will be required to route County runoff along the south ditch of Township Road 542 and along the pipeline corridor bordering the southeast edge of the annexation area, thus preventing County runoff from entering the annexation area municipal drainage systems. Stormwater management facilities (SWMF) are proposed within the annexation area as constructed wetland facilities to collect runoff and discharge at a controlled release rate of 3.0 L/s/ha as shown in **Figure 5.5**. Hydraulic assessment of Ross Creek and Pointe-aux-Pins Creek shows that there are no significant conveyance capacity constraints due to development of the annexation area at 3.0 L/s/ha. The upcoming Ross Creek Basin Study will assess erosion risks in Ross Creek that may impact the allowable release rate on site.

The first developer within each quarter section should construct the ultimate SWMF, outlet control structure and SWMF trunks to the quarter section boundary. A levy is required to be established where subsequent stages of development pay their share of the listed facility costs and the initial developer is refunded the costs of front-ending the ultimate infrastructure. It is recommended that the City allow SWMFs to be constructed and operated on an interim basis by regular water level monitoring and manual pump outs as needed to nearby road ditches. The total on-site stormwater management system off-site levy cost is approximately \$12.1M and the Yorkville Ditch re-alignment is expected to cost \$2.5M.

Water

The proposed annexation area water servicing concept was developed considering the existing water distribution system, including the Westpark and Main Reservoirs, and the existing and future demands within the pre-annexation area. The city's reservoir storage requirements for ultimate development of the pre-annexation and annexation areas is 23,313 m³. After reviewing the potential to upgrade the Main Reservoir, it was determined to be more cost-effective to construct a new reservoir within the south annexation area as shown on **Figure 6.4**. The centrally proposed reservoir location is adjacent to the anticipated first stage of development and is best suited to service interim development stages without needing extensive off-site piping.

Interim development of the annexation area can be serviced by 300 mm looping at existing 300 mm mains as shown in **Figures 6.7 to 6.9**, initially using the available pumping capacity in the existing Westpark and Main Reservoirs. Additional pumping capacity will be required when approximately five quarter sections of the annexation area are developed. The additional pumping capacity is expected to be provided by the new annexation area reservoir, but it could also be provided by upgrading the pumps at the Westpark Reservoir.

The annexation area reservoir is assumed to provide all future storage and pumping capacity upgrades and is estimated to cost \$31M which includes land acquisition costs. The proposed reservoir will service both the annexation area and the pre-annexation area. Thus, the reservoir off-site levy costs should be distributed to both the pre- and post-annexation areas.

Wastewater

The City of Fort Saskatchewan is a member municipality of the Alberta Capital Region Wastewater Commission (ACRWC) which provides wastewater transmission and treatment services for the city. Wastewater servicing of the annexation lands requires off-site infrastructure to one of the two ultimate servicing points:

1. ACRWC Fort Saskatchewan syphon Near Fort Lions Campground; or
2. The ACRWC SERTS-North system at Range Road 232 and Township Road 540.

The ACRWC has expressed concerns with the long-term capacity and existing condition of the syphon system. The ACRWC wants to utilize only one of the two syphon pipes at a time, with the other pipe as a standby. Therefore, they have expressed interest in the annexation area being ultimately serviced to SERTS-North instead of the existing syphon.

Hydraulic analysis of the existing city wastewater system indicated that the large diameter trunks upstream of the syphon have surplus capacity to accept full development of the annexation area. Thus, the annexation area off-site servicing only needs to extend north to the 1050 mm trunk on 86 Avenue.

Servicing to SERTS-North is technically feasible and the concept level design considered the impacts of the downstream pressure pipe and Point-aux-Pins Creek crossing. The off-site servicing options connecting to SERTS-North require approximately 10 km of off-site piping (forcemain / gravity trunk) and a large wastewater lift station.

Four off-site servicing options were developed:

- Option 1: a gravity outfall to ACRWC SERTS-North with the east annexation area serviced by lift station and forcemain to the trunk;
- Option 2: lift station and forcemain to ACRWC SERTS-North;
- Option 3: lift station and forcemain to the existing 1,050 mm trunk on 86 Avenue; and
- Option 4: gravity trunk connection to the existing 1,050 mm trunk.

On-site wastewater sewer networks were developed based on the off-site servicing options. A lift station in the southeast annexation area was common to all options except for Option 4. The on-site system for Option 4 may require a small lift station in the northwest annexation area to make a gravity connection to the existing 1050 mm trunk on 86 Avenue.

The off-site system costs are listed below:

Option	Total Cost
Option 1: Gravity to SERTS	\$54.0M
Option 2: Pumped to SERTS	\$34.9M
Option 3: Pumped to 1050 mm	\$20.0M
Option 4: Gravity to 1050 mm	\$11.4M

Note: Costs include engineering and contingencies.

Based on the above cost estimates, the gravity connection to the 1050 mm trunk is the preferred off-site servicing option. The on-site systems were relatively similar and thus would not affect the selection of the off-site servicing option.



The wastewater on-site and off-site trunk costs eligible for off-site levy funding are \$19.0M.

The syphon interim servicing analysis showed that there is sufficient syphon capacity to service the city, future pre-annexation development, and annexation development up to a total city population of 40,000 to 45,000. Beyond this population threshold, the syphon will require upgrading.

On-site interim servicing options include temporary lift stations connecting to the 450 mm sewer on Southfort Drive, 450 mm sewer on Greenfield Link, or the 525 mm sewer on 94 Street. Any of these interim options can defer the off-site wastewater trunk for several years. Other servicing options may be possible and would need to be confirmed through additional studies.

1.0 Introduction

On January 1, 2020, the City of Fort Saskatchewan (the City) had their request to annex 952 hectares of land from Strathcona County approved by the Province; the annexation is expected to supply land for the next 35 years of city growth. In support of the annexation, ISL completed a growth study in 2015 rationalizing the land requirement for annexation and identifying potential high level servicing concepts for transportation, stormwater, water, and wastewater. The growth study was a valuable tool in supporting the annexation, but since approval by the Province, the City requires more detailed service concepts in anticipation of developing Area Structure Plans (ASP) within the annexation lands and to reflect their updated Municipal Development Plan (MDP) (2020).

1.1 Scope of Work

The focus of this project is to develop detailed servicing plans for several service areas as inputs to future ASPs and off-site levies. These are as follows:

- **Transportation:** Determine roadway classifications (arterial, collector), alignments (to promote safe systems and connectivity), right-of-way requirements (based on existing/typical standards), active transportation links (trails), and intersection controls (traffic signals and roundabouts), and prepare cost estimates for future developer contributions to an off-site levy;
- **Stormwater:** Define catchment boundaries, identify stormwater management facility (SWMF) locations and elevations, determine stormwater trunk alignments and major drainage routes to SWMF, confirm SWMF release rates and size downstream trunks, establish outfall locations to Point-aux-Pins and Ross Creeks, and prepare cost estimates for off-site levy purposes;
- **Water:** Establish locations of future reservoirs (or upgrades to existing reservoirs), determine connection points to the City's existing distribution system in Southfort and Westpark, determine distribution main sizes to confirm future fire flows, and prepare cost estimates for off-site levy purposes;
- **Wastewater:** Define catchment areas, develop optimal wastewater servicing concept that ultimately connects to the Alberta Capital Region Wastewater Commission (ACRWC) system near its wastewater treatment plant (WWTP), determine wastewater trunk horizontal and vertical alignments, determine the need for lift station(s) and preferred location(s), perform staging of major infrastructure, and prepare cost estimates for off-site levy purposes;
- **Franchise Utilities:** Liaise with franchise utility owners to determine their requirements for servicing the annexed area (e.g., power transformers, utility right-of-way (ROW) requirements);
- **Other Constraints:** Consider other constraints such as significant topographical features (e.g., steep grades), natural environments, and pipeline corridors and incorporate them in the development of the detailed servicing briefs; and
- **External Stakeholders:** Hold an open house for landowners within the annexed area, the only external stakeholder meeting required for the project.

1.2 Study Outline

This report provides the detailed servicing plans for the annexation lands described through the following sections:

- **Section 2.0 – Development and Growth Projections:** Outlines the annexation area and land use statistics based on the City’s current MDP.
- **Section 3.0 – Design Standards:** Outlines design standards used for developing the detailed servicing plans.
- **Section 4.0 – Transportation Servicing:** Reviews existing transportation network. Develops and assesses the proposed transportation network and provided proposed recommended transportation plans (roads, active transportation, goods movement) including discussion of traffic safety, costs and discussion of impacts that annexation lands have on the pre-annexation transportation network.
- **Section 5.0 – Stormwater Servicing:** Recommends interconnected series of constructed wetland stormwater management facilities routing controlled discharges from annexation areas west of Highway 21 west to Pointe-Aux-Pins Creek, and from annexations areas east of Highway 21 east to Ross Creek; an assessment confirming the hydraulic conveyance capacity of Ross Creek to receive annexation area runoff; and a proposed realignment and extension of the Yorkville Ditch along the new annexation boundary to intercept runoff from County lands and reroute it along the city boundary to Ross Creek.
- **Section 6.0 – Water:** Recommends an ultimate reservoir solution based on the comparative analysis of upgrading the Main Reservoir and Pumphouse versus constructing a new reservoir and pumphouse within the annexation area. An ultimate on-site water system was recommended based on the preferred reservoir location, and connections back to the existing water network for additional looping and redundancy were considered.
- **Section 7.0 – Wastewater:** Recommends on-site ultimate sanitary sewer network and off-site system to ACRWC connection. The wastewater system analysis evaluated both the potential of off-site trunks and lift stations / forcemains connecting south and west to the Southeast Regional Trunk Sewer (SERTS) North System and northwards to the existing Fort Saskatchewan wastewater syphon. The existing wastewater network system was analyzed for capacity constraints and a recommendation for an off-site system connecting through the existing trunk system to the syphon was recommended based on conceptual cost estimates.
- **Section 8.0 – Stakeholder Engagement:** Summarizes feedback received from the November 2, 2022 stakeholder engagement event.
- **Section 9.0 – Franchise Utilities:** Provides a brief overview to confirm future franchise utility servicing for the annexation area.
- **Section 10.0 – Conclusions and Recommendations:** Key conclusions and recommendations for each of the service areas.

2.0 Development and Growth Projections

2.1 Annexation Area

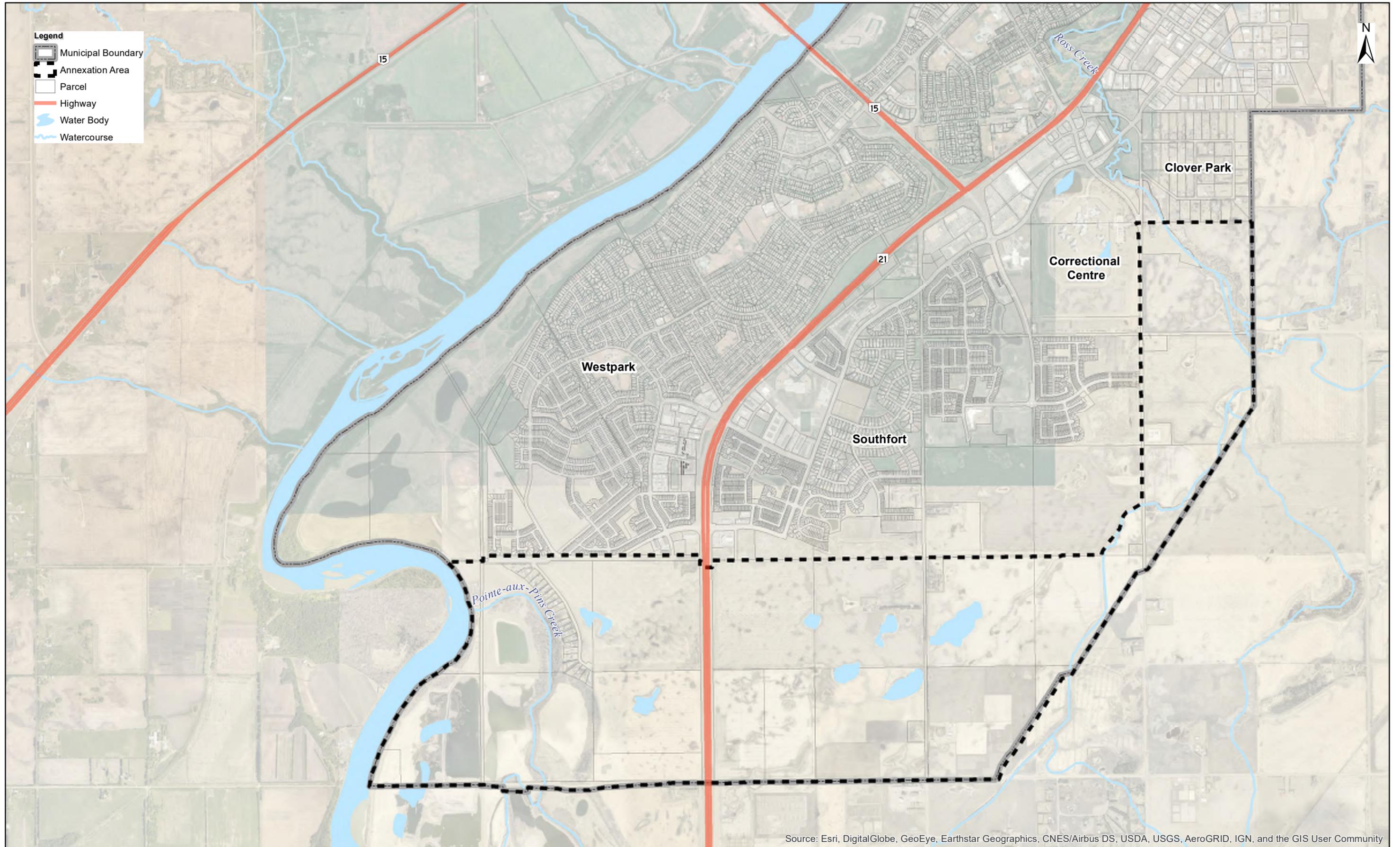
The lands recently annexed by the City of Fort Saskatchewan comprise a total of 952.3 ha. As shown in **Figure 2.1**, this annexation area is to the south of the pre-annexation city boundary, abutting the communities of Westpark, Southfort, and Clover Park, as well as the Fort Saskatchewan Correctional Centre.

Two watercourses meander through the annexation area, Pointe-Aux-Pins Creek and Ross Creek, both identified in **Figure 2.1**. Most of the land within the annexation area is unsubdivided, but there are some farmstead subdivisions scattered throughout. Currently, the predominant use of the land is agriculture. However, there is an existing country residential subdivision, Pointe-Aux-Pins Estates, in the west portion of the annexation area, adjacent to the creek sharing the same name. This subdivision has 22 dwelling units and has an approximate population of 57 persons. Based on aerial photo interpretation, there are also sand and/or gravel operations within the North Saskatchewan River Valley portion of the annexation area.

2.2 Anticipated Land Use Breakdown

The City has not yet prepared an official land use concept for these lands. Such cannot be established until ASPs are in place. However, the City anticipates that most of the annexation area will be primarily developed with residential uses, except for neighbourhood commercial nodes and the corridor along Highway 21, which present an opportunity for the development of highway commercial uses. **Figure 2.2** presents the notional and conceptual land use assumptions that were used in the preparation of this document. The assumptions are intended for the general guidance of the work undertaken in this study, and are not to be used by the City, the development community, or the public to inform their own land-use-related decisions or expectations.

As shown in **Figure 2.2**, it is assumed that the residential areas within the annexation area will include supporting institutional, park/open space, public utility, and circulation uses. It is also assumed that, in addition to the expected highway commercial uses, the annexation area will have small neighbourhood commercial nodes in every new community to support and complement residential uses. The conceptual location and configurations of the neighbourhood commercial nodes were derived from the City's *Terms of Reference for the Preparation of Area Structure Plans and Neighbourhood Structure Plans* (2021), which provides a sample land use concept for a theoretical plan area of a full section, or four quarter sections (see **Figure 2.3**).



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**

Annexation Area

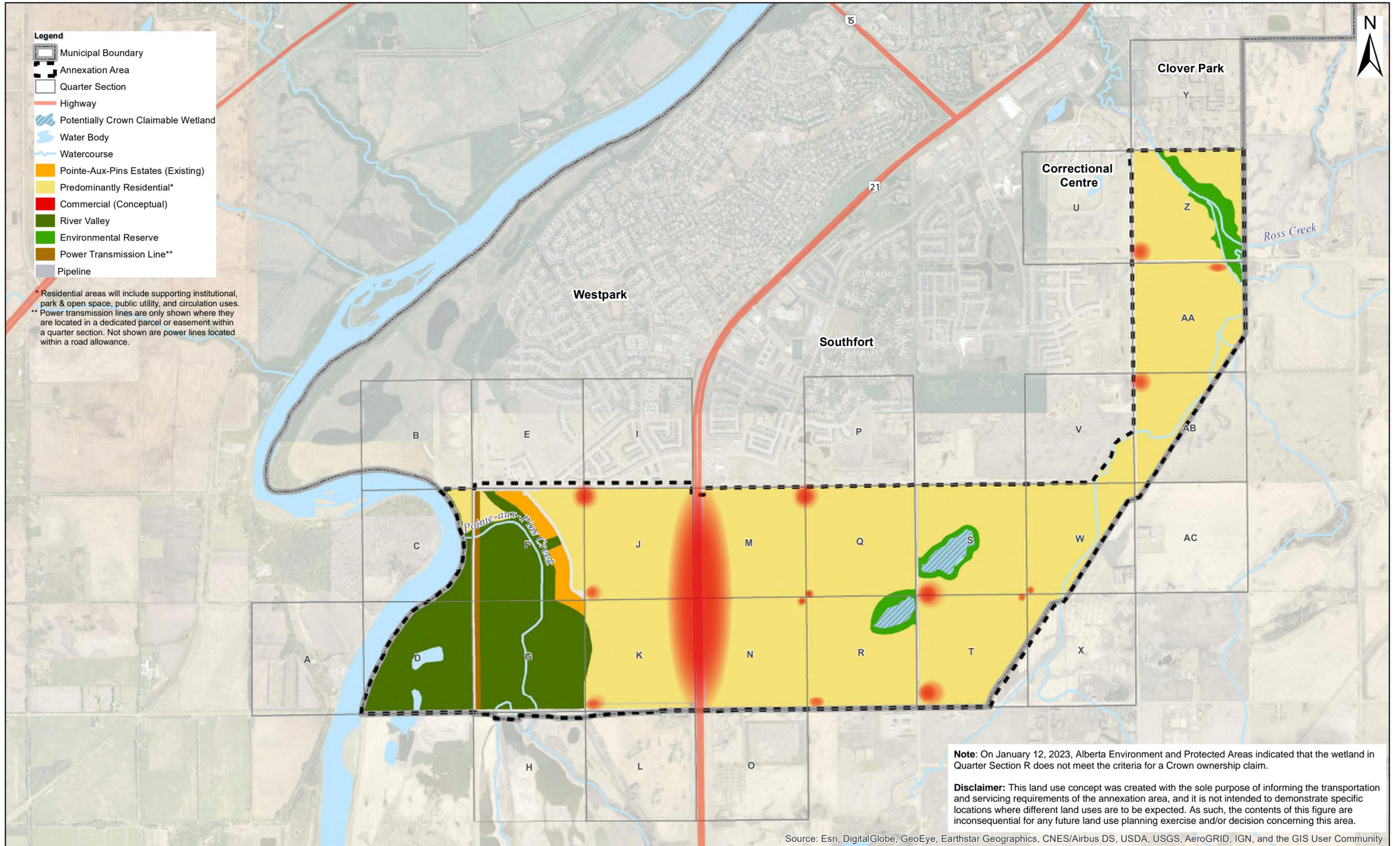
FIGURE 2.1

1:25,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

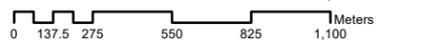




FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Underlying Land Use Assumptions

FIGURE 2.2

1:25,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS

AREA STRUCTURE PLAN Conceptual Land Use Plan

This map is conceptual, intended to identify the level of detail, transportation network, and distribution of land uses expected within Land Use Plans. It is to demonstrate planning concept of an area.

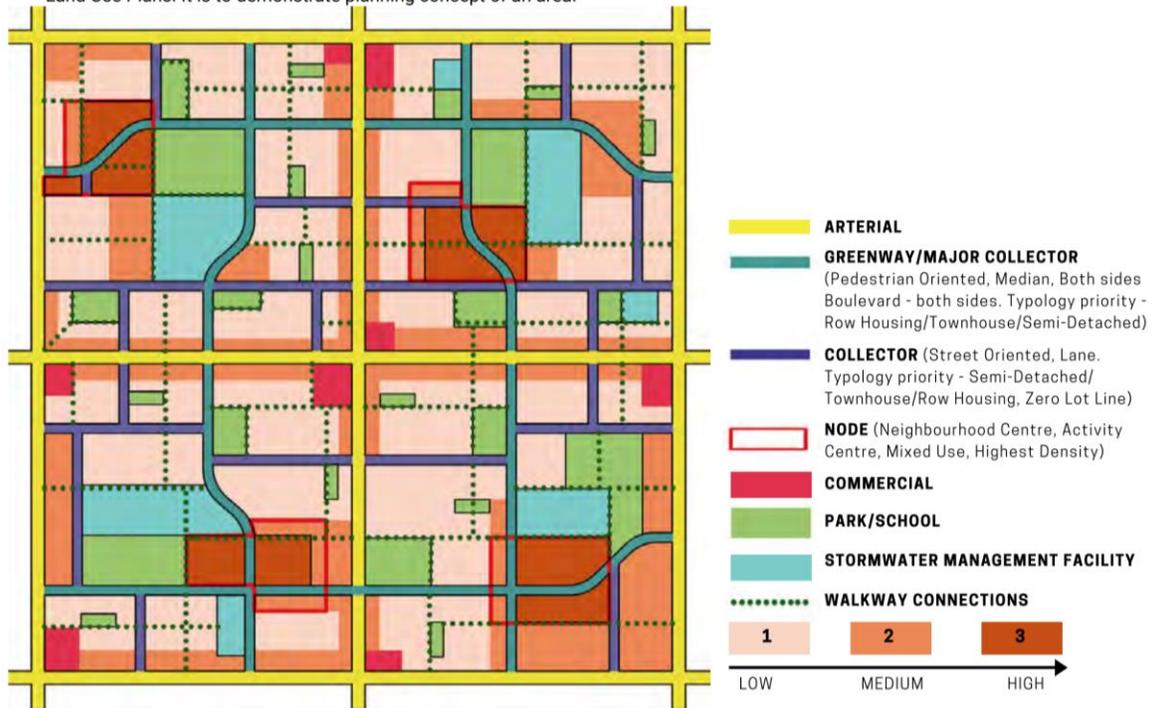


Figure 2.3: Example Land Use Concept, Appendix 3, City of Fort Saskatchewan Terms of Reference for the Preparation of Area Structure Plans and Neighbourhood Structure Plans (2021)

The notional and conceptual land use plan shown in **Figure 2.3** was replicated throughout the annexation area to extrapolate the potential location and distribution of neighbourhood commercial nodes. The resulting land use concept includes residential uses and commercial nodes ranging from 0.5 ha to 2 ha at the quarter section level. Other land uses shown in **Figure 2.3** were excluded from this land use concept. This analysis was undertaken for the sole purpose of informing the transportation and servicing requirements of the annexation area, and it is inconsequential for any future land use planning exercise and/or decision concerning this area. **Figure 2.2** provides some context regarding the breakdown of residential and commercial land uses per quarter section, but it is not intended to demonstrate the specific locations where commercial development is expected.

This study also assumes that 13.4% of the residential areas will be allocated to institutional uses such as schools, community facilities, and emergency services. This assumption was derived from the ratio of residential to institutional uses within the City’s pre-annexation boundary as detailed in the *Fort Saskatchewan Growth Study* (2015).

Wetlands

There are also a number of wetlands with potential to reduce the developable lands in the annexation area. The environmental study conducted in 2015 as technical support for the *Fort Saskatchewan Growth Study* recommended retention of all semi-permanent marsh (Class IV) and permanent marsh (Class V) wetlands through an environmental reserve designation due to potential landscape hydrologic impact. Some of these wetlands are located below the North Saskatchewan River Valley's top bank, so it is assumed that they will be designated as environmental reserve at the subdivision stage to protect the river valley escarpment, flood fringe, and floodway. The rest of these wetlands are in the balance of the annexation area, especially in the area immediately east of Highway 21.

From the Class IV wetlands identified in the 2015 environmental study, there were seven wetlands with particularly high environmental values that were initially considered for environmental reserve designation for the purpose of this study. A formal request for Crown claimability assessment was submitted to Alberta Environment and Protected Areas (AEP) at the beginning of this study for the two largest wetlands, but no response was received until the report was being finalized.

Relying on an environmental scientist's professional judgement and extensive previous experience with wetland assessments, it was determined that the larger two of the seven wetlands would be most likely to Crown claimable. These are shown in **Figure 2.2**. Similarly, to other aspects of the land use concept created in support of this study, this is only a well-informed assumption, but does not constitute a final or binding land use decision. It will be of utmost importance that developers determine the Crown ownership of any existing wetlands in the annexation area prior to conducting detailed ASP engineering studies. On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland in SE-1554-W4M (Quarter Section R) does not meet the criteria for a Crown ownership claim. Thus, developers will have the option to maintain or remove (with compensation) the wetland in this quarter section. The implications of this wetland being developed are included in Appendix D.

Figure 2.2 shows three environmental reserve sites, corresponding to two potentially Crown claimable wetlands east of Highway 21 and the ravine adjacent to Ross Creek. Excluded in the figure are existing registered rights-of-way for drainage purposes within the annexation area as it is assumed that these rights-of-way would likely be reconfigured in the future during the ASP stage or Neighbourhood Structure Plan (NSP) stage once preliminary engineering is undertaken.

Land Use Statistics

The following land use statistics were prepared based on the land use concept shown in **Figure 2.2** and described above. The quarter sections intersecting the annexation area were assigned a letter (A-AC) as a unique identifier to avoid the lengthier Alberta Township Survey descriptions.

Table 2.1: Annexation Area Land Use Statistics by Quarter Section

Quarter Section #	Gross Residential Area (ha)	Gross Commercial Area (ha)	Institutional Area (ha)	Existing Country Residential Area (ha)	Net Residential Area (ha)	Net Commercial Area (ha)	Number of Dwellings at Full Buildout	Number of Existing Country Residential Dwellings	Total Number of Dwellings at Full Buildout	Estimated Population at Full Buildout
A	0.00		0.00		0.00	0.00	0		0	0
B	0.00		0.00		0.00	0.00	0		0	0
C	3.06		0.47		1.99	0.00	80		80	207
D	0.00		0.00		0.00	0.00	0		0	0
E	0.00		0.00		0.00	0.00	0		0	0
F	14.08	0.61	2.18	9.90	9.15	0.40	366	20	386	1,003
G	0.16		0.02	1.21	0.10	0.00	4	2	7	17
H	0.00		0.00		0.00	0.00	0		0	0
I	0.00		0.00		0.00	0.00	0		0	0
J	37.71	20.44	5.84		24.51	13.29	981		981	2,549
K	36.93	18.96	5.71		24.00	12.32	960		960	2,496
L	0.00		0.00		0.00	0.00	0		0	0
M	25.40	30.52	3.93		16.51	19.84	661		661	1,717
N	23.80	31.10	3.68		15.47	20.21	619		619	1,609
O	0.00		0.00		0.00	0.00	0		0	0
P	0.00	0.00	0.00		0.00	0.00	0		0	0
Q	53.78	1.97	8.32		34.95	1.28	1,398		1,398	3,635
R	47.20	0.76	7.30		30.68	0.49	1,227		1,227	3,191
S	43.96	1.71	6.80		28.57	1.11	1,143		1,143	2,972
T	47.30	3.53	7.32		30.75	2.29	1,230		1,230	3,198
U	0.00		0.00		0.00	0.00	0		0	0
V	5.54		0.86		3.60	0.00	144		144	375
W	37.21	1.91	5.76		24.19	1.24	968		968	2,516
X	4.64	0.06	0.72		3.02	0.04	121		121	314
Y	0.01		0.00		0.01	0.00	0		0	1
Z	43.76	1.15	6.77		28.45	0.74	1,138		1,138	2,958
AA	51.38	0.95	7.95		33.40	0.62	1,336		1,336	3,473
AB	22.77	0.75	3.52		14.80	0.48	592		592	1,540
AC	0.45		0.07		0.29	0.00	12		12	30
TOTAL	499.16	114.42	77.24	11.11	324.45	74.37	12,978	22	13,000	33,800

Notes:

On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland in Quarter Section R does not meet the criteria for a Crown ownership claim. As a result, it could be developed (with compensation), which would increase the developable area. This would be (presumably) determined at the ASP stage.

Number of Existing Country Residential Dwellings only include dwellings within established country residential communities (the only one present in the annexation area is Point-aux-Pins). Farmsteads and other types or single rural dwellings are not included in this count because, unlike established country residential communities, it is assumed that they will be replaced with urban-type development as it unfolds in the annexation area.

The total area encompassed by the annexation area is 952.3 ha. Of this, it is estimated that 499.16 ha will be developed for residential uses, 114.42 ha for commercial uses, and 77.24 ha for institutional uses. Additionally, 11.11 ha are already developed as a country residential subdivision. For the conversion of gross to net residential and commercial areas, an overhead assumption of 35% was used. This assumes 10% for parks and open space, 5% for public utilities, and 20% for circulation.

To estimate the number of dwellings, an average density of 40 dwelling units per net residential hectare (du/nrha) was used. This assumption was derived from balancing the 35 du/nrha requirement from the Edmonton Metropolitan Region Growth Plan (EMRGP) with an understanding of the long-term development dynamics of Fort Saskatchewan. It is expected that the first communities to be developed within the annexation area will demonstrate a residential density closer to the 35 du/nrha required by the EMRGP, but as the City grows this density could climb as high as 45 du/nrha and beyond. Based on this assumption, it is estimated that at full buildout, the annexation area will host approximately 13,000 dwellings.

Finally, the population estimates were based on an average household size of 2.6 persons. This number was obtained by dividing the 2021 Census total population count for the city (27,088) by the number of total private dwellings occupied by usual residents (10,420). It is estimated that at full buildout, the annexation area will have a total population of approximately 33,800 residents.

2.3 Pre-Annexation Development Projections

This annexation area servicing study must also consider the anticipated development within the city's pre-annexation area boundaries. For example, both the pre- and post-annexation area developments will impact the traffic volumes, total water reservoir requirements, and potentially the total wastewater flows to the existing ACRWC syphon.

Unfortunately, the previous transportation, water and wastewater studies did not use consistent development assumptions within the pre-annexation boundaries. This may have been strategic where the City wanted, for example, to confirm that the water distribution system had adequate capacity to accommodate future infill development. These previous studies included the development of traffic and hydraulic (water, wastewater) models using these pre-annexation development assumptions. It should be noted that while water and wastewater modelling assumptions and calibrations have different ultimate pre-annexation demands, the projected population is identical for this study.

Within the pre-annexation municipal boundaries, there is anticipated future development based on the 2015 *Fort Saskatchewan Growth Study*. This future development includes residential development near the south side of the pre-annexation municipal boundary and non-residential development near the east side of the city. In addition, the Josephburg Road North Industrial ASP projects a significant amount of future industrial development on the east side of the city. **Table 2.2** summarizes the projected growth within the pre-annexation municipal boundary.

Table 2.2: Future Development within the Pre-Annexation Municipal Boundary

Land Use		Net Area Increase (ha)	Population Density (c/ha)	Increase in Population (c)
Industrial	Josephburg	479.0	-	-
	City	95.0	-	-
Commercial		24.8	-	-
Residential	Low Density	246.1	50 ¹	12,305
	Multi-Family	37.2	90 ¹	3,348

Note: Population densities are conservatively estimated using Fort Saskatchewan Design Densities and 2015 Growth Study Pre-Annexation Land Supply Areas as a high-level estimate to account for differences between growth projections from previous servicing studies.

2.4 Growth Rates

As the rate of growth within the pre- and post-annexation areas cannot be known, the growth projections will be tied to total city population in 5,000 population thresholds. It is the total growth that will trigger the need for municipal infrastructure such as roadways and water reservoirs.

It is expected that the pre-annexation and annexation areas will develop concurrently and that the total city growth will be a blend; thus, assumptions had to be made for the blend of annexation vs pre-annexation areas developed. These assumptions were made on a discipline-by-discipline basis due to the differences in planning assumptions from previous studies within the pre-annexation area.

3.0 Design Standards

The following subsections outline the methodology and design standards applicable to each of the service areas.

3.1 Transportation

The proposed transportation network includes collectors, arterials and expressways/highways based on the City's Transportation Master Plan (TMP) (Table 7.1) and the City Engineering Design Standards. These are outlined as follows.

Table 3.1: Roadway Classifications

Parameters	Functional Road Classification		
	Expressway/Highway	Arterial	Collector
Target Speeds (km/h)	60 to 80+	50 to 60	40 to 50
Daily Volume	10,000 to 50,000 +	10,000 to 30,000	Major >3,500 Minor <3,500
Number of Lanes per direction	1 to 3	1 to 2 (not typically 3)	1
Network Layout	Veterans Way (as provided)	800 m spacing, connecting across the City	400 m spacing, with shorter less connected segments, with a grid style layout
Land Use Access	Not permitted, limited to connecting public roadways	200 to 400 m spacing	Major – Limited front driveway (primarily alley access) Minor – More front driveways
Pedestrians and Cyclist Accommodation	As per City standards	As per City standards	As per City standards
Applicable Design Standard	As per functional study, if available	T-13 (major divided) T-12 (standard divided) T-11 (minor undivided)	T-7 (11.5 m collector) T-8 (12 m industrial collector) T-9 (13.5 m collector) T-10 (13 m industrial collector)

The transportation (roads) network and active transportation network are be planned to follow a grid network based on the City's Municipal Development Plan (MDP), with 800 m spacing between arterials, 400 m spacing between collectors, and added shared-use path connections as needed.

3.2 Stormwater

Stormwater management infrastructure should be designed to meet the City of Fort Saskatchewan Engineering Design Standards, Section 4 Storm Drainage. Key criteria include the following:

- Subdivisions are to be constructed with dual drainage systems, where
 - Runoff from the 1:5-year, 4-hour Chicago design event is collected and routed through the minor (storm sewers) drainage system;
 - Runoff from events larger than the 1:5-year, up to the 1:100-year, 4-hour Chicago event is routed through the major (overland) drainage system in a safe manner that does not pose flood risk to properties or the public; and

- That both the minor and major drainage systems route runoff to a SWMF designed to control peak discharges to downstream systems to rates that prevent flooding or erosion, and that provide a reasonable level of stormwater quality treatment;
- Culvert and channel crossings of natural watercourses through roadways or rail shall be designed to convey runoff expected from the 1:200-year event;
- SWMFs are to be designed with live storage capacity to accommodate runoff from the 1:100-year, 24-hour Huff event;
- Wet lakes and constructed wetlands are to have water surface areas at normal water level (NWL) of 2.0 ha or greater wherever practicable; this criteria is intended to limit the proliferation of SWMFs, and tends to result in one SWMF per quarter section; and
- Some key specific standards for constructed wetlands include:
 - Length to width ratio of about 3:1 to maximize travel time through the facility for optimized water quality treatment;
 - Pond side slopes above NWL should be a maximum of 7:1, and pond side slopes below NWL can be 5:1;
 - Some guidance on dead storage depths through the wetland marsh areas to encourage growth of emergent and submergent wetland vegetation;
 - Shallow water depths can range from 0.1 m to 0.3 m to promote the growth of emergent vegetation;
 - Open water pool areas should occupy less than 25% of the pond surface and should be 2.5 m deep to prevent vegetation growth;
 - Open water pools with forebays should be located at all inlets for sediment control;
 - Inlets and outlets should be located to minimize short circuiting; and
 - Inlet and outlet pipes shall be fully submerged and their crowns located a minimum of 1.0 m below NWL to keep below ice levels to remain functional in winter.

3.3 Water

Key information from City Design Standards are as follows:

- Minimum Water Reservoir Storage = 2 x Average Day Demand + Fire Flow;
- Water demand is calculated based on an average daily demand (ADD) of 360 L/c/d with peaking factors of 2.0 for maximum day demand (MDD) and 3.0 for peak hour demand (PHD);
- Maximum allowable system pressures are to be restricted to 515 kPa while 280 kPa is the minimum pressure during PHD and 140 kPa is the minimum during MDD plus fire flow conditions; and
- Allowable fire flows are summarized by land type below and 233 L/s was used as a conservative estimate to analyze the fire flow performance of the proposed annexation water system:
 - Single Family Residential – 100 L/s
 - Multi-Family Residential – 133 L/s
 - Industrial and Institutional – 183 L/s; and
 - Apartments and Commercial – 233 L/s.

Based on historical water demand, the ADD was reduced to 250 L/c/d. The adjusted design parameter was approved by the City as a realistic yet slightly conservative estimate.

3.4 Wastewater

Key information from City Design Standards are as follows:

- Average dry weather flow (ADWF) from the City design standards mention 360 L/c/d for residential land uses and a minimum of 0.2 L/s/ha for industrial, commercial and institutional (ICI) land uses;
- The residential peak factor shall be the larger of 1.5 or $2.6P^{-0.1}$ where P is the population in thousands and the ICI peak factor shall be $2.5 \leq 10Q^{-0.45} \leq 25$;
- A general inflow and infiltration (I/I) allowance of 0.28 L/s/ha shall be applied to all residential areas to account for wet weather inflow to manholes not located in street sags and for infiltration into pipes and manholes;
- A general I/I allowance of 0.05 L/s/ha shall be applied to all ICI areas to account for wet weather inflow to manholes not located in street sags and for infiltration into pipes and manholes;
- The City design standards have references for minimum pipe sizes and slopes and the most upstream residential sewer (design population ≤ 25 c) should be at least 1.0%;
- Gravity sewers are to be designed using Manning's Equation while forcemains will be designed using the Hazen-Williams equation;
- Minimum velocities for gravity sewers shall be 0.6 m/s and 0.75 m/s for forcemains; maximum velocities should not exceed 3.0 m/s; and
- The minimum depth of cover from ground to top of pipe is to be 2.8 m.

Based on historical generation analysis and wastewater model calibration, the average dry weather unit flows were reduced to 250 L/c/d for residential land uses and 0.045 L/s/ha for non-residential land uses. Future potential heavy industrial used a more conservative value of 10,000 L/ha/d (0.116 L/s/ha). These adjusted design parameters were approved by the City for use in this study.

4.0 Transportation

4.1 Methodology

The methodology for identifying the transportation servicing requirements is outlined as follows:

- **Existing Transportation Network:** Review of the existing transportation network.
- **Transportation Network Development:** Developing the transportation network from existing ASPs, existing roadway connections, and based on established municipal policy in the MDP, TMP and others.
- **Travel Demand Modelling:** Travel demand modelling to forecast and assess the travel demands generated due to growth of the annexation and pre-annexation land uses.
- **Active Transportation (Walking and Cycling):** Review of the active transportation network created from the transportation network with a focus on ensuring a high level of connectivity is provided.
- **Goods Movement:** Designation of potential goods movement routes within the transportation network identified for the annexation area.
- **Traffic Safety:** Review the proposed recommended transportation plans against safe systems principals with a focus on identifying potential policies that could carry forward into future ASPs.
- **Costs:** Completion of cost estimates for transportation projects that apply to the City's off-site levy.

4.2 Existing Transportation Network

The existing roadway network is illustrated in **Figure 4.1** and consists of the following:

- **Veterans Way:** North/south roadway connecting from the north to south city boundary. Outside of the city, Veterans Way is owned and operated by Alberta Transportation as Highway 21, connecting to Highway 16 to the south and into Strathcona County.
- **Southridge Boulevard:** East/west 4-lane arterial roadway from Veterans Way to Southfort Drive, this roadway currently terminates near the north pre-annexation boundary.
- **92 Street:** North/south unimproved rural road that connects from the south annexation boundary into the Southfort neighbourhood. North of Southridge Boulevard, most of this roadway is closed and converted to an active transportation connection with development of the Southfort ASP.
- **101 Street:** North/south roadway that exists as an unimproved rural connection from the south boundary, switching to an improved urban arterial at Southfort Drive. Outside of the city, 101 Street is owned and operated by Strathcona County as Range Road 224.
- **Township Road 542:** Existing unimproved rural roadway located on the south annexation boundary.
- **Existing Collectors:** Several existing collectors that end near the pre-annexation boundary, including Willow Link, Westpark Drive and Southview Drive.

4.3 Transportation Network Development

Through a series of team discussions, several iterations of potential plans for transportation network were created and discussed prior to completing any traffic modelling. The focus was to create a logical network that integrated well with existing roadways and land use plans. Generally, the process was fluid and collaborative. Sources used in developing the transportation network include the following:

- Municipal Development Plan (MDP)
- Transportation Master Plan (TMP)
- Southfort Area Structure Plan (ASP)
- Southfort TMP
- Existing Off-site Levy Bylaw

Highlights of the main subject areas discussed in developing the transportation model are discussed in the following sub-sections.

Extending Existing Roadways

Extending connections of existing roadways into the annexation lands, described as follows.

- **Westpark Drive:** Existing collector extended from the existing Westpark neighbourhood, west of Veterans Way connection directly south into the annexation area. This roadway is intended to provide rear access to the potential commercial lands along Veterans Way.
- **Willow Link:** Existing collector similar to Westpark Drive, extended south into the annexation, intentionally given a curvilinear alignment to increase travel time to mitigate potential traffic shortcutting through the annexation area to avoid Veterans Way.
- **Southview Way:** Existing collector extended from Southridge Boulevard, south into the annexation area. This roadway is intended to provide a high level of connectivity between the highway, future arterials and future commercial areas along Veterans Way.
- **Sienna Boulevard:** Existing collector extended from the Southfort neighbourhood through the annexation area to 101 Street.

Revising and Integrating the Southfort ASP

The team also discussed revising the Southfort ASP roadways to create a grid style roadway network providing better connectivity to the annexation lands. The new city boundary provides an opportunity for the City to update the Southfort ASP roadway alignments as the current plans reflect a curvilinear alignment with the area not connected to 101 Street due to the previous city boundary. Changes to the roadways and their benefits to supporting the MDP and better integrate with the annexation lands are outlined as follows:

- **Southridge Boulevard:** The following describes the layout of Southridge Boulevard.
 - Realigned arterial roadway to create a continuous connection to 101 Street and providing a continuous east/west connection across the north boundary of the annexation lands. The layout of the 101 Street/Southridge Boulevard network provides a semi-ring arterial roadway connecting to existing and future developments in the south and north areas of the city. This realignment will require an ASP amendment.
 - Assumed to be 2-lanes east of Southfort Drive, with an existing 4-lanes between Veterans Way and Southfort Drive.
 - The Southfort ASP is provided in Appendix A for reference.
- **94 Street:** The following describes the layout of 94 Street.
 - Realigned arterial roadway to create a four-legged intersection with Southridge Boulevard. 94 Street is extended into the annexation area as continuous arterial connecting to Veterans Way and land west of Veterans Way. Provides a semi-ring arterial roadway similar to Southridge Boulevard/101 Street, connecting to existing and future developments in the south and north areas of the City. This realignment will require an ASP amendment.
 - 94 Street is assumed as a 4-lane roadway from Veterans Way to Sienna Boulevard/Southpointe Boulevard, based on the Southfort Transportation Master Plan and offsite levy. The remaining half of the road has been built to the 4-lanes.
- **Allard Way:** Realigned collector roadway to create a four-legged intersection at Southridge Boulevard and further extended into the annexation lands. A new east/west collector roadway within the Southridge ASP replaces this previous alignment. This realignment will require an ASP amendment.

The Southfort developer indicated that the proposed ASP amendments above were acceptable in a meeting with the City prior to finalizing the proposed roadway network.

Applying a Grid Layout

Applying a grid style layout with arterials spaced at 800 m and collectors spaced at 400 m is described as follows.

- **Arterial A:** New east/west arterial placed 800 m north of Township Road 542, intended as central arterial servicing the annexation area, connecting from areas west of Veterans Way to the extension of 94 Street.
- **Arterial B:** New north/south arterial placed approximately 800 m southeast of the intersection of Southfort Drive/Southridge Boulevard. Extending Southfort Drive into the annexation area did not provide sufficient spacing from Southview Way and was not pursued. The placement of this arterial provides a central connection between Southridge Boulevard and Township Road 542.
- **92 Street (Southridge Boulevard to Township Road 542):** New north/south arterial, placed 800 m east of 94 Street, similarly provides a centre connection within the annexation lands.
- **Collectors A and B:** New east/west collector provides connectivity between Willow Link, Veterans Way (right in/right out) and Allard Way. The alignment is intended to avoid the anticipated crown claimable wetlands.
- **Collector C:** New north/south collector between Collector A and Township Road 542, placed between 92 Street and Arterial A.
- **Collector D:** New north/south collector provides connectivity through the northeast area of the annexation.

Other Roadways

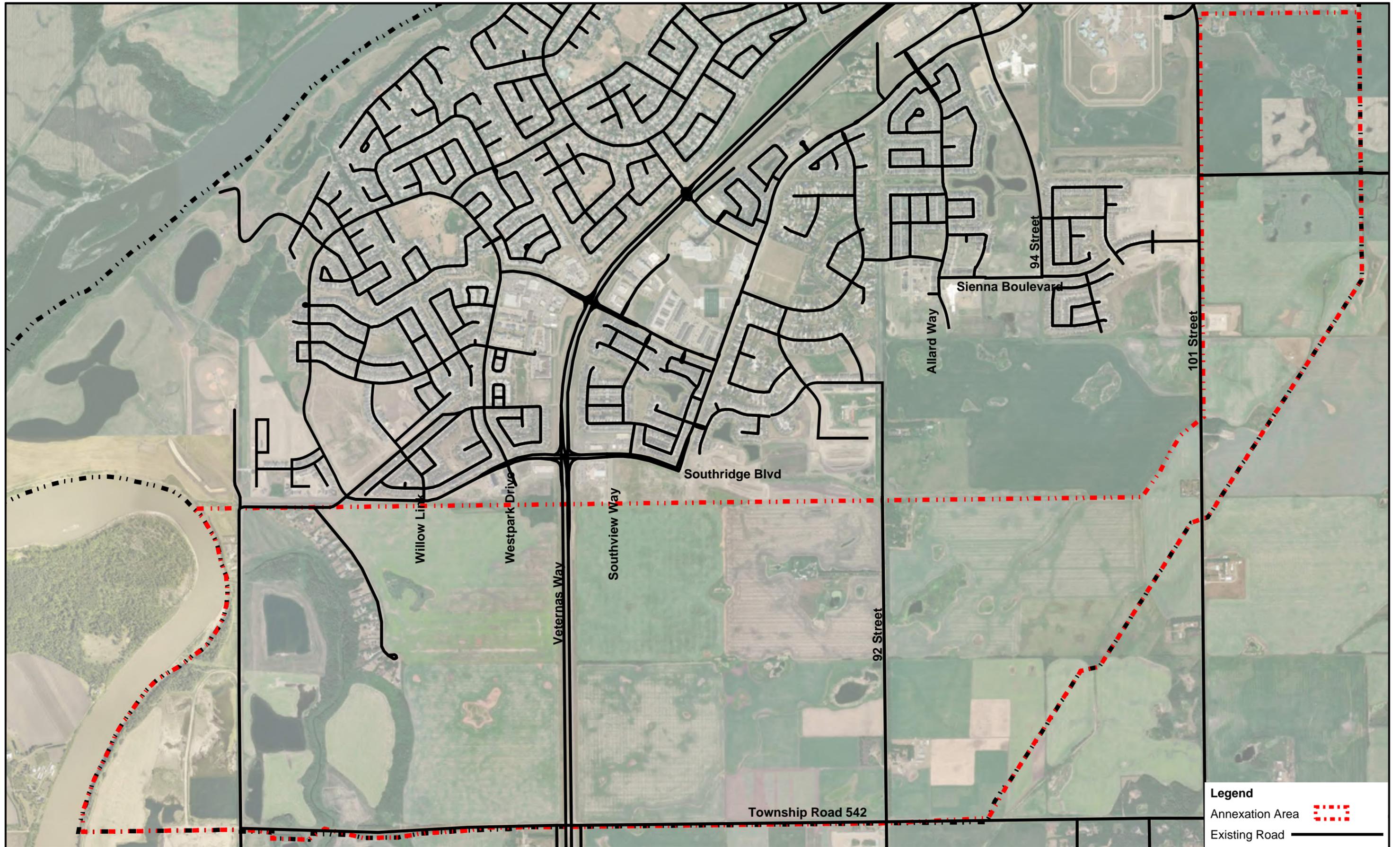
Roadway classifications and number of lanes for other transportation links are described as follows:

- **Veterans Way (South Boundary to 112 Street):** Maintains existing highway classification for modelling purposes. Widening to six lanes as outlined in the City's TMP (84 Street to 112 Street) is extended to the south city boundary to service the annexation lands.
- **Highway 15 (West Boundary to Veterans Way):** Widened to six lanes (including the bridge) is assumed based on the City's TMP, identifying the need for additional capacity and the Regional Travel Model which assumes this provides six lanes capacity in the long term.
- **94 Street (Southfort Drive to Sienna Boulevard):** Arterial roadway widening to four lanes based on the off-site levy bylaw and Southfort TMP.
- **84 Street (Veterans Way to Southfort Drive):** Arterial roadway widening to four lanes from Veterans Way to Galloway Wynd as outlined in the off-site levy bylaw and Southfort TMP is extended to Southfort Drive.
- **Southfort Boulevard (Veterans Way to Southfort Drive):** Arterial roadway widening to four lanes as planned in the off-site levy bylaw and Southfort TMP.
- **Southfort Drive (Southridge Boulevard to 94 Street):** Arterial road widening to four lanes as outlined in the City's TMP and Southfort TMP to Southfort Boulevard is extended to Southridge Boulevard as planned in the off-site levy bylaw.
- **Major Interchange Improvements:** Highway 15 on/off ramps at 99 Avenue are improved as outlined in the City's TMP.
- **Other:** Completion of other neighbourhood roadways (with development).

- The Northeast River Crossing (NERC) previously included in the City's TMP was removed from the model due to changes in regional transportation priorities occurring (outside of the City's control) between completion of the TMP and this study.
- **Future Bypass:** External connection (Highway 21 to Range Road 223) upgraded to a Highway classification to function as a bypass as outlined in the City's TMP.
 - Note: Township Road 540 is classified as a Highway in the Regional Travel Model (RTM) and connects Highway 21 to Range Road 223, however preliminary engagement materials for the NERC also showed Township Road 542 as a potential connection. This study assumes the bypass connection is at Township Road 540 is the official bypass route in accordance with the Regional Travel model.

Proposed Roadway Network

The proposed roadway classifications and number of lanes within the annexation area and revised Southfort neighbourhood are shown in **Figure 4.2** and **Figure 4.3**, respectively. The proposed roadway classifications and number of lanes within the travel demand model (described in Section 4.4) is illustrated in **Figure 4.4** and **Figure 4.5**, respectively.

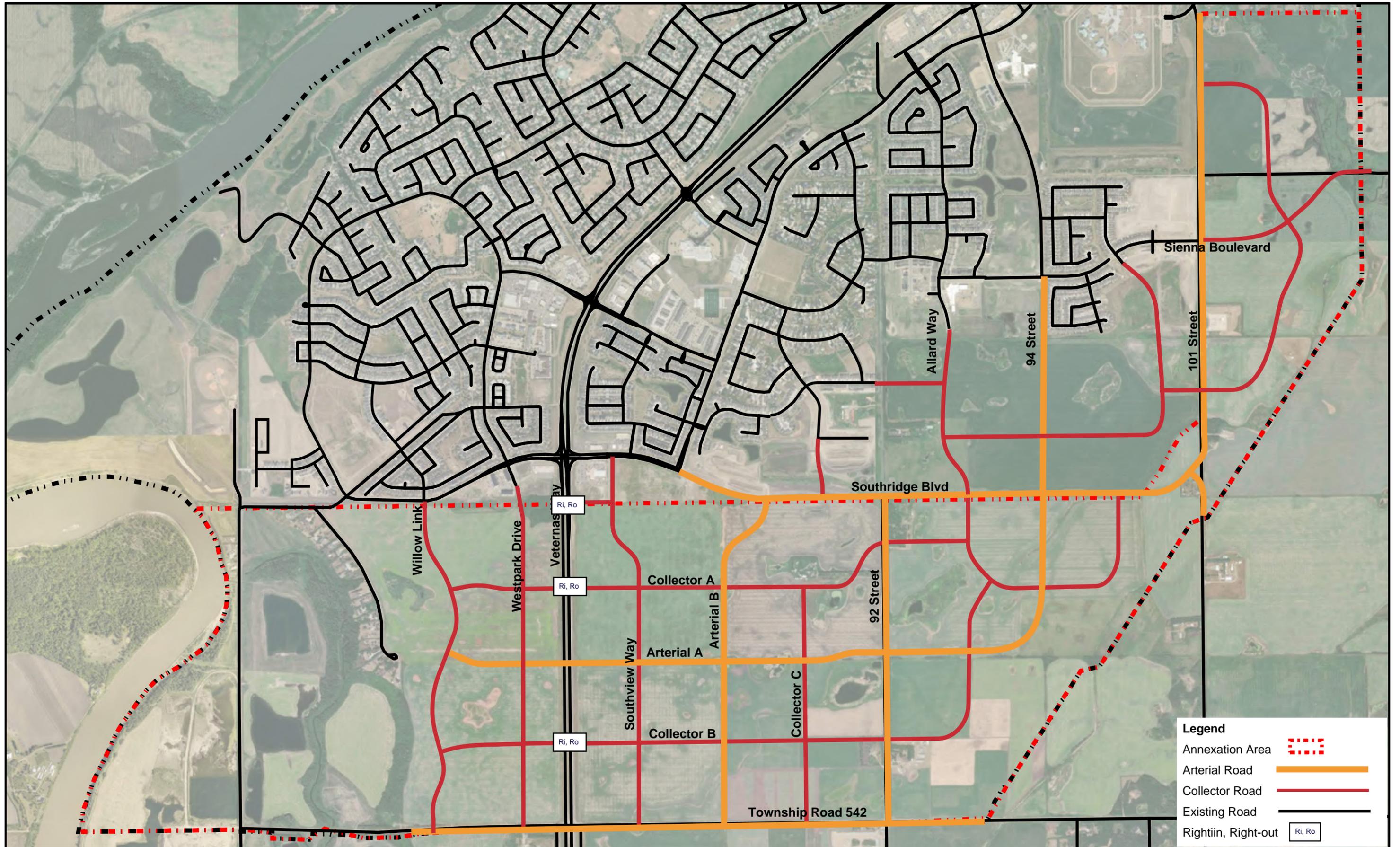


**FORT SASKATCHEWAN ANNEXATION
SERVICING DESIGN BRIEF**
EXISTING ANNEXATION AREA ROADWAY NETWORK

Legend
 Annexation Area 
 Existing Road 

FIGURE 4.1
1:17,000e

0 90 180 360 540 720 Meters
 Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS

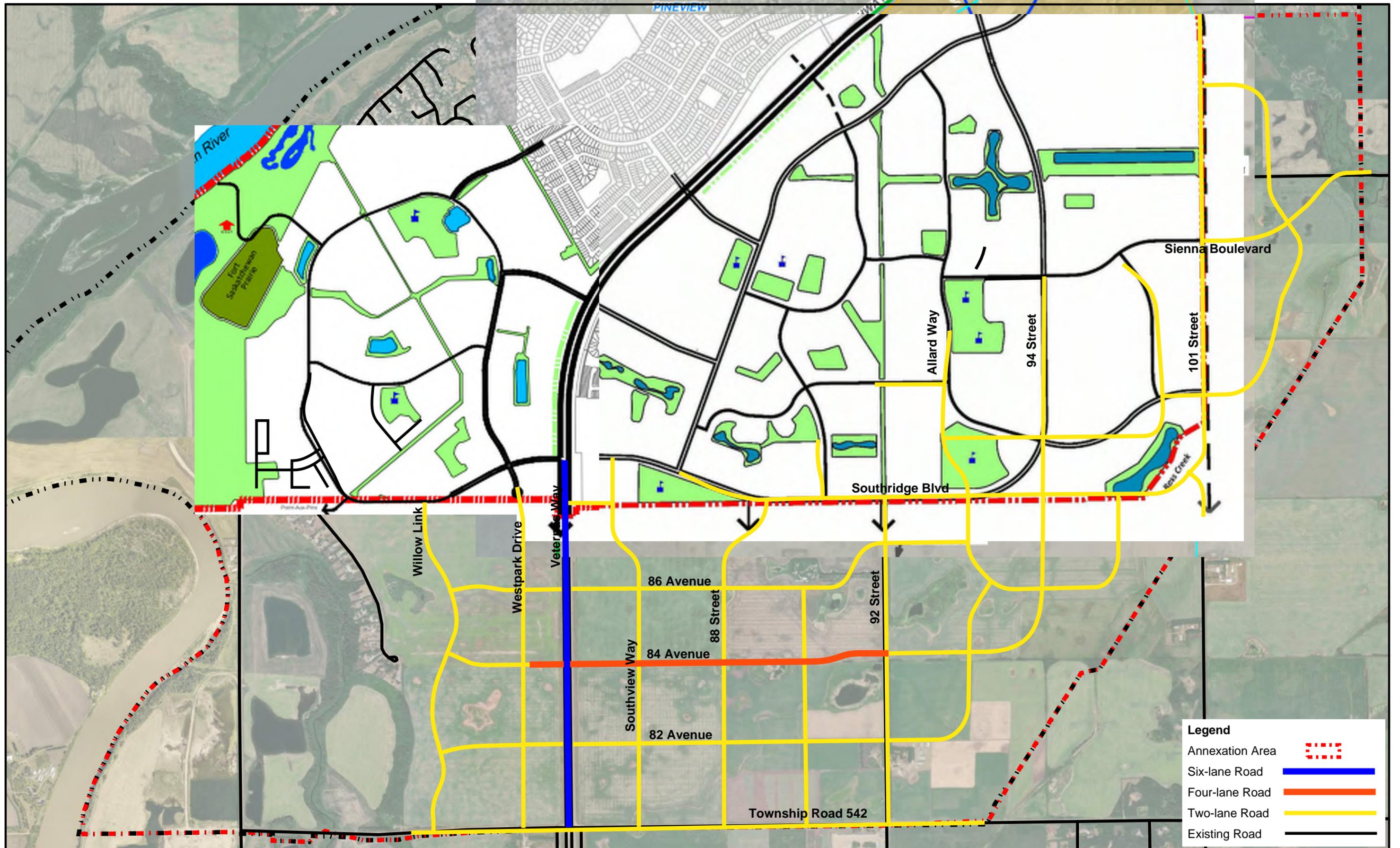


Legend

- Annexation Area
- Arterial Road
- Collector Road
- Existing Road
- Rightin, Right-out Ri, Ro

**FORT SASKATCHEWAN ANNEXATION
SERVICING DESIGN BRIEF
PROPOSED ANNEXATION AREA ROADWAY NETWORK**

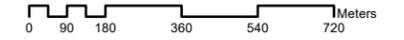
FIGURE 4.2



**FORT SASKATCHEWAN ANNEXATION
SERVICING DESIGN BRIEF**
PROPOSED ANNEXATION AREA ROADWAY NETWORK NUMBER OF LANES

FIGURE 4.3

1:17,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

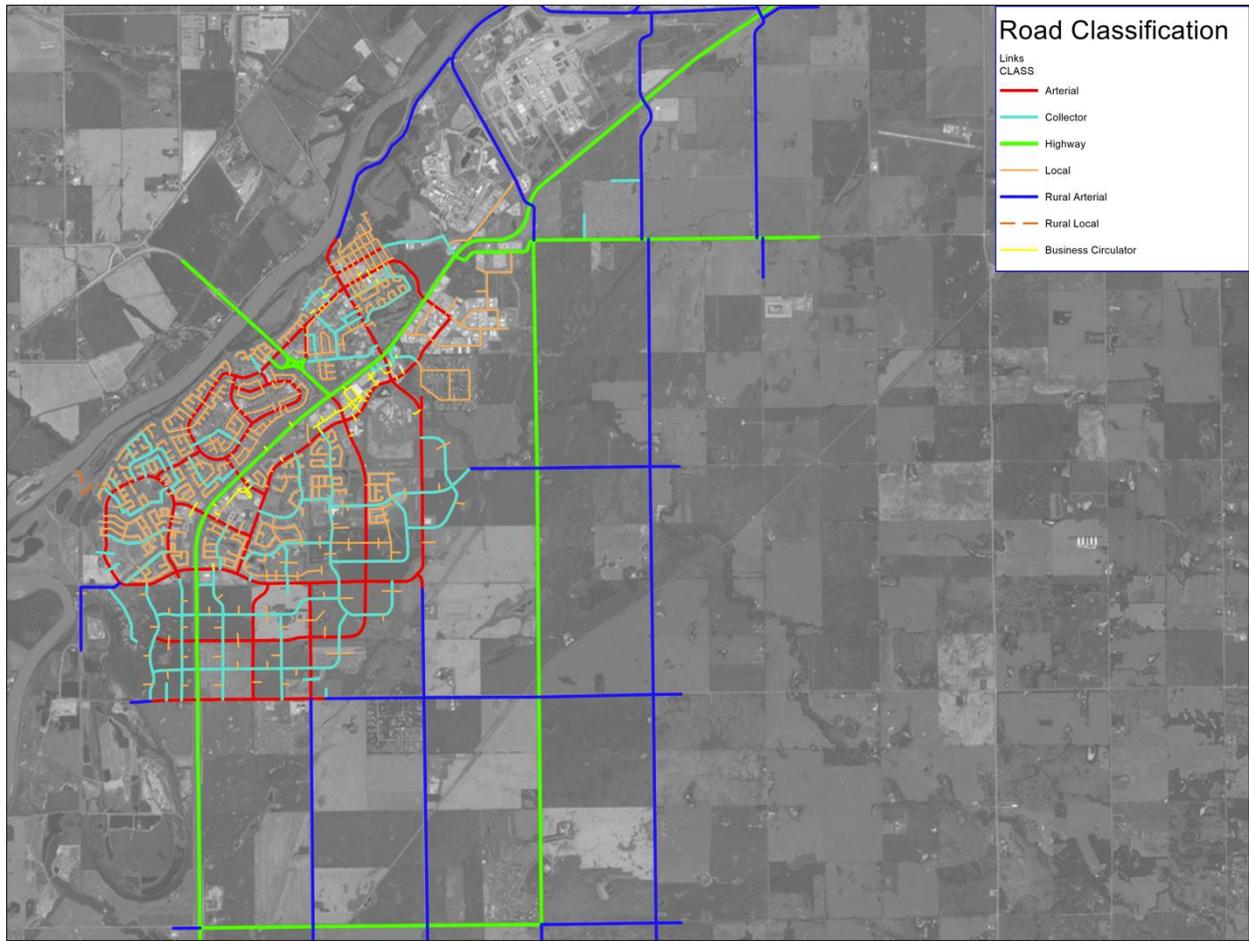


Figure 4.4: Roadway Classification (Travel Demand Model)

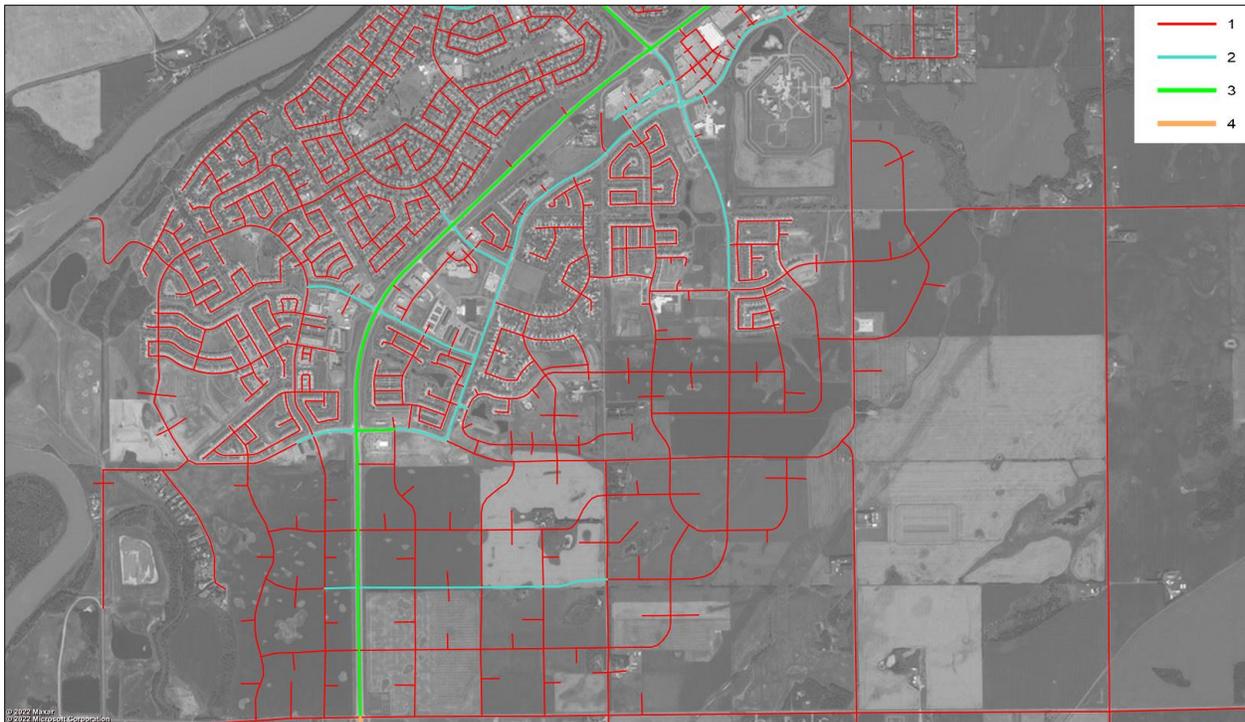


Figure 4.5: Number of Lanes Per Direction (Travel Demand Model)

4.4 Travel Demand Modelling

The methodology for travel demand modelling is described in the following sub-sections:

- | | |
|------------------------------------|--|
| 1. Travel Demand Model Setup | 4. Annexation Traffic Impacts Discussion |
| 2. Land Use Inputs | 5. Recommended Transportation Plans |
| 3. Travel Demand Modelling Results | |

Travel Demand Model Setup

Future travel demand is based on applying land use growth to the City's PM peak traffic model using PTV VISUM software developed for the TMP. Trips are forecasted based on the calibrated trip rates from the base model where existing traffic volumes are correlated to existing travel patterns and land classes including the following: Single family houses, Multi family, Retail employment, Industrial employment, Oil upgrader employment, and Non-retail employment (e.g., institutional). Existing travel patterns for the travel within the city were provided by a third-party data company (described in the TMP) and include internal/internal travel (travel within the city), internal/external (travel to/from outside the city) and external/external (through travel). ISL completed this work for the City in 2018. For further details of the model setup and calibration please refer to Section 6.0 of the publicly available TMP.

Travel demand generated due to land use growth from outside the city was supplied by the Edmonton Metropolitan Region as they administer the Regional Travel Model (RTM). This included volumes generated from outside the city's boundaries, travelling through the city between entry and exit points. The reference entry/exit points are illustrated in the following figure.

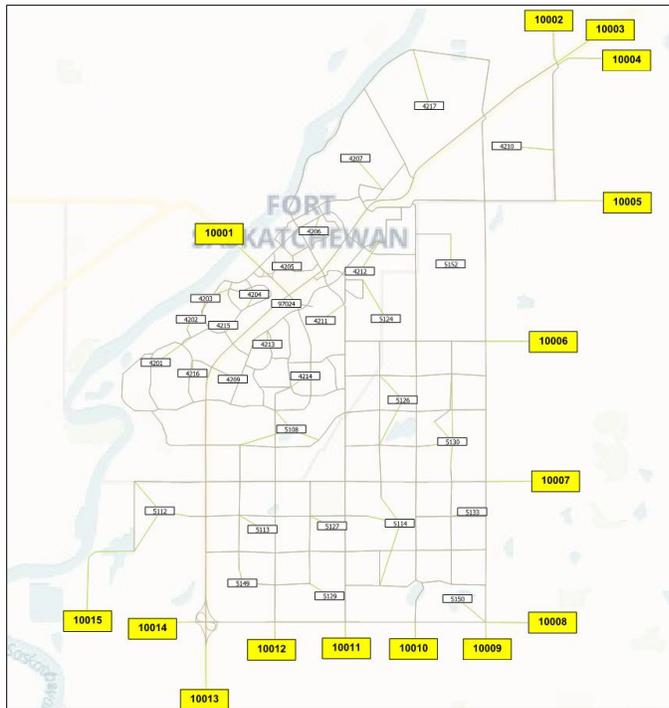


Figure 4.6: External Entry/Exit Points (RTM)

Future traffic volumes travelling between external entry/exit points during the PM peak hour are depicted in the following table.

Table 4.1: External Traffic Volumes at Entry/Exit Points

	10001	10002	10003	10004	10005	10006	10007	10008	10009	10010	10011	10012	10013	10014	10015	Total
10001	0	51	545	7	4	23	3	5	6	25	23	5	222	14	0	933
10002	292	0	46	40	0	1	0	0	7	9	5	0	26	5	0	433
10003	912	24	0	0	4	4	0	0	0	0	0	0	56	12	0	1013
10004	12	2	0	0	0	0	0	0	0	0	0	0	1	0	0	16
10005	35	0	4	0	6	0	0	0	2	3	2	0	3	1	0	56
10006	7	0	2	1	0	1	0	0	1	0	1	0	0	0	0	14
10007	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
10008	0	0	0	0	0	0	0	0	35	25	63	13	0	3	0	140
10009	5	4	0	0	0	1	0	9	0	0	1	0	0	0	0	21
10010	9	0	0	0	0	1	0	8	0	0	3	0	8	6	0	37
10011	14	0	0	0	0	0	0	9	1	2	0	0	3	6	0	36
10012	4	0	0	0	0	0	0	3	0	0	0	0	0	0	0	10
10013	76	13	39	1	3	0	0	2	0	6	3	3	0	4	0	152
10014	31	0	10	0	0	0	0	9	0	18	35	0	0	0	0	102
10015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1399	96	645	49	17	34	4	44	54	90	137	23	320	52	0	2964

The information supplied in the table represents bypass traffic generated from external land use growth travelling through the city. It may be compared to future travel demand growth due to pre-annexation and annexation lands to help understand the proportion demand between city and non-city travel.

Land Use Inputs

Land use growth is added to the model for each of the traffic analysis zones. The model estimates travel demand generated from the new land use and applies the demand to the transportation network based on existing travel patterns used to calibrate the model. Future travel demand (traffic volumes) is compared against available transportation capacity to determine which links require additional capacity (generally where volume to capacity is greater than 0.9).

The total residential land use statistics representing the approximate 82,000 population scenario are illustrated in **Figure 4.7**. The total employment land use statistics at this same horizon are illustrated in **Figure 4.8**.

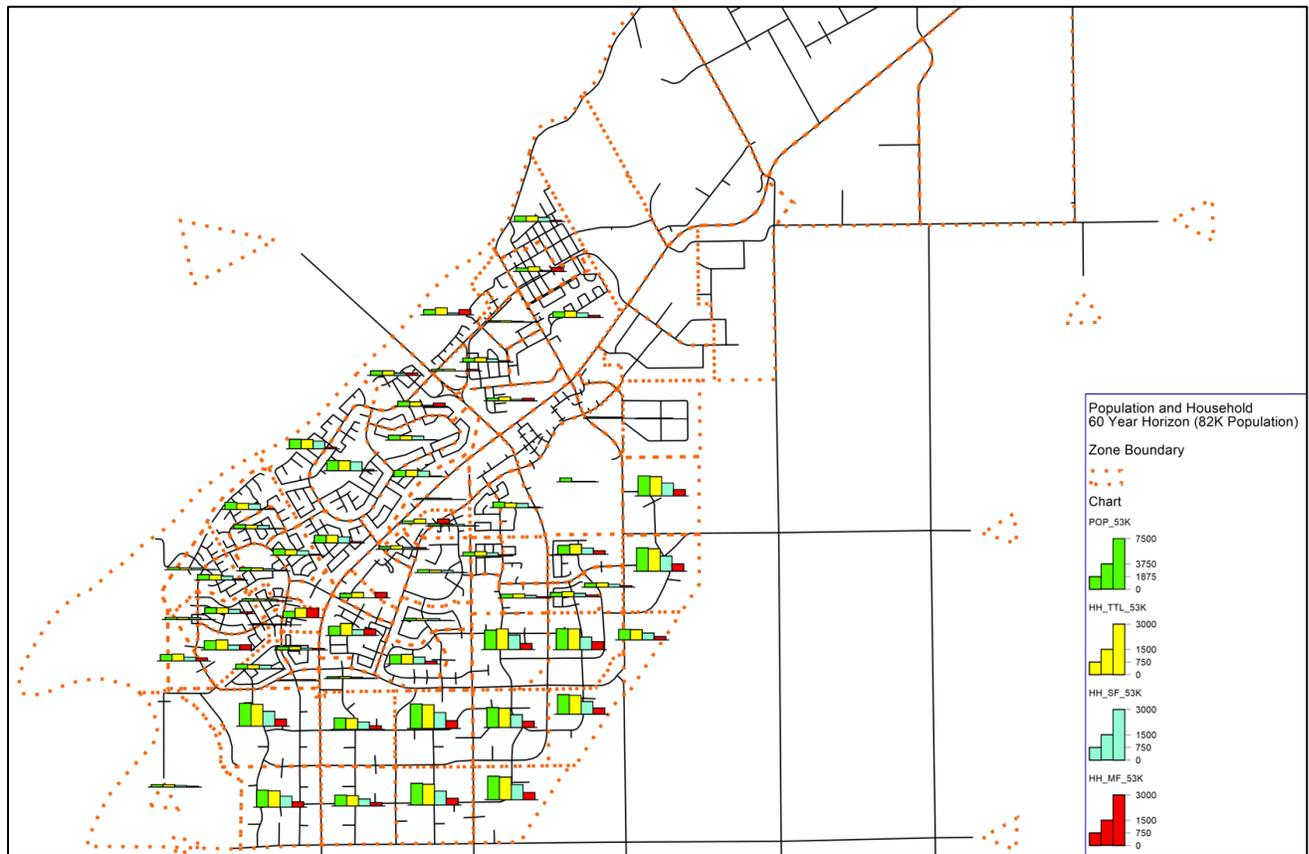


Figure 4.7: 82,000 Population Horizon Residential Dwellings

Employment growth includes retail, non-retail, industrial and oil/gas related employment. The total employment values are illustrated in the following figure.

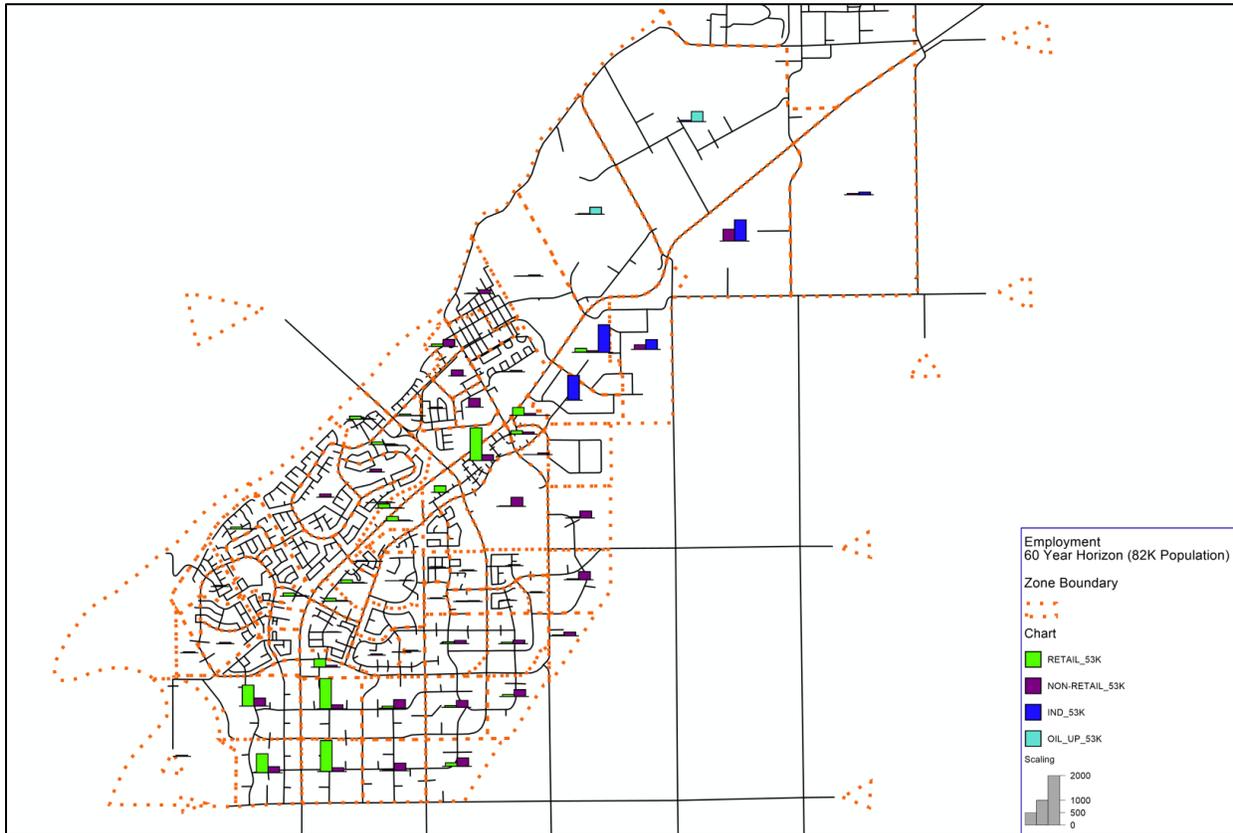


Figure 4.8: 82,000 Population Horizon Employment

Travel Demand Modelling Results

Travel demand modelling results depicting the volume to capacity ratio of for the transportation network for the entire traffic model and the annexation area are shown in **Figure 4.9** and **Figure 4.10**, respectively.

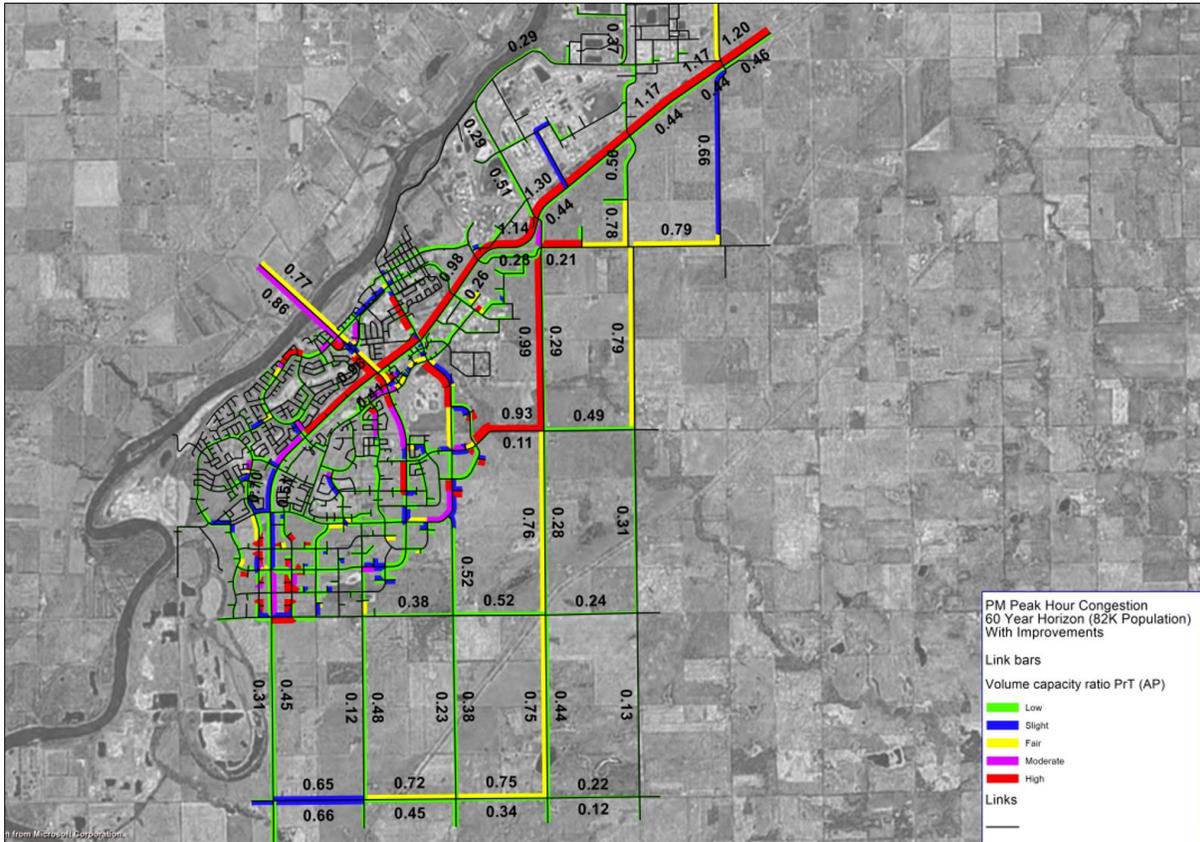


Figure 4.9: Volume to Capacity (82,000 Population Horizon)

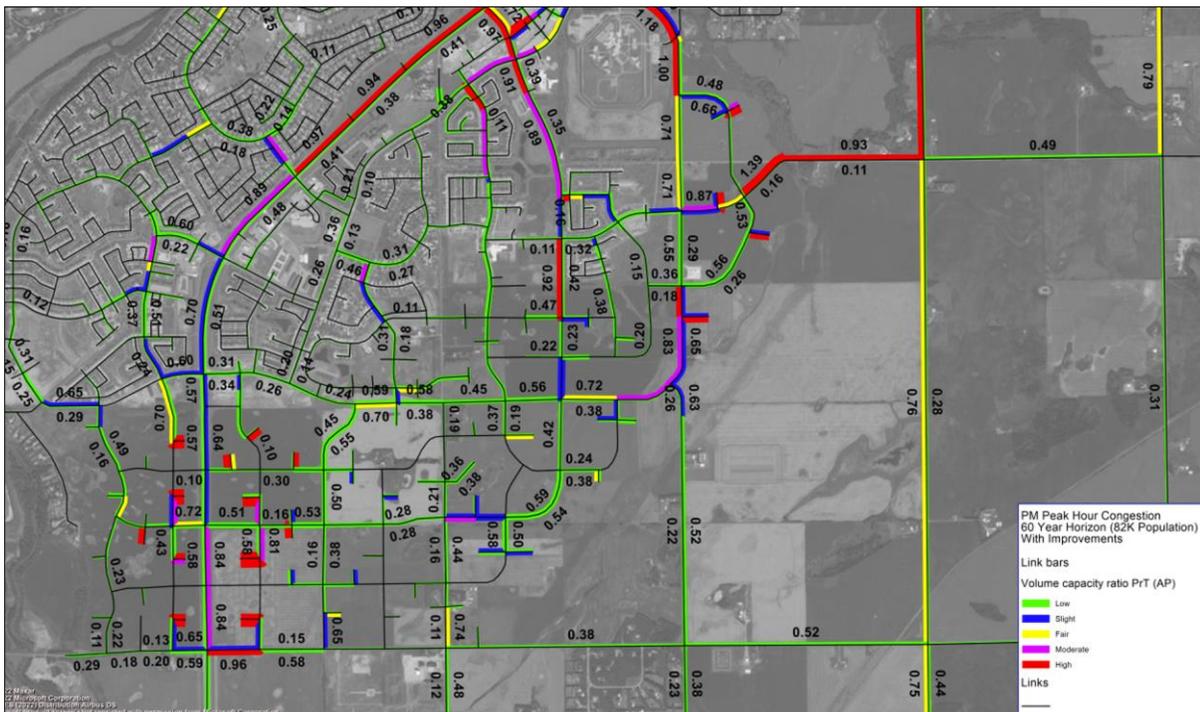


Figure 4.10: Volume to Capacity (82,000 Population Horizon) – Annexation Area

The following is observed in reviewing the above two figures:

- Annexation roadways proposed provide sufficient capacity for servicing the annexation land use.
- Township Road 542 along the south boundary of the area shows high levels of congestion, but this is inconsequential as traffic is more realistically to spread between Township Road 582 and the right in/right out accesses to the commercial area on Veterans Way.
- Allard Way within the Southfort neighbourhood appears to be near capacity and should be monitored as development occurs.
- Significant levels of congestion are found in areas outside of the annexation area along 94 Street and 101 Street.
- The intersection of Willshire Boulevard and Willow Link is expected to operate well as a stop controlled intersection.

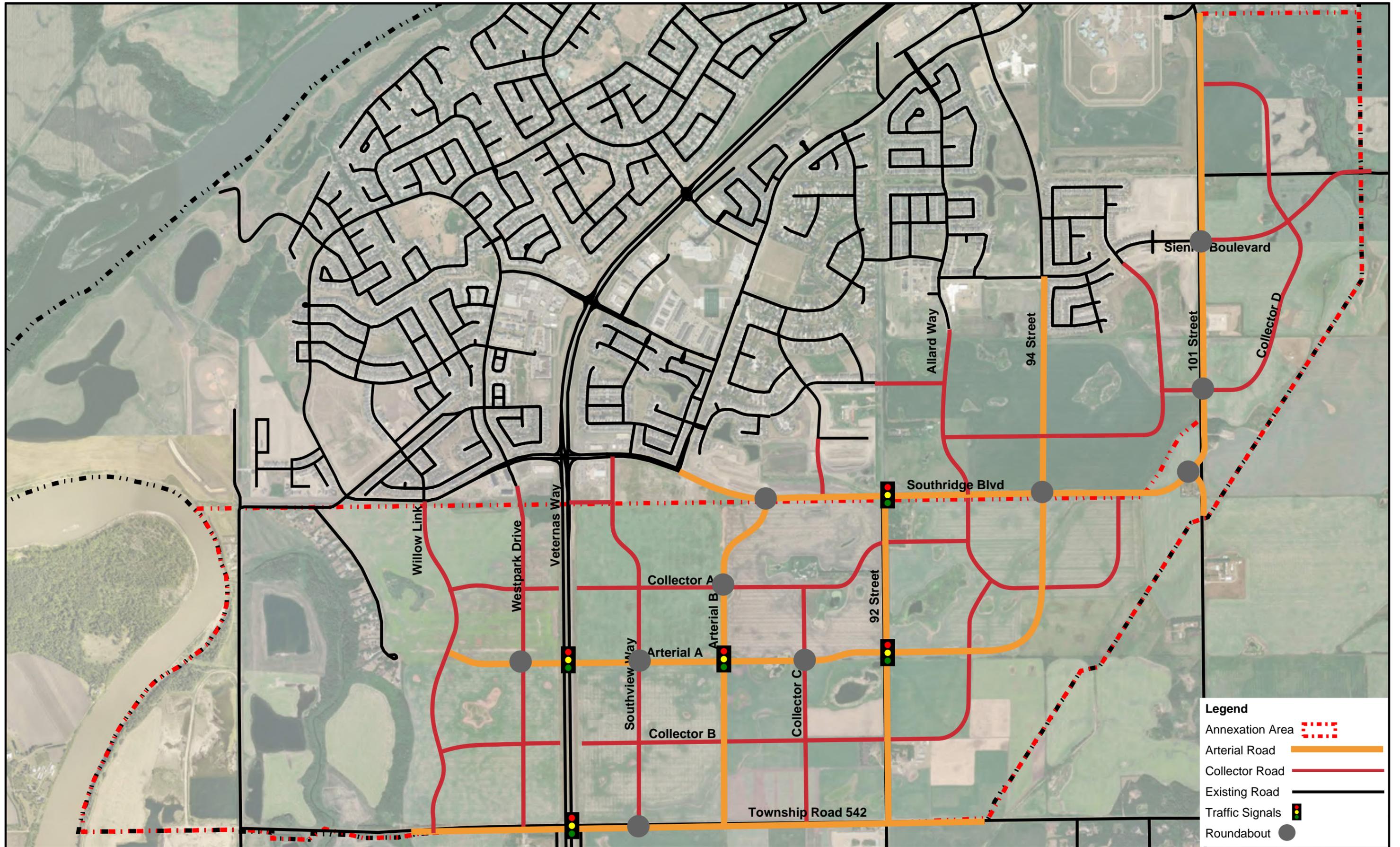
Traffic volumes from the modelling outputs are provided in Appendix A.

On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland in Quarter Section R (Figure 2.2) does not meet the criteria for a Crown ownership claim. While this was not part of the traffic model assumptions, the modelling results indicate the proposed annexation area roadway network has enough spare capacity to accommodate the additional trips that may be generated if the wetland is developed. As such, this new information is expected to have little to no impact on transportation servicing

Intersection Traffic Controls

Intersection traffic controls are based on anticipated volumes. Generally, roundabouts are assumed for roadways within the annexation area at intersections expected to require a level of traffic control greater than stop controlled, based on reviewing volumes against engineering judgement. Roundabouts are preferred over traffic signals for their improved vehicle safety benefits. Traffic signals are assumed at arterial intersections with Veterans Way, planned as a 6-lane roadway and not suitable as for roundabouts. Traffic signals are also assumed where a higher level of active modes is expected for their greater degree of right-of-way control for pedestrians.

Figure 4.11 depicts the recommended intersection traffic controls. Intersection traffic controls are summarized in the following table.



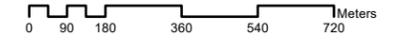
Legend

- Annexation Area
- Arterial Road
- Collector Road
- Existing Road
- Traffic Signals
- Roundabout

**FORT SASKATCHEWAN ANNEXATION
SERVICING DESIGN BRIEF
PROPOSED ANNEXATION AREA INTERSECTION CONTROLS**

FIGURE 4.11

1:17,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

Table 4.2: Traffic Control Summary

Intersection		Control	Descriptions
Veterans Way	Arterial A	Traffic Signals	Traffic signals preferred based on 6-lane cross-section on Veterans Way
	Township Road 542	Traffic Signals	
Arterial A	Westpark Drive	Roundabout	2-lane roundabout
	Southview Way	Roundabout	2-lane roundabout
	Arterial B	Traffic Signals	Traffic signals assumed to break up the east/west flow of traffic to improve function of other roundabouts
	Collector C	Roundabout	2-lane roundabout
	92 Street	Traffic Signals	Traffic signals preferred due to the higher level of active modes expected on the 92 Street corridor
Township Road 542	Southview Way	Roundabout	Single lane roundabout
Southridge Boulevard	Arterial B	Roundabout	Single lane roundabout
	92 Street	Traffic signals	Traffic signals preferred due to the higher level of active modes expected on the 92 Street corridor
	Arterial A 101 Street	Roundabout	Single lane roundabout
101 Street	Collector D	Roundabout	Single lane roundabout
	Sienna Boulevard		

Other intersections within the plan area are expected to be stop-controlled. The traffic controls are based on network level travel demand modelling which presume a certain land use scenario (see Section 2.0). The exact type of control should be verified at the completion of future ASP based on a more refined land use plan. A lesser type of traffic control may be needed if additional connections are provided to the transportation network, such that the turning volumes can be spread throughout. This should also be studied with the completion of future ASPs.

Additional intersection control considerations for future ASPs include:

- **101 Street:** Overhead power lines run along both sides of 101 Street and may limit available right-of-way for intersection improvements. Future improvements on 101 Street will need to be coordinated with Alta Link and Fortis.
- **Commercial Areas:** Roundabouts have been identified as the recommended intersection treatment in the commercial areas. While future ASPs may make the case for an alternative intersection traffic control, there are several benefits to roundabouts in commercial areas that should be considered. Roundabouts typically result in shorter queues than traffic signals. This is especially beneficial in the commercial areas because it reduced the likelihood of queues spilling into Veterans Way. The functional area of a roundabout is also much more clearly defined than a traditional intersection, reducing the likelihood of accesses being placed too closely together and interfering with operations along the corridor.

Annexation Traffic Impacts Discussion

To understand the changes to the transportation network caused from traffic demand generated due to the buildout of the annexation area, ISL completed an additional modelling scenario which included the following:

- Full buildout of land uses within the city's pre-annexation boundary, including in areas of the southeast, Southfort area, and expected infill growth. This scenario is equal to an approximate population of 48,000.
- Assume external-external traffic growth generated from land uses outside of the city's modelling area to be consistent with modelling work completed for the annexation lands.
- Re-run the model based on the improved transportation network from the City's 10-year and 30-year improvement scenario from the TMP. These scenarios include a portion of the improvements assumed in the development of the city's transportation network for the annexation.
- The number of lanes, roadway classifications and congestion plots are provided in the following figures.

Travel demand modelling results depicting the volume to capacity ratio for the transportation network for the entire traffic model and the annexation area are shown in **Figure 4.13** and **Figure 4.14**, respectively.

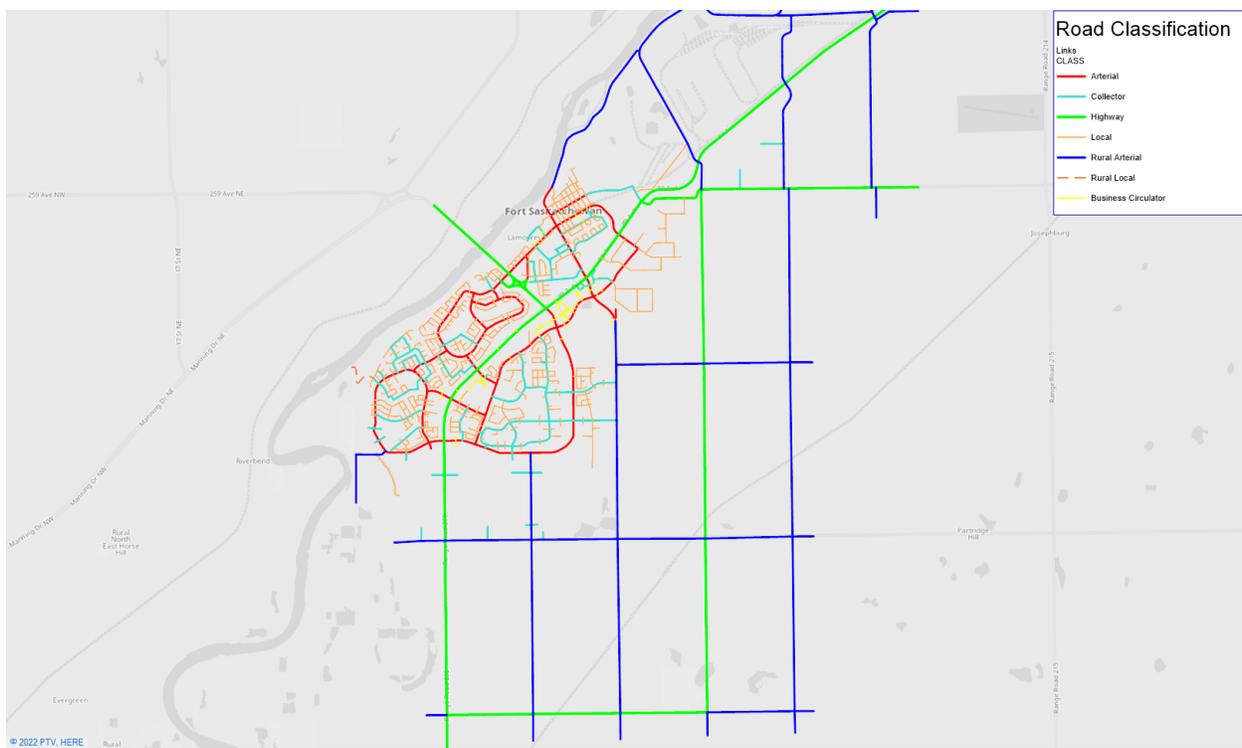


Figure 4.12: Full Buildout Roadway Classifications (Pre-annexation) Transportation Network

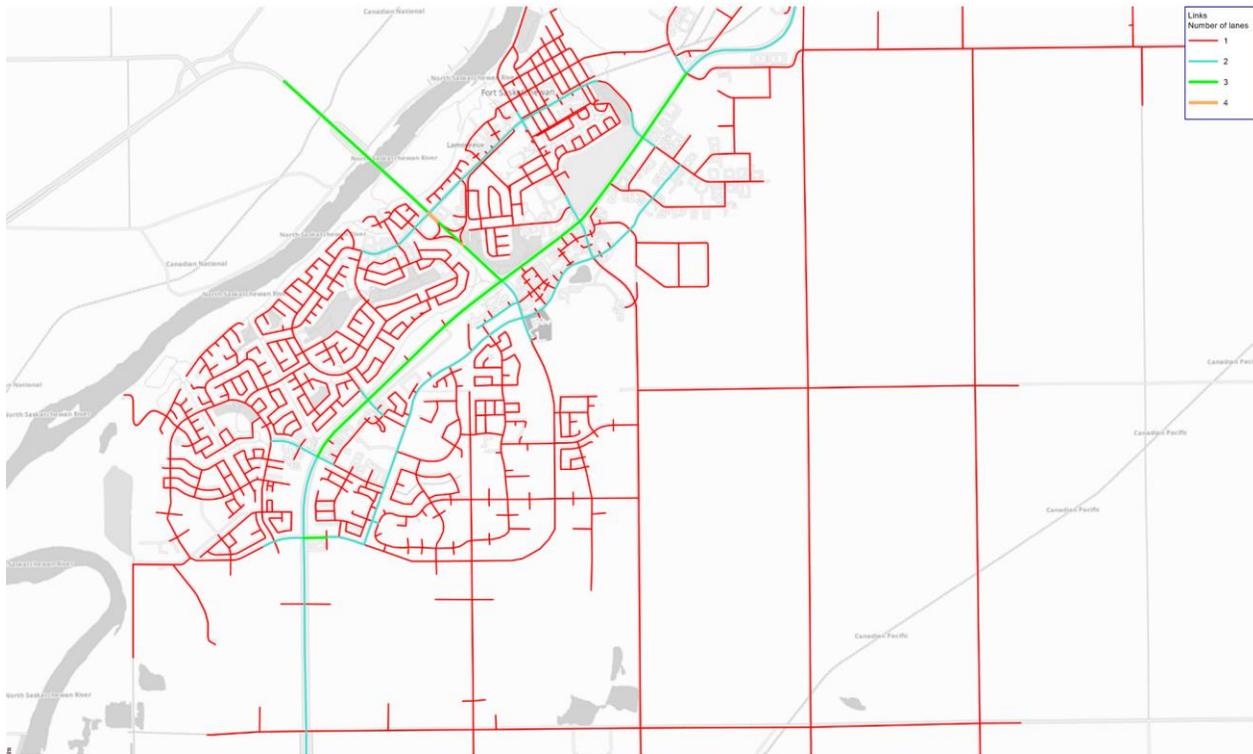


Figure 4.13: Full Buildout Roadway Number of Lanes (Pre-annexation) Transportation Network

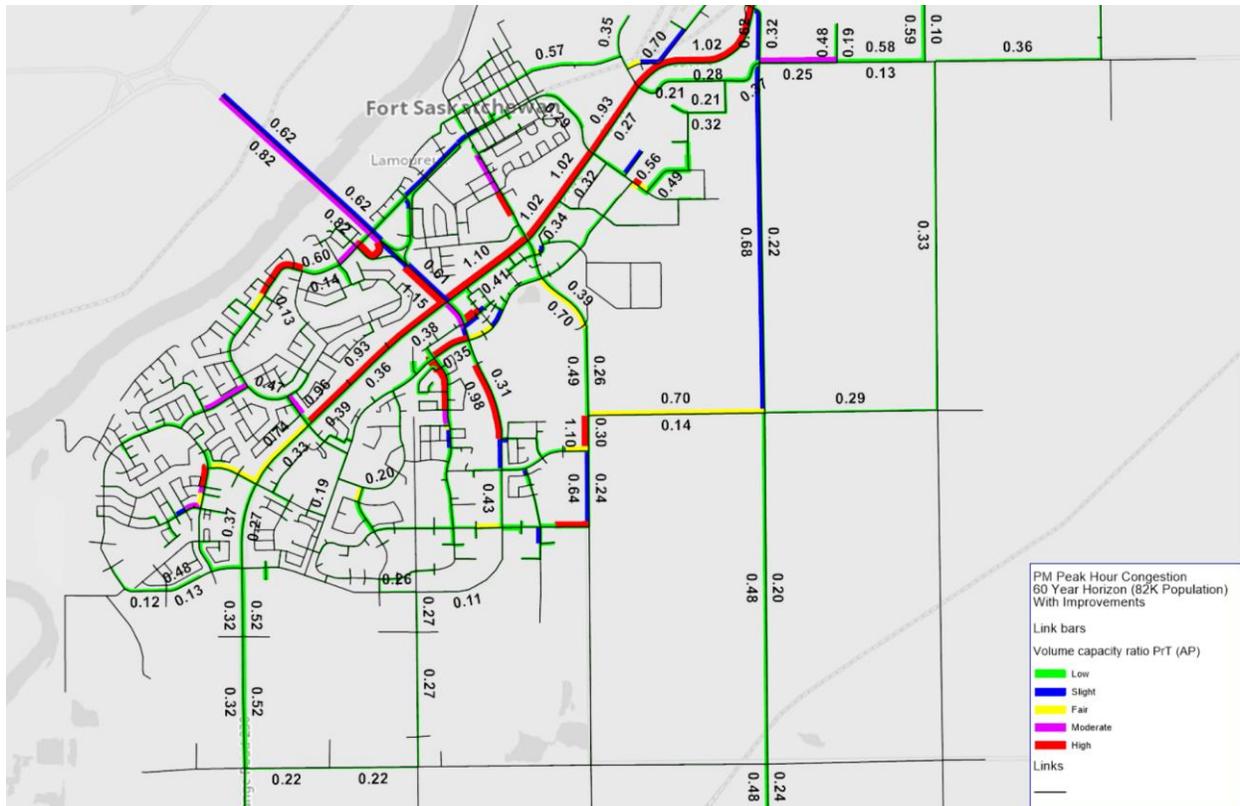


Figure 4.14: Full Buildout Volume to Capacity (Pre-annexation) Transportation Network

Reviewing the full buildout volume to capacity results based on full buildout of the city's pre-annexation boundary, the following is observed:

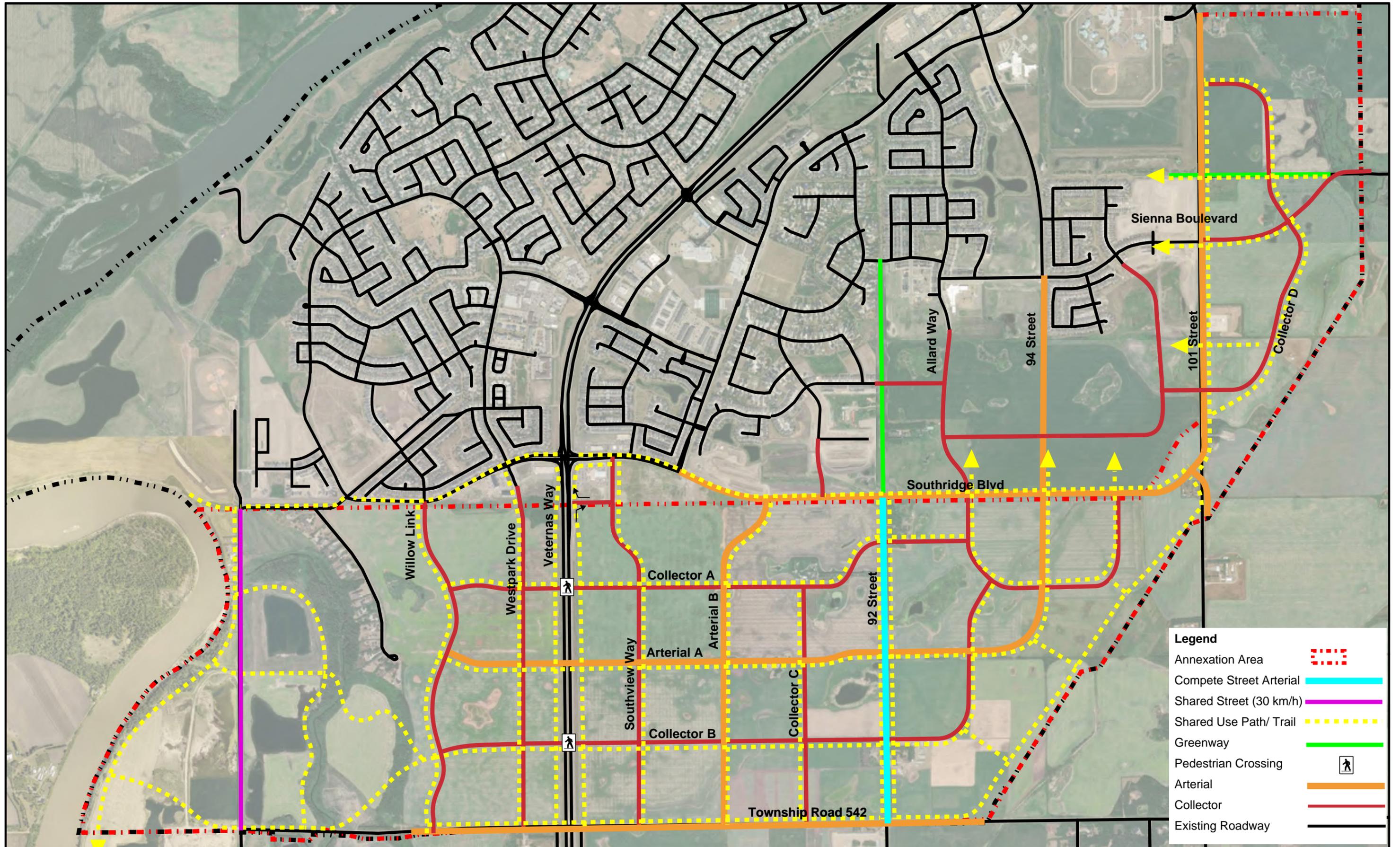
- **Veterans Way (south of 84 Street):** Veterans Way, south of 84 Street and within the annexation area, is operating at low congestion levels with pre-annexation growth and widening to six lanes appears to be benefitting traffic generated from the annexation lands.
- **Veterans Way (north of 84 Street):** Congestion occurs within the Veterans Way corridor with pre-annexation growth. Congestion levels do not appear to change significantly with annexation growth. This implies that additional roadway capacity provided through new roadways connecting to the annexation area help to spread demand.
- **94 Street (Southfort Drive to Sienna Boulevard):** Widening to four lanes benefits the pre-annexation growth and is already planned in the City's off-site levy bylaw. Beyond Sienna Boulevard, growth due to annexation appears to increase congestion levels, such that widening could be considered if this becomes problematic as a benefit to the annexation lands. Note it is only for a small section, south of Sienna (refer to Figure 4.10), that has congestion with annexation growth.
- **101 Street and Future Industrial Bypass (Range Road 223):** Both connections operate with fairly low levels of congestion with pre-annexation growth. Congestion increases with annexation and both connections are maintained as 2-lane cross-sections. This route functions as an important connection to both pre-annexation and annexation growth as an alternative to the congested routes on Veterans Way. 101 Street currently exists as an unimproved rural cross-section and will need to be improved to accommodate future volumes, benefitting pre-annexation and annexation growth. Similarly, the Township Road 540/Range Road 223 corridor will need to be improved, but this is outside of the city's boundaries and excluded from costs in this study.

4.5 Active Transportation (Walking and Cycling)

The active transportation network layout is described as follows:

- **Shared Use Paths (Roadways):** Placed on one side of collector and arterial roadways as per the City's engineering standards.
- **Sidewalks (Roadways):** Placed opposite to shared use paths as per the City's engineering standards.
- **Greenway (92 Street):** Extension of the greenway along the old 92 Street alignment north of Southridge Boulevard into the annexation area. 92 Street within the shared use path area is expected to provide a shared use path on both sides of the roadway, along with additional public realm features, including additional trees, benches and improved lighting.
- **Greenway (Township Road 544):** The greenway with a shared use path connecting from the Southfort neighbourhood is extended into the annexation area along the Township Road 544 alignment.
- **Shared Use Paths (Yorkville Ditch):** A shared use path continues from the Township Road 542 alignment along the Yorkville ditch and east boundary of the annexation area. Several connections between this path and future paths along the roadway network are proposed to maintain a grid style network for improved connectivity.
- **Shared Use Paths (West Annexation, Environmental Reserve):** Shared use paths are proposed between Willow Link and the west annexation boundary through the environmental reserve areas.

The proposed active transportation network is provided in **Figure 4.15**. The alignments proposed will require future study to confirm their feasibility.



**FORT SASKATCHEWAN ANNEXATION
SERVICING DESIGN BRIEF**
PROPOSED ANNEXATION AREA ACTIVE MODES NETWORK

FIGURE 4.15

1:17,000

0 90 180 360 540 720 Meters

Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

4.6 Goods Movement

The existing goods movement routes include Highway 15 from the northwest city boundary to Veterans Way, and Veterans Way from the pre-annexation south boundary to the north boundary. Goods movement routes along Veterans Way are extended to the south boundary of the annexation area. The City will need to update their traffic bylaw to incorporate this change.

4.7 Traffic Safety

As part of developing the transportation network, ISL conducted a literature review with a focus on understanding how to implement traffic safety goals at the network planning level. Incorporating traffic safety at the planning level aligns with the City's strategic priorities of improving traffic safety as outlined in their Traffic Safety Plan. The purpose of this section is to complete the following:

- Review and discuss the proposed transportation network against traffic safety principals applicable at the planning level; and
- Identify applicable policies that could apply to future ASPs created within the annexation area for improving traffic safety.

The following subsections outline our review of three publications for the purposes of reviewing safety.

Safe Systems in the Planning Process (Steinmets et al., 2015)

This document includes a checklist resource for incorporating the Safe Systems Approach to multiple levels of network planning (ASP, Master Plans, Functional, Corridor). For this study, the checklists for big picture planning from this report apply. An abbreviated checklist is adopted for the purposes of this study and discussed in the following table.

Table 4.3: Big Picture Checklist Application (abbreviated version)

Road Safety Planning Issue	Comment
Is the road hierarchy clear and servicing the integrated transportation objectives?	Yes – The road hierarchy is clear and consistent with the MDP and applies an arterial and collector roadway network hierarchy.
Are the proposed arterials consistent with the intended function, including consideration for pedestrians and cyclists?	Yes –The arterial roadways provide shared use paths on one side and sidewalks on the other.
Are intersections between arterials controlled with roundabouts?	Yes – Intersections are planned to be controlled by roundabouts, where feasible.
Is access to arterial roadways controlled or prevented?	Yes – Annexation lands are provided access to the collector roadway network for the purposes of this study. A future access management plan needs to be created to ensure future plans are consistent.
Do collector and local roads encourage lower operating speeds?	Future ASPs need to include policy that direct for the lower speed collector roadways.
Are the needs of pedestrians and cyclists considered on the local network (e.g., off-road paths)?	Yes – Sidewalks and shared use paths are provided off-street and throughout the plan area.
Are active transportation networks separated from vehicles?	Yes.

The review demonstrates that the transportation network aligns with safe systems planning and identifies area for follow-up including application of access management and a policy that directs for lower speed design on collectors and local roads.

Sustainable and Safe: A Vision and Guidance for Zero Road Deaths (Welle et al., 2018)

This document is a global review of Safe Systems written as a collaboration between WRI Ross Center for Sustainable Cities and the Global Road Safety Facility of the World Bank. It provides specific action areas to be considered at different stages of transportation planning and operation. The study provides supporting evidence related to land use planning, street design and engineering, improved active transportation mobility and speed management. A selection of applicable supporting facts is presented and discussed in the following table.

Table 4.4: Safety and Transportation Plan

Safety Related Evidence	Alignment in Recommended Plan
Low density neighbourhoods, with long blocks and poor street connectivity are directly related to poor road safety. For every 1% change toward compact and connected land uses, fatality rates for all-modes decrease by 1.49% and pedestrian fatality rates decrease by 1-3.5%.	The City’s MDP adopts growth targets focused on providing compact and connected land uses which should have a positive change in improving safety.
Grid-based street network layouts produce 30-60% fewer road collisions than arterial-oriented suburban road patterns.	The plan intentionally applies a grid style roadway network for arterials and collectors to the extent feasible. The City should consider adopting policies for future ASPs developed in the area to extend the grid network into the layout of local roadways and avoid building culs-de-sac and loops not providing connectivity across neighbourhoods.
Roundabouts, chicanes and speed humps incorporated into the street design will produce a large percent injury reduction.	Roundabout are planned at many intersections throughout the annexation area. The City should consider adopting policy for future ASPs to incorporate traffic calming features into their design to produce lower speed limits where desired.

Vision, Strategies, Action: Guidelines for an Effective Vision Zero Action Plan (Vision Zero Network, Livable Streets Alliance, 2017)

This document provides guidelines for creating an action plan that can be helpful at a planning level for identifying Vision Zero policies which could be adopted into future ASPs in the annexation area or could be administered by the City. Some potential areas that could be included as ASPs are developed include:

- Through predictive safety analysis, identifying safety areas such as intersections, corridors and areas where crashes are most likely to occur. Plan to develop the neighbourhood with proactive safety interventions to mitigate future safety issues.
- Plan roadways to produce lower speeds in areas expected to have higher pedestrian, cycling and/or transit usage.
- Integrate high pedestrian-generated land uses into communities and transit links such that more people can travel by non-vehicle modes. For example, avoid placing large schools on vehicle-oriented roadways such that vehicle-oriented travel is only feasible.

4.8 Off-site Levy Cost Estimates

Costs for projects considered for the future off-site levy are those projects benefitting the annexation lands. A description of non-cost and cost items assumed based on the City's current levy assumptions are provided for information:

- **Local, Collector and Arterials (first two lanes):** Cost for local, collector and the first two lanes of arterial roadways are excluded from the levies.
- **Arterials (widening):** Cost for widening arterials are included in the levy and based on the City's engineering standards.
- **Right-of-way Cost:** ROW cost is assumed to be collected through subdivision and is not included in the off-site levy.
- **Intersections:** Cost for intersection traffic signals or roundabouts are included in the levy.
- **Pedestrian Grade Separation:** Cost for pedestrian grade separation is included in the levy.

Cost estimates for the proposed transportation projects were prepared and are shown in **Table 4.5** (corridors) and **Table 4.6** (intersection controls).

Table 4.5: Transportation Off-site Levy Cost Estimates (Corridors)

	From	To	Description	Costs (\$)	Engineering (\$)	Contingency (\$)	Total (\$)
Arterial A	Westpark Drive	92 Street	Widen to 4 Lanes	6,600,000	990,000	1,980,000	9,570,000
Veterans Way	South Boundary	84 Street	Widen to 6 Lanes	Extrapolated from Veterans Way Functional Study (Westpark Drive to 114 Street)		14,870,000	
			Functional Study	Functional Study		100,000	
Collector Road A	Veterans Way		Grade Separated Pedestrian Crossing	Based on cost estimate for Highway 21/15 pedestrian crossing.		5,000,000	
Collector Road B	Veterans Way		Grade Separated Pedestrian Crossing	Based on cost estimate for Highway 21/15 pedestrian crossing.		5,000,000	
						Total	34,540,000

Notes:

1. Total cost includes 15% engineering and 30% contingency.

The following additional information is provided to describe the costs:

- **Arterial A:** Cost for widening is based on engineering standard for major divided arterial (T-13). Costs estimates assume that the first two lanes are constructed with development and include rough grading for the widening, underground utilities but not the concrete median. Details are provided in **Appendix A**.
- **Veterans Way Widening:** Cost for widening to 6 lanes is based on the Veterans Way Functional Study (2020), completed by ISL. The costs were estimated at \$20,117,178 for approximately 5,150 m of widening, compared with approximately 3,400 m for widening from 84 Street to the south boundary. The cost estimates are expected to be similar as the available ROW and anticipated type of widening (to the outside) is similar.
- **Grade Separated Pedestrian Crossings:** Costs for the pedestrian grade separation is based on the City's estimated pedestrian crossing cost at Highway 21 and Highway 15.

Table 4.6: Transportation Off-site Levy Cost Estimates

Intersection	Control	Costs	Engineering (\$)	Contingency (\$)	Total (\$)	
Veterans Way	Arterial A	Traffic Signals	450,000	68,000	135,000	653,000
	Township Road 542	Traffic Signals	450,000	68,000	135,000	653,000
Arterial A	Westpark Drive	Roundabout	80,000	12,000	24,000	116,000
	Southview Way	Roundabout	80,000	12,000	24,000	116,000
	Arterial B	Traffic Signals	400,000	60,000	120,000	580,000
	Collector C	Roundabout	80,000	12,000	24,000	116,000
	92 Street	Traffic Signals	400,000	60,000	120,000	580,000
Township Road 542	Southview Way	Roundabout	620,000	93,000	186,000	899,000
Southridge Boulevard	101 Street	Roundabout	130,000	20,000	39,000	189,000
101 Street	Collector D	Roundabout	130,000	20,000	39,000	189,000
	Sienna Boulevard		130,000	20,000	39,000	189,000
Total					4,280,000	

Costs for intersections are further described as follows:

- Engineering cost is 15% and contingency is 30% of the total construction cost.
- **Traffic Signal:** \$350,000 is assumed for the construction costs for an intersection of two-lane roadways. \$400,000 to \$450,000 is assumed for the construction for intersections with four lanes or six lanes.
- **Roundabouts:** The costs listed for roundabouts represent the difference in construction costs for a basic all-directional unsignalized intersection and a comparable roundabout.

ISL completed a high-level cost estimate for a greenfield traffic signalized intersection and a roundabout based on the City's design standards and existing intersections. The estimate indicates, in greenfield conditions, the construction cost of a roundabout is slightly less than a signalized intersection in both cases. This is primarily due to:

- roundabouts and signalized intersections having similar basic road works (such as the same number of through lanes),
- roundabouts not needing additional pavement structure at the approach for turn lanes, and
- the additional cost of the traffic signal itself.

This may not be the case for retrofits or when one of the intersecting roadways exists already. The above costs are based on generic intersection templates. Additional study should be completed to confirm the intersection treatment costs at each location. The full cost estimate and intersection templates used for the cost comparison are provided in **Appendix A**. Note that the full cost estimate was completed for comparison purposes and does not include items assumed to be equivalent.

4.9 Right-of-Way Requirements

ROW requirements for arterial corridors are provided in the following table.

Table 4.7: Right-of-Way Requirements (Arterials)

Roadway Segment	From	To	Cross-section	Standard	ROW (m)
Arterial A	Willow Link	Westpark Drive	2-Lane Minor Undivided	T-12	33
	Westpark Drive	92 Street	4-Lane Major Divided	T-13	44
	92 Street	94 Street	2-Lane Major Divided	T-13 (first half)	44
Township Road 542	Willow Link	East Boundary	2-Lane Minor Undivided	T-11	33
Veterans Way	South Boundary	84 Street	6-Lane Highway		Existing
Arterial B	Township Road 542	Southridge Boulevard	2-Lane Minor Undivided	T-11	33
92 Street	Township Road 542	Southridge Boulevard	Complete Street Arterial		35 – 40 m
94 Street	Arterial A	Sienna Boulevard	2-Lane Major Divided	T-13 (first half)	44
101 Street	Sienna Boulevard	Southridge Boulevard	2-Lane Minor Undivided	T-11	33*

*Existing ROW is 20 m

- 94 Street:** 94 Street is proposed as a 2-lane arterial, but it is recommended that the City obtain ROW for a 4-lane major divided roadway. This is recommended as a logical continuation of the 4-lane cross-section from Arterial A to the future 4-lane section of 94 Street, north of Sienna Boulevard.
- 92 Street:** It is recommended that the City complete a planning study for the future 92 Street corridor as this is planned to provide a unique level of complete street elements, unlike other arterials in the annexation area. It may include wider ROW, larger public realm features, benches, and other aspects.
- 101 Street:** As previously noted, the power lines along both sides of 101 Street may impact the ROW available for improvements. Currently, the ROW is 20 m while the T-11 cross section requires 33 m. The recommended cross section should be reviewed in future ASPs to confirm it is feasible with the utility constraints.

Bypass Considerations for Township Road 542

Township Road 542 was not modelled as a part of the Highway 21 bypass. Potential implications of Township Road 542 being designated part of the Highway bypass in the future that could be considered when planning adjacent developments, if there is a desire to have a bypass. This includes:

- ROW:** The recommended T-11 cross section for Township Road 542 which requires 33m ROW. The 2-lane major divided arterial cross section (T-13) would likely be more appropriate if the corridor is designated part of the Highway bypass. As a result, an additional 11m of ROW would be required on Township Road east of Veterans Way.
- Access:** The City would likely reclassify Township Road 542 as a Highway, which may result in more restrictive access management requirements. Assuming similar access spacing as Veteran's Way, the Southfort Way and Collector C intersections may need to be converted to right-in, right-out to maintain an all-directional access spacing of approximately 800m.

■ 5.0 Stormwater Servicing

5.1 Existing Drainage

5.1.1 Existing Drainage Patterns

Existing drainage patterns for Fort Saskatchewan, including the recently annexed 952 ha annexation area, are shown on **Figure 5.1**. Developed areas of the city are serviced by a standard urban dual-drainage system consisting of storm sewers (minor drainage) and overland (major drainage) systems. Storm sewers convey runoff from small events up to a small flood event to the North Saskatchewan River or local creek systems, providing convenience drainage, that is, positive drainage with no surface ponding during most events that occur each year. Major (overland) drainage systems, including roadways and ditch systems, route runoff in excess of sewer system capacities to outlets. In newer portions of the city, Stormwater Management Facilities (SWMFs) collect runoff from both the local minor and major drainage systems and release it at controlled rates established to protect downstream systems from flooding or eroding. SWMFs also provide a level of runoff water quality treatment and spill containment.

The following key existing drainage features can be observed on **Figure 5.1**:

- Storm sewer systems from developed areas of the city drain to either Ross Creek or directly to the river;
- Ross Creek routes through the central to northern part of the city, while Pointe-aux-Pins Creek routes through the furthest southwestern part of the city;
- Portions of the annexation area located west of Highway 21 currently drain west where runoff can collect in low wetland areas, with any overflows draining west down the river valley slopes into the lower portions of Pointe-aux-Pins Creek;
- A southwest portion of the annexation area is located within the river valley, and is susceptible to flooding from high river levels, with the entire valley area, including the portion of Pointe-aux-Pins Creek running through the annexation area, predicted to be flooded during a 1:100-year river event;
- Runoff from portions of the annexation area located east of Highway 21 currently collects in multiple wetland or low areas that generally drain northeast to the Yorkville ditch that drains to Ross Creek; and
- The Yorkville ditch also drains County lands from the south, and currently routes in and out of the annexation area.

5.1.2 Estimated Peak Flows in Creeks

Both Pointe-aux-Pins Creek and Ross Creek route through the city but have large catchment areas that extend well beyond city limits to the southeast. Watersheds for four drainage systems are shown on **Figure 5.2**, including:

- Ross Creek;
- Pointe-aux-Pins Creek;
- Yorkville Ditch; and
- An unnamed drainage course that contributes to Ross Creek at its downstream end, labeled the East Tributary.

It can be observed on the figure that the watersheds are largely comprised of farmlands with several natural areas and wetlands. Catchment areas for these large watersheds are provided in **Table 5.1**.

Table 5.1: Watershed Catchment Areas

Watershed	Catchment Areas (ha)	
	Gross	Effective
Ross Creek to city limits	14,584	7,397
City drainage to Ross Creek	1,360	1,360
Pointe-aux-Pins Creek	15,690	10,888
Yorkville Ditch	3,413	3,371
East Tributary	9,599	2,809

Also shown on **Figure 5.2** is the location of a Water Survey of Canada (WSC) hydrometric streamflow monitoring station called Pointe-aux-Pins Creek Near Ardrossan, Gauge # 05EB902, with 44 years of records from 1979 through 2022. At the gauge location, the gross drainage area is 10,600 ha, and the effective drainage area is 6,320 ha. Runoff from the effective drainage area routes directly to the creek, with runoff from the remaining gross area routed into wetlands.

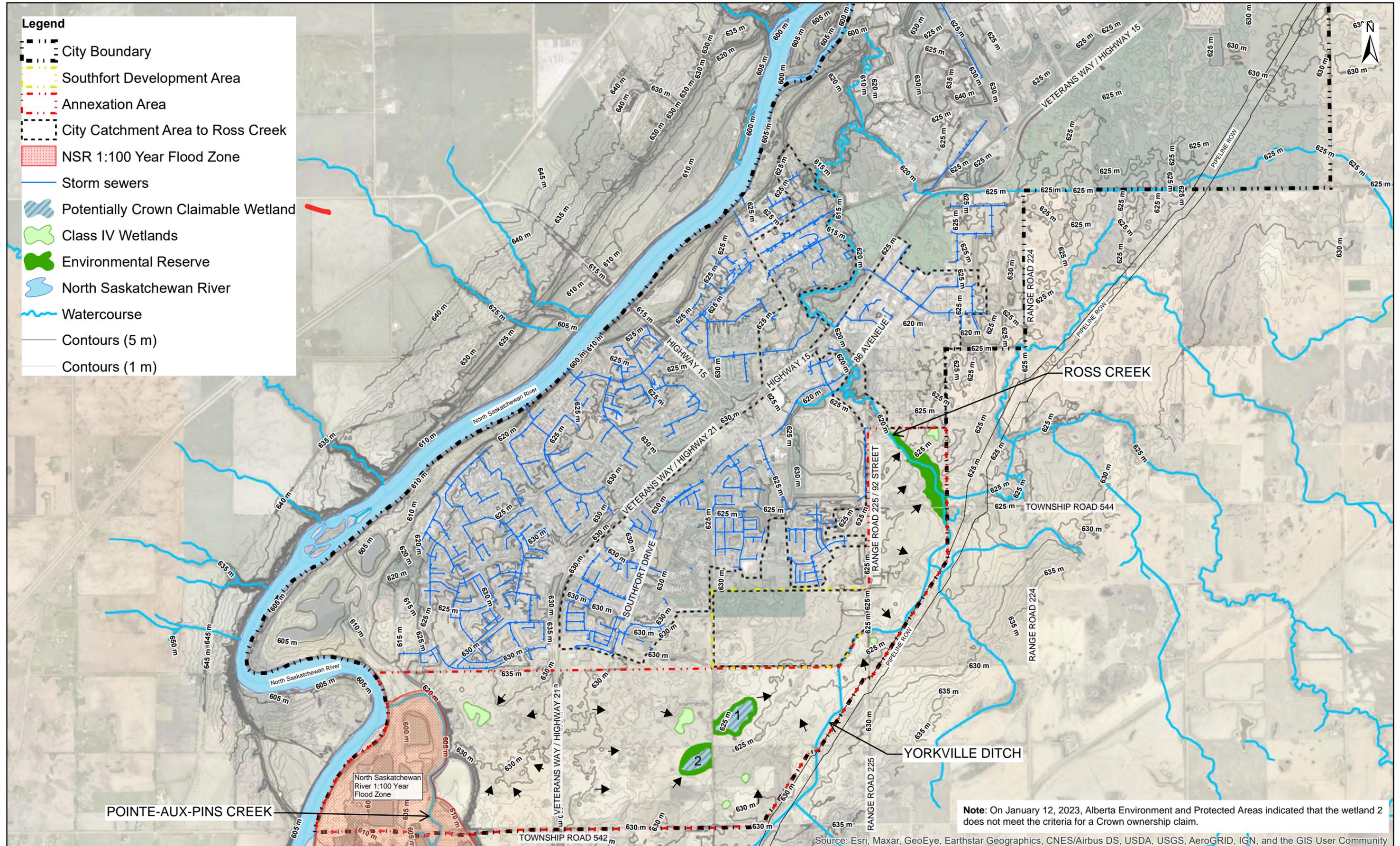
One method of estimating peak runoff flows during the design event from a watershed is called the basin transfer method. This method involves developing the unit peak discharge rate during the design event from a nearby monitored catchment, in terms of L/s/ha, and applying it to the catchment of interest. Differences in various catchment area hydrologic characteristics, including catchment size and how well drained each catchment is, must also be considered. In this case, as Gauge # 05EB902 monitors runoff from an area of similar size and runoff characteristics as the Ross Creek and Yorkville Ditch catchments, the unit rate developed for the gauged site can be applied to estimate peak flows in Ross Creek at the city limits and from the Yorkville Ditch.

A statistical analysis of peak flow records at Gauge # 05EB902 was undertaken in the study *Bremner and Local Employment Area (LEA) Utilities Master Plan*, Stantec, 2019, that resulted in an estimate of the 1:100-year unit rate of 1.6 L/s/ha.

However, this study also referenced some erosion investigative work undertaken by Northwest Hydraulic Consultants (NHC) on the nearby Oldman Creek system that investigated the potential to allow for higher discharge rates from urban SWMFs discharging into the downstream portions of Oldman Creek. That study recommended that up to 3.0 L/s/ha could be allowed for discharges from SWMFs to Oldman Creek during the 1:100-year design event, with a maximum of 1.0 L/s/ha during events up to the 1:5-year event. Since the Oldman Creek system is close to Pointe-aux-Pins Creek, the 2019 Stantec study recommended the same discharge strategy for the Bremner lands discharging to Pointe-aux-Pins Creek. It was also recognized that previous culvert upgrades along Ross Creek through the city were made in the 1970s and 1980s based on an estimate of 3.5 L/s/ha from the upstream catchment area.

As a result, for this project, we propose to take the following approach:

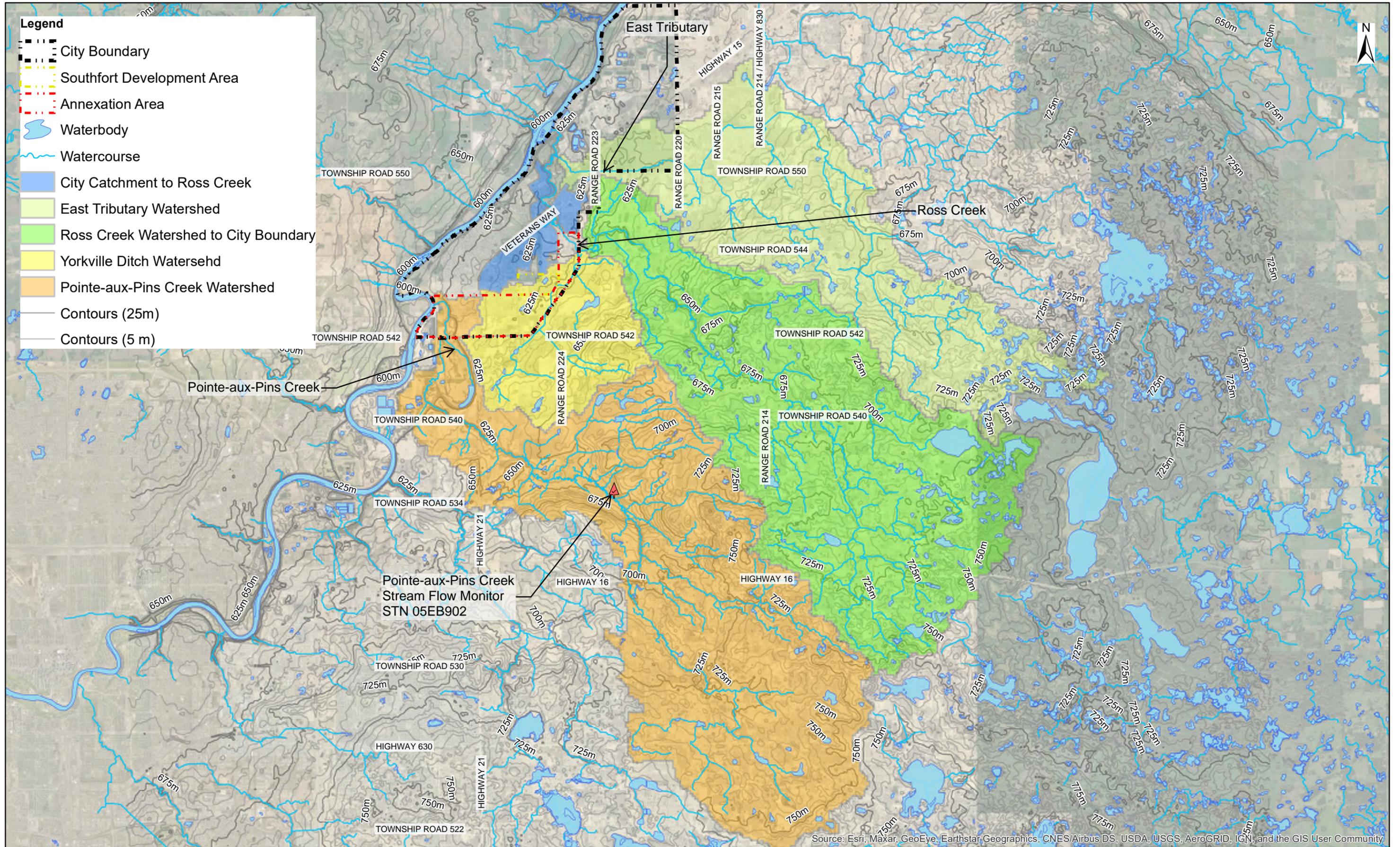
- Estimate 1:100-year flows in Ross Creek from its catchment area based on application of 1.6 L/s/ha applied to its effective drainage area, with proposed SWMFs within the annexation area discharging at maximum rates of 3.0 L/s/ha;
- Then checking the conveyance capacity of Ross Creek through the city all the way to the river, including all culvert crossings, to confirm its ability to convey the resulting estimated peak flows. If capacity constraints are recognized, consideration will be given to lowering the maximum SWMF discharge rate to mitigate any downstream capacity problems.



- Legend**
- City Boundary
 - Southfort Development Area
 - Annexation Area
 - City Catchment Area to Ross Creek
 - NSR 1:100 Year Flood Zone
 - Storm sewers
 - Potentially Crown Claimable Wetland
 - Class IV Wetlands
 - Environmental Reserve
 - North Saskatchewan River
 - Watercourse
 - Contours (5 m)
 - Contours (1 m)

Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Watershed Plan of Local Creek Systems

FIGURE 5.2

1:135,000

0 750 1,500 3,000 4,500 6,000 Meters

Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS

5.2 Servicing Considerations

5.2.1 Natural Environment Preservation

Wetlands

An assessment was conducted as part of ISL's *Fort Saskatchewan Growth Study*, 2015, that identified and classified many wetlands within the annexation area

No wetlands were identified within the annexation area to be permanent marsh (Class V) wetlands. However, seven wetlands were identified to be semi-permanent marsh (Class IV) wetlands; these seven wetlands are shown on **Figure 5.1**. Other wetlands of lower classifications were also identified. These wetlands are not shown on the figure, and it is assumed that they will not be claimed by the Province. And, as a result, these additional wetlands will most likely be lost to development.

At the start of this study, it was not known which of the seven Class IV wetlands may be claimed by the Province, as their general methodology for determining which wetlands they will claim is unclear. On May 5, 2022, ISL submitted a request to Alberta Environment and Protected Areas (AEP) for an assessment of Crown Claimability. As no response was received, the study progressed on the assumption that the province is most likely to claim bed-and-shore ownership of the two largest Class IV wetlands. As a result, for purposes of this study it is assumed that these two wetlands will likely be allocated the land use designation of Environmental Reserve (ER), which would mean that they would need to be preserved and would not be available for use for municipal stormwater management purposes. However, on January 12, 2023, as this report was being finalized, Alberta Environment and Protected Areas responded indicated that the wetland in Quarter Section R (NE18-54-22-W4M) does not meet the criteria for a Crown ownership claim. The report is based on the assumption that both wetlands are preserved. This should be reviewed and refined at the ASP stage.

Preservation of natural wetlands within an urban development can be very difficult to achieve. One key objective includes designing to preserve the wetland's natural hydrologic cycle, to the extent practicable. Urbanization results in a dramatic change to hydrologic conditions, increasing runoff potential multiple times greater than predevelopment conditions. As a result, runoff from developments within most of the wetland's natural catchment area must be directed elsewhere to protect the wetland. The best approach to preserving wetland hydrology includes:

- Direct runoff from enough of the adjacent urban area to the wetland to balance average annual runoff volumes to predevelopment levels – this tends to be between 10% to 20% of the original catchment area; and
- Provide an overflow within the wetland to allow it to spill excess volumes to the adjacent municipal storm drainage system during flood events:
 - Peak runoff from the contributing urban areas during a flood event can flood out an existing wetland; and
 - An overflow can provide a means of controlling high water levels within the wetland to better match predevelopment conditions – overflows are typically designed to function for design events greater than about the 1:5-year event.

For this study we have conservatively sized the proposed SWMFs to exclude the storage that would occur within the two existing natural wetlands during the 1:100-year design event, as those storage volumes are expected to be relatively small compared to the total storage required in the SWMFs.

However, during the development process urban catchment areas to the natural wetlands and the overflow systems should be developed and the nearby SWMF sizing should be refined to reflect the volumes captured within the natural wetlands.

Creek Systems

Creek systems are shown on **Figure 5.1** are the natural areas adjacent to the portion of Ross Creek within the annexation area that are to be designated ER and are to be preserved to allow the floodplain functionality to be preserved. Development within the ER designated areas will be prohibited.

The lower portion of Pointe-aux-Pins Creek within the annexation area is located entirely within the river valley floodplain – where the floodplain lands are susceptible to flooding during a 1:100-year river flow event. Development within these lands should be restricted to uses that can withstand occasional flooding, including parkland with passive uses.

5.2.2 Proposed Development

Understanding potential or likely land use allows for stormwater runoff estimates to be made. Land use development expectations for the annexation area are shown on **Figure 2.2**. The area is expected to be largely residential with some highway commercial and some commercial mixed within the residential areas. Land areas designated for preservation are indicated as Environmental Reserve (ER) on the figure and include the two largest Class IV wetland areas and an area along Ross Creek.

5.2.3 Stormwater Management

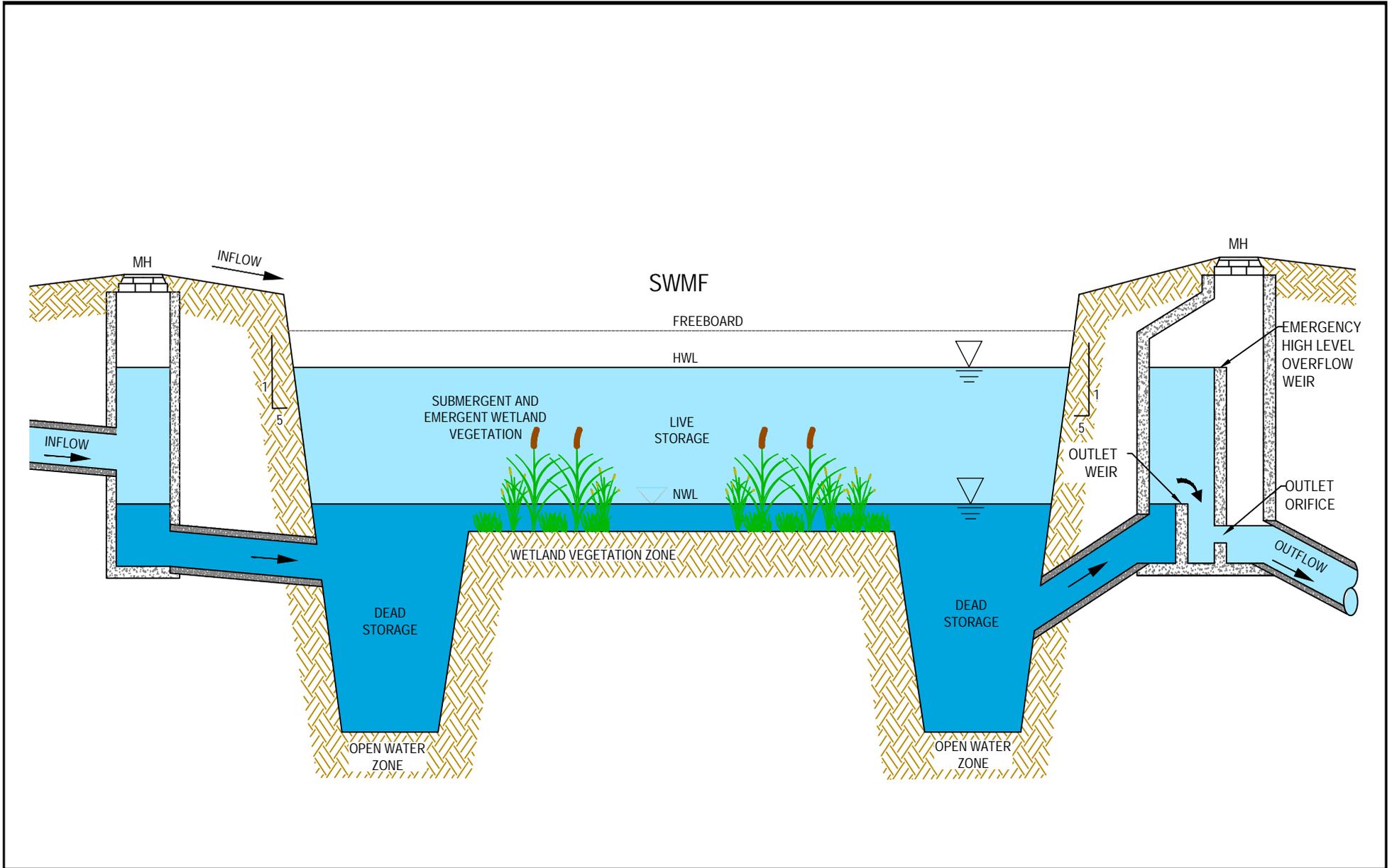
SWMFs are designed to control runoff to rates that prevent downstream flooding or erosion. SWMFs are also intended to provide runoff water quality treatment and spill containment features. All types of SWMFs can be designed to provide the required degree of volumetric controls. However, constructed wetland type SWMFs provide superior water quality treatment and can be designed to provide strong spill containment features. Constructed wetlands have become the favoured SWMF type for many jurisdictions for their aesthetic benefits in addition to the above benefits. Constructed wetlands much more closely represent a natural environment, and provide multiple benefits associated with natural environments, including environments that support a wide variety of wildlife, reduced heat island affects, increased carbon capture, and opportunities for trees along their perimeters providing shade. As a result, for purposes of this study we are recommending that constructed wetland type SWMFs are promoted within the annexation area.

A schematic showing the key features of a constructed wetland SWMF that can provide water quantity control, water quality treatment and spill containment is shown on **Figure 5.3**. The following key features can be observed on the figure:

- The live storage zone, shown as the light blue shaded area, is located between pond normal water level (NWL) and high water level (HWL), and is sized to contain all runoff directed to the pond during the 1:100-year, 24-hour Huff Distribution design event (127.3 mm of precipitation), less water discharged during the event – some design considerations include:
 - The greater the vertical height of the live storage zone the less land required for the pond;
 - As there are no design standards governing the vertical distance between NWL and HWL, there is flexibility to size ponds in a manner that is impacted by factors such as upstream and downstream vertical constraints, land minimization, aesthetics, geotechnical considerations, and the presence of walk-out basements; and

- For this project, a typical vertical distance for the live storage zone of 2.0 m was assumed, but vertical site constraints may require smaller vertical distances to HWL for some facilities;
- Areas of water below NWL, shaded in dark blue, are known as the dead storage zone, and are intended to remain inundated with water both during and between storm events, with small fluctuations expected due to the effects of evaporation, evapotranspiration, and groundwater infiltration;
- A freeboard allowance is provided for occasions when events larger than the design event occur, as a safety feature to accommodate potential higher water levels within the confines of the facility – for sites where there is an adequate overland overflow route, a reduced freeboard allowance can be considered as the consequences of exceedance are reduced;
- Deep open water pools are shown at inlet locations and are designed with sediment traps to accommodate sediment contributions from the incoming sewer system – a typical depth of 2.5 m has been proven to prevent vegetation from growing so that open water is maintained;
- The majority of the pond surface is designed to be shallow to accommodate both submergent and emergent wetland vegetation, with the vegetation providing a significant water quality treatment function through the processes of filtering and adsorption – typical depths can range between 0.1 m and 0.3 m;
- A deep open water pool is designed at the outlet to provide for a submerged outlet design – as most spilled materials float on water (e.g., hydrocarbons), the submerged outlet design prevents the spilled materials from discharging from the pond, providing first responders opportunity to contain and collect the spills;
- Inlet and outlet pipes from the pond are typically located deeper than 1.0 m below NWL to maintain functionality in winter as ice depths can be up to 1.0 m;
- The outlet control structure is designed to be robust and fixed, with no moving parts, and operate as follows:
 - A weir with its crest set at NWL both maintains NWL during dry periods, and provides increased drawdown back to NWL following runoff events, especially at lower pond levels;
 - An outlet orifice, located downstream of the NWL weir, is sized to release maximum allowable discharge rates when the water levels in the pond are at HWL, and is located somewhat below the outlet weir for optimum discharge capacity at all pond operating levels; and
 - An emergency overflow weir is provided at pond HWL to provide increased discharge through the outlet pipe system for brief periods during emergency conditions where the event exceeds the design event, as a means of minimizing the increase in pond level above HWL; and
- The Public Utility Lot (PUL) established for each SWMF includes a 20 m buffer beyond top-of-cut to ensure enough land is available to accommodate variable shapes of the SWMF along with some park space.

Lastly, SWMFs should be designed with an emergency overland overflow set at freeboard level where there is an overland flow route available (e.g., A roadway ditch, drainage course). In these situations, a reduced freeboard allowance can be considered.



**FORT SASKATCHEWAN ANNEXATION
AREA SERVICING DESIGN BRIEF**
CONSTRUCTED WETLAND STORMWATER
MANAGEMENT FACILITY CONCEPT

FIGURE 5.3

N.T.S.

5.2.4 Ross Creek and Pointe-aux-Pins Creek

Ross Creek

Controlled discharges from SWMFs that will service most of the annexation area, the portions east of Highway 21 will be designed to discharge into Ross Creek at a location along the creek just inside the city boundary. As shown on **Figure 5.1**, Ross Creek passes through multiple roadway crossings and a rail crossing as it routes through the city to the North Saskatchewan River.

The portion of Ross Creek that routes through the city may be susceptible to erosion, overloading, or flooding during a 1:100-year design event. Adjusting the maximum allowable discharge rates from the SWMFs is a tool available to the City to mitigate these risks. The City intends to investigate current erosion conditions in the portion of Ross Creek that routes through the city and explore potential erosion risks associated with discharges from the annexation area in a future study. For this study, the hydraulic conveyance capacity of Ross Creek, including all roadway and rail crossings through the city, will be evaluated, and if any bottlenecks are found, alternate SWMF peak discharge rates may be explored to mitigate the downstream flood risks.

Pointe-aux-Pins Creek

Controlled discharges from SWMFs that will service areas west of Highway 21 will be designed to discharge into Pointe-aux-Pins Creek at a location along the creek near its furthest downstream end. Pointe-aux-Pins Creek passes through only one roadway crossing downstream of the proposed discharge point before discharging to the river (Bridge File BF00806).

The capacity of BF00806 to pass runoff expected during the 1:100-year design event from the creek's contributing watershed along with controlled discharges from the proposed contributing SWMFs will be confirmed. If capacity constraints are found, alternate pond discharge rates may be explored.

5.2.5 Yorkville Ditch

As shown on **Figure 5.2**, the Yorkville Ditch currently services a significant catchment area of both County and City lands to Ross Creek. In future, when the City's annexation lands develop, the catchment area to the Yorkville Ditch will be reduced as the annexation lands will be serviced by local SWMFs.

As shown on **Figure 5.1**, the Yorkville ditch currently takes an irregular, circuitous route, winding in and out of the City's annexation area and the County. The portions of Yorkville Ditch routing through the annexation area create remnant land parcels that are not practical to develop or would generate far less sales revenue due to their irregular shapes. As a result, to optimize the developability of the annexation lands, it is proposed to realign the portion of the Yorkville ditch within the city to run along the new city boundary. The realigned ditch would serve the same function as the current ditch, which is to intercept runoff from the County lands, preventing it from entering the city lands, and routing that runoff around the city to Ross Creek as it currently does.

In addition, runoff from County lands that currently drain into the annexation area along its southern boundary will need to be intercepted and rerouted east along the city boundary to the realigned Yorkville Ditch.

5.3 Proposed Stormwater Servicing Concept

5.3.1 Proposed New Boundary Ditch and Realigned Yorkville Ditch

As shown on **Figure 5.2**, the catchment area to Yorkville ditch includes County lands as well as City lands. As the lands within the city develop, runoff from the developed lands will be routed into the municipal drainage systems, and as a result, will no longer contribute to the Yorkville Ditch.

To prevent uncontrolled runoff from the County lands from routing into the City's development areas, a ditch along the city's south and southeast boundary, to be located immediately within the city boundary, is proposed. The ditch would collect runoff from the County lands and route it along the perimeter of the city to Ross Creek. The ditch would also pick up flows from the Yorkville Ditch, allowing portions of the Yorkville ditch within city limits to be abandoned and freed up for development.

The proposed boundary ditch and realigned Yorkville Ditch and the contributing County catchment areas are shown in plan view on **Figure 5.4**. The boundary ditch and realigned Yorkville Ditch and any culverts required at crossings would be designed to convey runoff expected from the 1:100-year design event. As shown on sample cross sections on **Figure 5.4**:

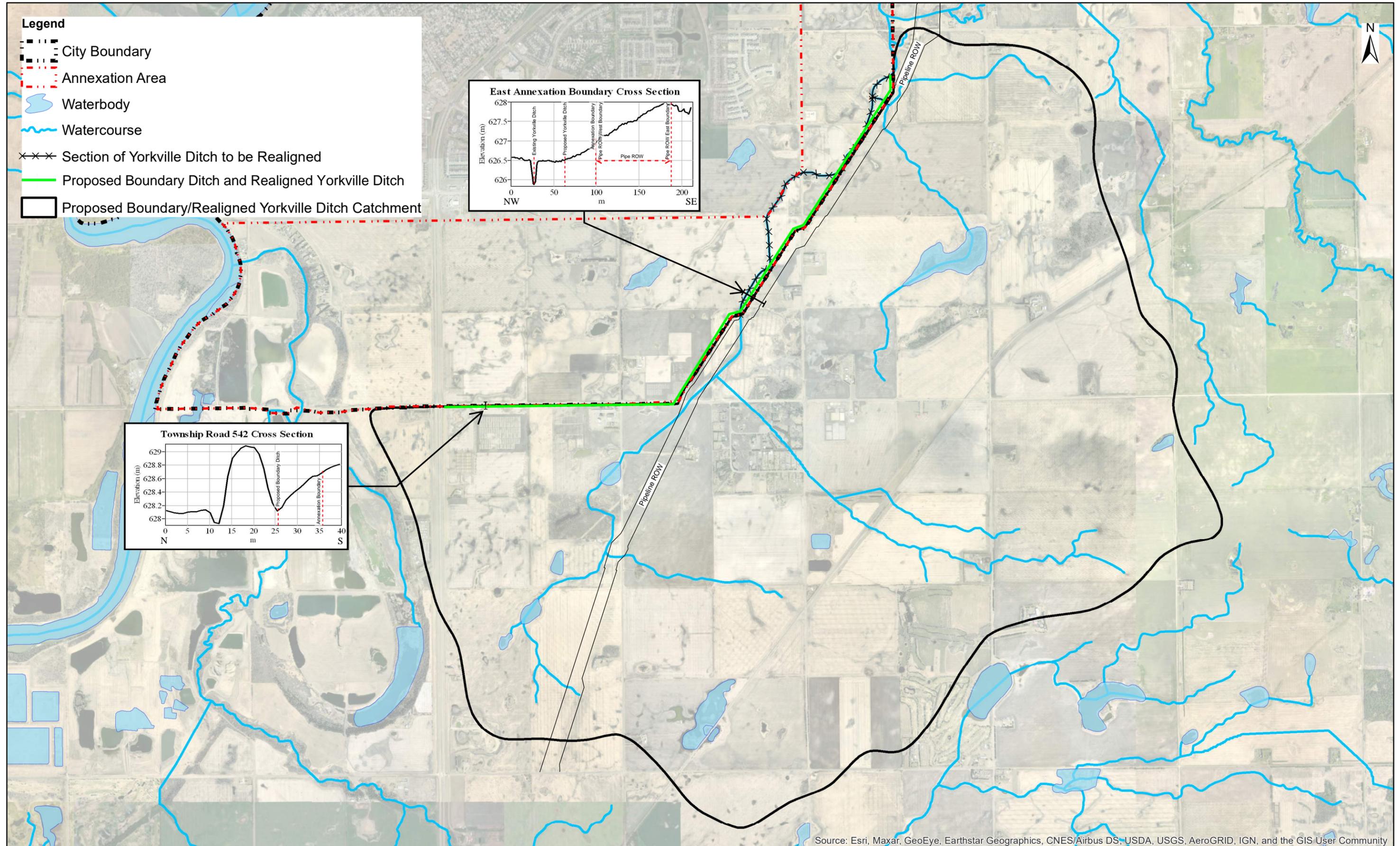
- The south boundary ditch would be located through the existing south roadway ditch of Township Road 542, located just inside the new city boundary:
 - The capacity of the existing ditch and culvert system would need to be confirmed to convey 1:100-year runoff from the contributing County lands, and any needed ditch or culvert improvements made; and
 - A culvert through Township Road 542 would be required to route the south boundary ditch flows north into the relocated Yorkville ditch;
- The relocated Yorkville ditch would be located immediately inside the new city boundary and immediately to the west of the pipeline corridor that is located in the County, and would extend from Township Road 542 northeast inside the city boundary and discharge back into the existing Yorkville ditch just before it contributes to Ross Creek; and
- Existing portions of the Yorkville ditch within the annexation area that would no longer be needed to service the County lands would be abandoned with those lands freed up for development.

5.3.2 Proposed Stormwater Management Facilities

As described in Section 5.2.3 and shown schematically on **Figure 5.3**, constructed wetland-type SWMFs are proposed to service developments within the annexation area. For planning purposes SWMFs are identified to service areas the size of about one quarter section and are located on **Figure 5.5**. The SWMF conceptual designs were based on consideration of the following constraints:

- Ponds are to be located at the low point of each quarter section with freeboard levels located at or below the adjacent ground levels;
- Outlet piping between ponds should be located along proposed roadways and can be at grades as flat as 0.01%;
- Upstream inverts on outlet piping should be located a distance below pond NWL, the target was 0.5 m, for improved pond post-event drawdown performance;
- The outlet for Pond 1 should discharge into Ross Creek somewhat above the bottom of the creek which is located just below elevation 621.0 m;
- Freeboard levels can be 0.3 m above pond HWL since each pond is expected to be able to have an emergency overland overflow route; and
- Pond live storage volumes were estimated by estimating inflows during the design event from an estimate of potential future land use, with consideration of an outlet orifice designed to discharge at a rate of 3.0 L/s/ha during peak conditions.

Consideration of the above resulted in the design of the pond NWLs, HWLs, surface areas at NWL, and PUL land requirements. The ponds shown on **Figure 5.5** are shown to reflect the approximate water surface and land areas that may be required for each pond. Key conceptual (approximate) design data for the SWMFs are provided in **Table 5.2** and were assumed to have a length to width ratio of 2 and a side slope of 5:1.

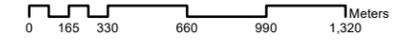


Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

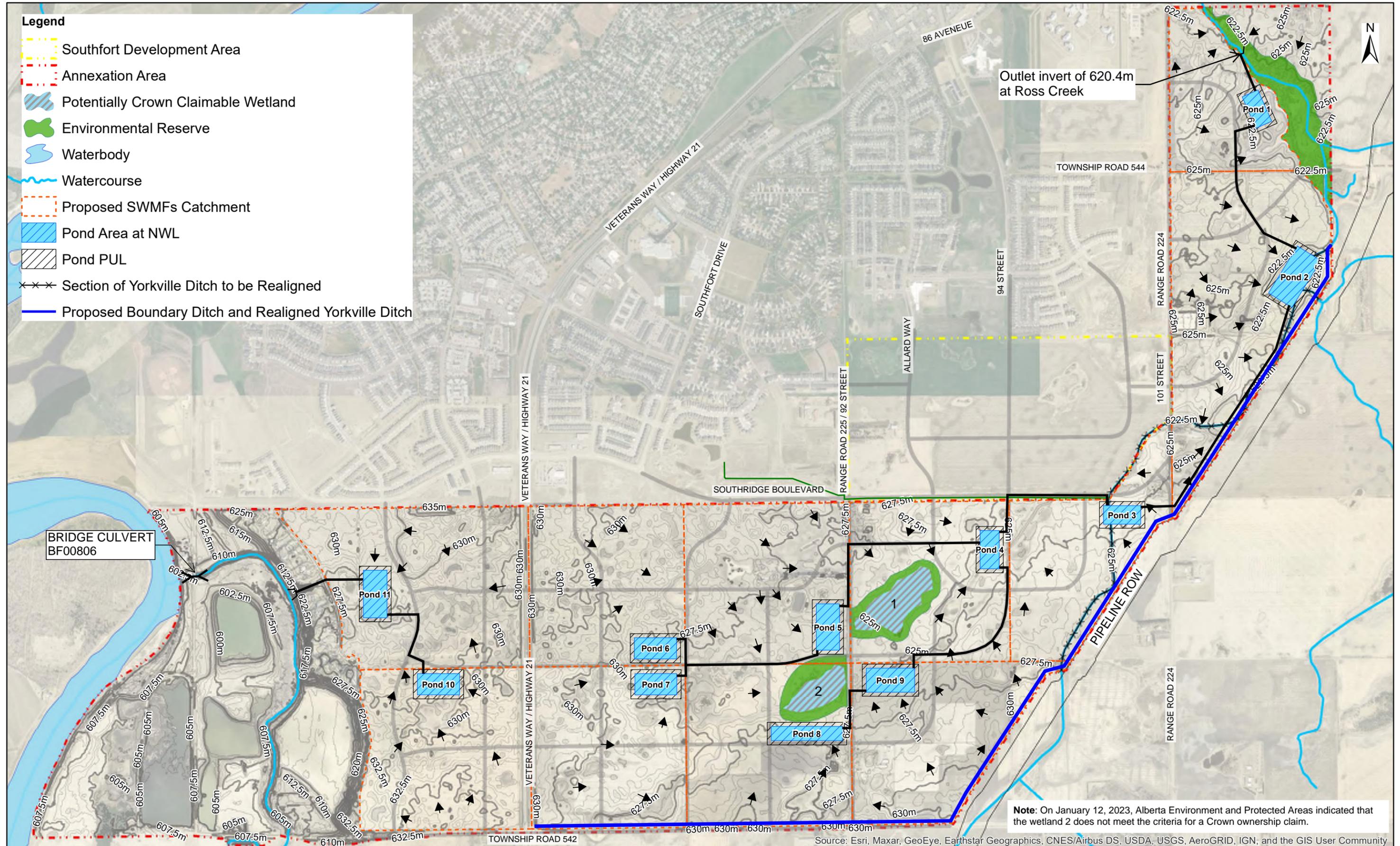
FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Proposed Boundary Ditch and Realigned Yorkville Ditch

FIGURE 5.4

1:30,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS



Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Proposed Stormwater Servicing Concept

FIGURE 5.5
 1:17,000

Table 5.2: Conceptual SWMF Key Design Data

SWMFs	General Data				Proposed Levels					Proposed Land Areas	
	Catchment Area (ha)	Runoff Coefficient, C	Required Live Storage Volume (m ³)	Peak Discharge Rate (m ³ /s)	Lowest Ground Level (m)	Freeboard Level (m)	HWL (m)	NWL (m)	Live Storage Depth (m)	Water Surface @ NWL (ha)	PUL (ha)
1	51.7	0.76	50,000	1.71	622.8	622.8	622.5	620.8	1.7	1.4	2.6
2	89.9	0.74	85,200	1.56	623.1	623.1	622.8	621.3	1.5	3.8	5.6
3	53.5	0.73	50,000	1.29	623.8	623.8	623.5	621.8	1.7	1.7	3.0
4	63.7	0.65	52,400	1.13	624.5	624.3	624.0	622.3	1.7	1.8	3.1
5	75.6	0.66	63,700	0.58	626.0	625.5	624.5	622.8	1.7	2.6	4.2
6	59.8	0.85	64,900	0.18	628.0	627.5	627.0	625.0	2.0	2.2	3.6
7	58.6	0.86	63,900	0.18	627.0	626.5	626.0	624.0	2.0	2.2	3.6
8	55.2	0.75	52,900	0.17	626.5	626.0	625.5	624.0	1.5	2.6	4.2
9	63.5	0.76	61,600	0.36	626.0	625.5	625.0	623.5	1.5	2.9	4.5
10	61.79	0.81	63,400	0.19	629.0	628.5	628.0	626.0	2.0	2.2	3.6
11	77.9	0.80	79,400	0.42	628.0	627.5	627.0	625.0	2.0	2.8	4.4

5.3.3 SWMF Interconnecting Storm Sewers

SWMF interconnecting storm sewers are to be located along municipal roadways or other public corridors and are to be designed to pass discharges from upstream SWMFs without surcharging. Vertical constraints and other design considerations are identified in the previous section as the design of the interconnecting pipes must be developed in conjunction with the design of the SWMFs. Key conceptual (approximate) interconnecting pipe design details are provided in **Table 5.3**.

The gradient of the proposed interconnected stormwater system to drain the annexation area lands east of Highway 21 to Ross Creek is very flat with little drop in elevation as they drain east. In addition, Ross Creek is very shallow as it crosses the northeast corner of the annexation area. This means that there will be little flexibility in the design of the SWMF water levels and interconnecting pipe system to achieve positive drainage into Ross Creek. The majority of the interconnecting pipe system will need to be designed at very flat grades. In addition, the interconnecting pipes will need to contribute to downstream SWMFs at NWL, which will make them susceptible to receiving backflows from the downstream facilities. While system backflows may not be desirable the system will still be able to drain effectively by gravity.

The outlet orifice size controls the pond outlet rate to the outlet trunk and was sized using a release rate of 3.0 L/s/ha plus the controlled release rate of upstream ponds. The orifices were sized using the model which accounted for the peak head experienced in each pond during the 100-year, 24-hour simulation. The orifice sizes were rounded to the nearest 10 mm.

It is noted that the interconnecting storm sewers were sized to include upstream wetland areas and thus will not be affected if the wetland is Quarter Section R is developed.

Table 5.3: Conceptual SWMF Connectivity and Interconnecting Pipe Data

Connectivity		Configuration			Sizing			
Pipe # (U/S SWMF)	D/S SWMF	Length (m)	U/S Invert (m)	D/S Invert (m)	Slope (%)	Design Flow (m ³ /s)	Diameter (mm)	Outlet Orifice Diameter (mm)
1	Ross Creek	265	620.5	620.4	0.04%	1.82	1,650	940
2	1	701	621.0	620.9	0.01%	1.73	2,100	890
3	2	1,497	621.5	621.2	0.02%	1.29	1,650	800
4	3	466	622.0	621.9	0.02%	1.29	1,650	900
5	4	956	622.5	622.4	0.01%	0.91	1,650	740
6	5	934	624.7	624.4	0.10%	0.19	600	510
7	5	833	623.7	623.3	0.10%	0.25	750	240
8	9	465	623.7	623.7	0.05%	0.18	900	240
9	4	879	623.2	622.8	0.04%	0.55	1,050	360
10	11	446	625.5	625.3	0.05%	0.25	750	230
11	Pointe-aux-Pins Creek	165	624.5	624.3	0.10%	0.57	900	350
		188	624.3	608.0	0.7%	0.51	600	

Note: Outfall 11 includes a steep section of embankment between the houses of Pointe-aux-Pins Estates. The ground slope is about 8% but the outfall is assumed to be designed for a much flatter slope to avoid supercritical flows.

5.3.4 Discharges to Pointe-Aux-Pins Creek

SWMFs 10 and 11 are planned to discharge into the lower reaches of Pointe-Aux-Pins Creek located down in the river valley, upstream of existing bridge culvert BF00806. Based on the unit rate of 1.6 L/s/ha and the effective drainage area for Pointe-Aux-Pins Creek of 10,888 ha, the 1:100-year flow in the creek near its downstream end is estimated at about 17.4 m³/s. Peak 1:100-year discharges for SWMFs 10 and 11 are estimated at about 0.57 m³/s. This means that 1:100-year peak flows in Pointe-Aux-Pins Creek at culvert BF00806 may be about 18.0 m³/s.

BF00806 consists of a 3,200 mm diameter corrugated steel pipe (CSP) culvert approximately 34 m long, with a flow full capacity of about 16.9 m³/s. As a result, the expected maximum flow to capacity ratio is approximately 1.06 implying a minor capacity constraint and potential for minor surcharging at the culvert. This culvert can be expected to pass the proposed 18.0 m³/s design rate under a surcharge of about 0.04 m. The County roadway is located approximately 1.7 m above the creek, so it is expected that the culvert will be able to pass the expected 1:100-year flow without overtopping the roadway.

5.4 Ross Creek Conveyance Capacity Assessment

The capacity of Ross Creek channel and culverts through the city to convey the expected 1:100-year flows were assessed to confirm the 3.0 L/s/ha maximum discharge rate from the proposed annexation area SWMFs. If the creek channel and/or culverts were estimated to have conveyance capacity constraints, an option to reduce the maximum allowable discharge rates from the annexation area SWMFs may be considered.

The ability of the downstream creek system to convey the expected design flows in a manner that does not result in significant erosion risk was not assessed in this study. A creek erosion investigation is planned to be conducted as part of a future Ross Creek Basin Study and has potential to lead to reduced peak discharge rates from the proposed SWMFs.

5.4.1 Assessment Approach

Hydrology

Stormwater runoff from the majority of the annexation area, all areas east of Highway 21 (593 ha) is planned to discharge at a controlled rate of up to 3.0 L/s/ha during the peak of the 1:100-year design storm into Ross Creek, a short distance inside the city boundary. Ross Creek also receives runoff from its watershed catchment and from the Yorkville ditch system catchment at the city boundary at a maximum rate of 1.6 L/s/ha. Ross Creek then routes through the city, through several culvert crossings, and picks up additional runoff from the city’s storm sewer system. Lastly, runoff from a large rural catchment contributes to Ross Creek at a rate of 1.6 L/s/ha near its downstream end.

A conservative approach to hydrology was taken to estimate design flows. It involves assuming the peak inflows from all sources might occur at the same time, and as a result, would be cumulative. The rationale in support of this approach is as follows.

The contributing watershed hydrographs can be expected to have broad, drawn-out peak flows that would lag several hours behind peaks from hydrographs from the city. However, since runoff contributions from the annexation area would be controlled through SWMFs, it can conservatively be approximated that discharges from the SWMFs that would occur at the same time as peaks from the watersheds would be close to peak discharges.

In addition, weather radar data supports the understanding that large events in the region do not occur over large areas the scale of the Ross Creek watershed at a consistent high intensity across the whole area at the same time. Large events occur in cells where the highest intensities occur over smaller areas closer in size to the annexation area. As a result, a dynamic simulation of expected runoff peaks was not conducted. Instead, a conservative approach was taken to estimate 1:100-year creek flows that involved estimating the peak flows expected from all contributing sources and simply adding them up.

Estimated 1:100-year peak flows that would contribute to Ross Creek once the Yorkville ditch is realigned and extended along the south boundary of the city, and once the annexation area develops, are summarized in **Table 5.4**.

Table 5.4: Estimated Peak 1:100 Year Future Inflows to Ross Creek

Source	Contributing Area (ha)	1:100-Year Unit Rate (L/s/ha)	1:100-Year Peak Rate (m ³ /s)	Portion of Total
Ross Creek Watershed to City	7,397	1.6	11.8	23%
East Tributary Watershed to City	2,809	1.6	4.49	9%
Yorkville Ditch (realigned)	2,672	1.6	4.28	8%
Annexation Area East SWMFs	593	3.0	1.78	3%
East Tributary	2,809	1.6	4.49	9%
City – controlled	379	3.0	1.14	2%
City – uncontrolled	224	-	24.36	47%
TOTAL	-	-	52.38	100%

Notes:

1. Rural watershed areas are effective drainage areas.
2. Estimated peak flows from city sewers were estimated using the Rational Method as the 1:5-year flows, since catch basin inlets tend to limit flows to the sewer system to rates in the order of the 1:5-year peaks during large events, with excess flows remaining on the surface until catch basin and downstream sewer capacities become available.

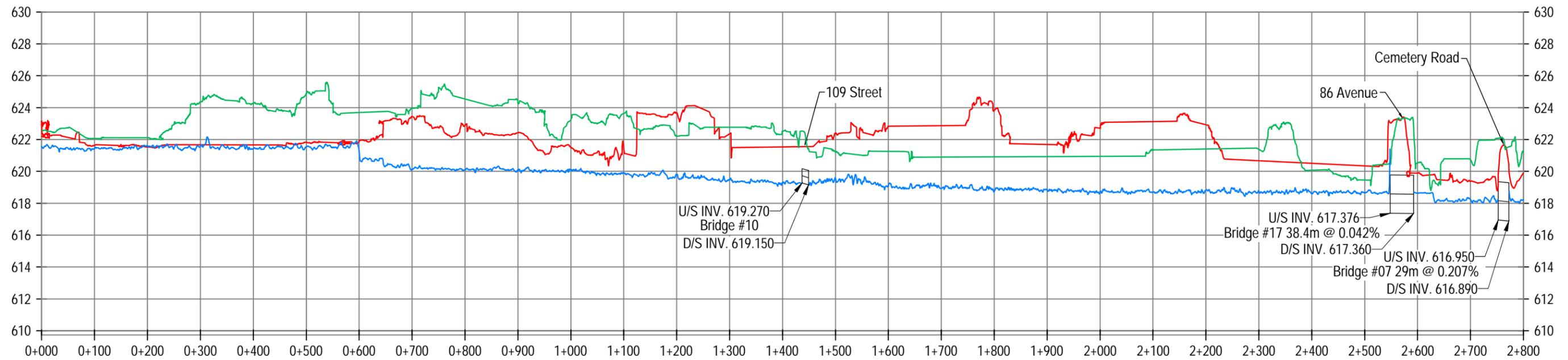
The most important observation that can be made from this information is that future discharges from the annexation area SWMFs to Ross Creek represent a very small portion of the peak flows within the creek during a 1:100-year event (about 3%). This means that any refinements to the proposed 3.0 L/s/ha release rate for the annexation area SWMFs would have little impact on the total flows in the creek.

Hydraulic Assessment

A hydraulic analysis was undertaken, using the PCSWMM computer simulation modelling software, to confirm the capacity of Ross Creek and its culvert crossings as it routes through the city to convey the design flows expected during a 1:100-year event design condition. Ross Creek as it routes through the city is shown in plan/profile on **Figures 5.6, 5.7 and 5.8**, with the upper portion shown on **Figure 5.6**, a central portion shown on **Figure 5.7**, and the furthest downstream portion shown on **Figure 5.8**. Chainage distances along the creek centerline from where the creek enters the city (Station 0+000) to where the creek enters the river (Station 8+840), almost 9 km, are shown on the plan/profiles, along with all culvert crossings between. Shown on the figures are the locations and elevations of the creek bottom, along with the left and right top-of-bank elevations, providing an indication of the changing depth of the creek valley system as it routes through the city. It can be observed from the figures that the creek bottom drops from an elevation of about 621.5 m as it enters the city, to an elevation of about 597.5 m as it enters the river, a drop of about 24 m through the city.

The watersheds contributing to Ross Creek are shown on **Figure 5.2**, with the future Yorkville Ditch watershed shown on **Figure 5.4**. The total area contributing from the city's storm sewer systems is outlined on **Figure 5.1**, and a plan showing sub-catchment areas that contribute directly and those that route through SWMFs is provided in **Appendix B**.

A hydraulic model of the creek and culvert system was constructed in PCSWMM. Configuration information on all culverts was entered in the model to allow for conveyance capacity calculations, including upstream and downstream invert elevations, culvert diameters or cross-sectional measurements, culvert lengths, and material types. A digital surface was imported into the model along the route of the creek that fully represented the creek shape. The model tool developed cross-sections from the digital surface at established intervals and selected representative cross-sections for routing each channel segment. The model then developed estimates of channel conveyance capacity for each channel segment by routing flows along the segment based on the cross-section shapes, channel longitudinal slope and estimated roughness. Details of the creek hydraulic assessment are provided in **Appendix B**.



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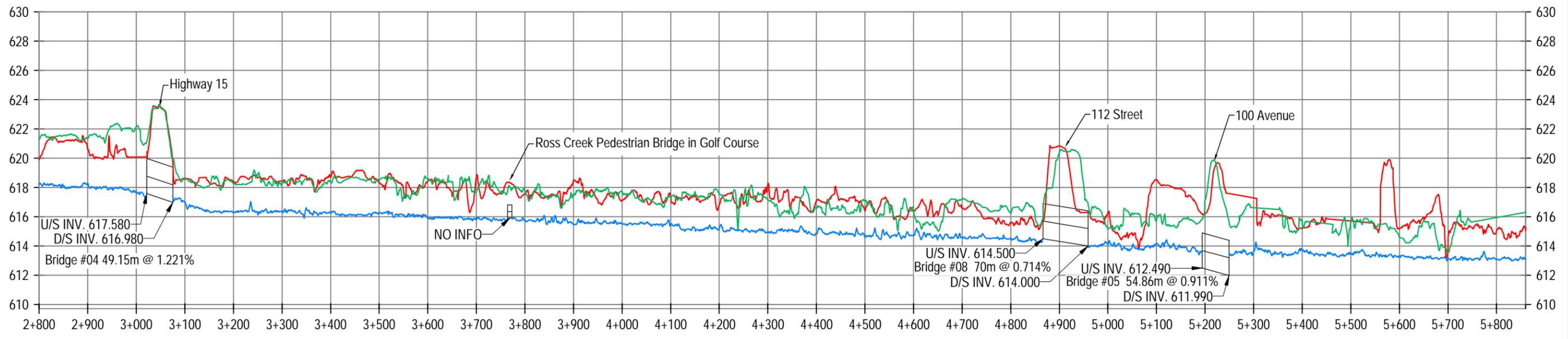
- Ross Creek - Centerline
- Ross Creek - Left Bank
- Ross Creek - Right bank

**FORT SASKATCHEWAN ANNEXATION
AREA SERVICING DESIGN BRIEF**
ROSS CREEK PLAN/PROFILE

FIGURE 5.6

PLAN 1:5000 PROFILE N.T.S.





Matt Julion / Jun. 10. 22 / G:\Projects\160001610016178_Annexation_Servicing_Design_Brief\02_CADD\00_Drafting\04_Servicing\16178_RossCreek\Alignment.dwg

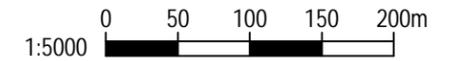


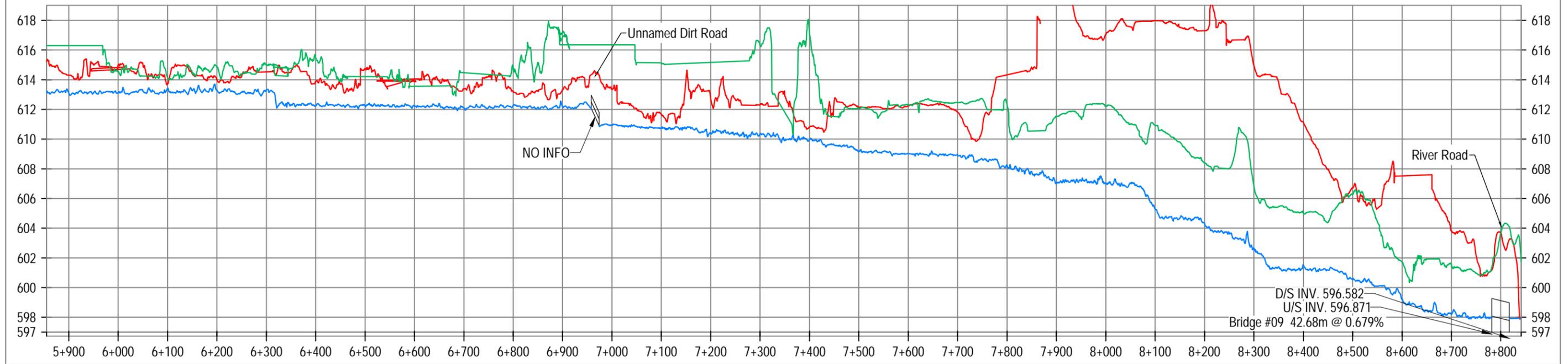
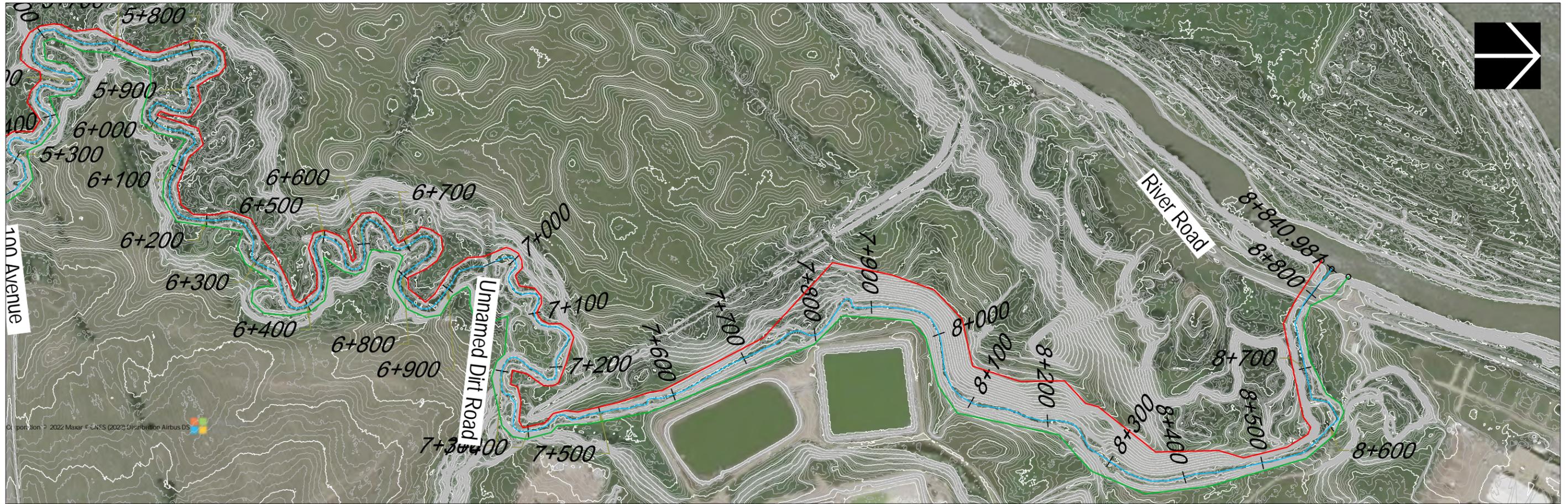
- Ross Creek - Centerline
- Ross Creek - Left Bank
- Ross Creek - Right bank

**FORT SASKATCHEWAN ANNEXATION
AREA SERVICING DESIGN BRIEF**
ROSS CREEK PLAN/PROFILE

FIGURE 5.7

PLAN 1:5000 PROFILE N.T.S.





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 2022 Maxar © CANES (2022) Distribution Airbus DS

- Ross Creek - Centerline
- Ross Creek - Left Bank
- Ross Creek - Right bank

**FORT SASKATCHEWAN ANNEXATION
AREA SERVICING DESIGN BRIEF**
ROSS CREEK PLAN/PROFILE

FIGURE 5.8
PLAN 1:5000 PROFILE N.T.S.



5.4.2 Ross Creek Hydraulic Assessment Results

Channel Sections

As Ross Creek routes through the city, the creek is generally comprised of a main channel with a flood fringe beyond the channel to the creek valley slopes. In the upper portion of the creek running through the annexation area, the main channel is relatively small with a greater flood fringe area. Channel transects (cross-sections) were developed at multiple locations along the creek through the city and included in the modelling. The model results for each transect are presented in **Appendix B** and show that peak flows during the 1:100-year event are mostly contained within Ross Creek for its entire length within the city. The Ross Creek channel through the city does not appear to have any significant conveyance capacity constraints.

Culverts

Configuration information and hydraulic capacity model results for the Ross Creek culverts through the city are summarized in **Table 5.5**. Details of the hydraulic modelling are provided in **Appendix B**. Full ratios are the proportion of peak flow to flow full capacity, where values greater than 1.0 indicate peak flows exceeding flow full capacity.

Table 5.5: Ross Creek Culvert Conveyance Capacities and Performance

Bridge #	Culvert		Inverts (m)		Road Elev. (m)	Length (m)	Slope (%)	Max Flow (m ³ /s)	Size (mm)	Shape	Capacity (m ³ /s)	Max Flow / Capacity
	Station	Crossing	U/S	D/S								
17	2+550	86 Ave	617.38	617.36	623.34	38.4	0.04%	24.4	8,030	Semi Circular	32.9	0.74
7-1	2+750	Cemetery Rd	616.95	616.89	621.83	29.0	0.21%	13.1	3,200	Circular	14.3	0.92
7-2			617.58	617.45	621.83	25.0	0.52%	11.3	2,600	Circular	13.1	0.86
4-1	3+025	Hwy 15	617.58	616.98	623.30	49.2	1.22%	9.1	3,000 x 2,200	Box	41.4	0.22
4-2			617.58	616.98	623.30	49.2	1.22%	9.1	3,000 x 2,200	Box	41.4	0.22
4-3			617.58	616.98	623.30	49.2	1.22%	9.0	3,000	Circular	29.3	0.31
8-1	4+860	99 Ave	614.50	614.00	620.50	70.0	0.71%	20.5	3,200	Circular	26.7	0.77
8-2			614.50	614.00	620.50	70.0	0.71%	20.5	3,200	Circular	26.7	0.77
5-1	5+195	100 Ave	612.49	611.99	619.58	54.9	0.91%	20.9	3,670	Circular	43.4	0.48
5-2			612.49	611.93	619.58	59.0	0.95%	21.9	3,800	Circular	48.6	0.45
9	8+780	River Rd	596.87	596.58	604.00	42.7	0.68%	48.3	4,920	Circular	81.9	0.59

Note: Inlet / Outlet offsets applied in model to ensure culvert slopes are consistent with digital elevation model (DEM).

The following can be observed from these assessment results:

- As discussed earlier, the approach taken to estimate the 1:100-year peak flows can be considered somewhat conservative, and as a result, the absolute values of performance expectations provided in the above table should be considered approximate;
- The above crossing capacities are based on flow full conditions – culverts can pass additional flows under surcharge conditions; and
- None of the culverts show a maximum flow / capacity ratio greater than 1.0 indicating that all of the culvert crossings have sufficient capacity.

From this hydraulic assessment the following can be concluded:

- The culverts along Ross Creek through the city can pass runoff expected from a 1:100-year design event from the contributing watersheds, from the existing city storm drainage systems and from the future annexation area discharging at a peak rate of 3.0 L/s/ha; and
- Changes in the annexation area SWMF discharge rate would not have much impact on the flows in Ross Creek as those contributions are very small (3%) in relation to total flows in the creek.

Current City Design Criteria

As noted earlier, the current City design criteria for culvert crossings along natural watercourses through the city is runoff expected from the 1:200-year design event. These rates would be incrementally greater than the 1:100-year rates presented in **Table 5.5**. Further work would be required to estimate 1:200-year creek flows to confirm that capacities of the existing culverts to meet these criteria, but since the existing Ross Creek culverts appear to have spare capacity to pass the 1:100-year flows, it is expected that they should also be able to pass 1:200-year flows with the potential for some culvert crossings to experience some degree of surcharging.

5.5 Staging and Interim Servicing

5.5.1 Quarter Section Local Staging

It is recommended that the first stages of development within a quarter section construct the ultimate SWMF, outlet structure and portion of downstream outlet piping to the boundary of the quarter section under development. Runoff from their stage of development must be directed to the SWMF.

The developers should also construct the interconnecting piping from any upstream SWMFs to the on-site SWMF and activate the upstream outlet system to allow the upstream SWMFs to drain down to the on-site SWMF by gravity. This would then reduce the number of SWMFs that Operations staff would need to monitor and occasionally pump out, to the furthest downstream pond.

5.5.2 Interim Servicing

Broadly, as the proposed stormwater servicing concept involves a system of interconnected SWMFs draining downstream to the next facility until the chain of facilities eventually discharges into a creek, it would be ideal that the systems develop from the downstream ends in an upstream direction so that the ultimate pond gravity discharge routes are in place for each facility as it develops. Unfortunately, development staging rarely proceeds in this direction, or is driven by stormwater servicing considerations.

Fortunately, a reasonable approach to the provision of stormwater management servicing during development staging taken by most municipalities involves allowing SWMFs to be constructed and operated for an interim period without the ultimate gravity downstream conveyance piping systems in place. The municipality would then need to take the following measures to ensure that the SWMFs can provide their intended stormwater management servicing functionality through the interim period until such time as the downstream gravity outlet systems are in place:

- Monitor the levels in each SWMF on a regular basis and following significant runoff events; and
- Pump out excess pond volumes during the rainy season (June, July and August) to ensure capacity is available to accommodate runoff from a potential extreme event.

This approach involves an operational commitment by the municipality to facilitate non-contiguous staging of the stormwater management systems.

Specific recommendations include:

- Water level monitoring
 - Have the developer provide a staff gauge within the SWMF located within the live storage zone within the facility at a point near the nearest roadway and with markings easily read from the roadway;
 - Monitoring should involve driving by each facility and noting the water level in relation to the live storage capacity; and
 - Monitoring should be considered at the following frequencies:
 - Once/month in the spring and fall;
 - Once/week through the summer wet weather season (June, July and August); and
 - Following any significant runoff event (maybe a few per year).
- Pump-out
 - Pump-out should be considered when:
 - Pond levels are significantly above NWL which would mean that the available live storage volume within the facility would be significantly reduced; and
 - Pond levels are greater than about 0.3 m above NWL during the summer wet weather season (June, July and August) to ensure adequate storage capacity is available during a period where extreme events tend to occur; and
 - Pump-out can be through the use of a small capacity portable pump with the inlet hose inserted in the outlet structure and the outlet hose directing discharges into the nearest downstream roadway ditch or watercourse.

It is anticipated that any given SWMF may require pump-out a limited number of times each year because most runoff events through each season tend to be relatively small, and if constructed as engineered wetlands, SWMFs can experience a reasonable degree of water losses through a season from the natural processes of evaporation and evapotranspiration.

5.6 Cost Estimate

Cost estimates for the proposed on-site stormwater management system were prepared and are shown in **Table 5.6**.

Table 5.6: Stormwater Management On-Site System Cost Estimate

Item	Description	Cost (\$)	Engineering (\$)	Contingency (\$)	Total (\$)
1	Outlet Pipe System (1,650 mm)	398,000	59,000	120,000	577,000
	1,650 mm Outfall into Creek	100,000	15,000	30,000	145,000
2	Outlet Pipe System (2,100 mm)	1,142,000	171,000	343,000	1,656,000
3	Outlet Pipe System (1,650 mm)	1,992,000	299,000	598,000	2,889,000
4	Outlet Pipe System (1,350 mm)	566,000	85,000	169,000	820,000
5	Outlet Pipe System (1,200 mm)	1,033,000	155,000	310,000	1,498,000
6	Outlet Pipe System (600 mm)	601,000	91,000	180,000	872,000
7	Outlet Pipe System (750 mm)	634,000	95,000	190,000	919,000
8	Outlet Pipe System (600 mm)	320,000	48,000	96,000	464,000
9	Outlet Pipe System (1,050 mm)	815,000	122,000	244,000	1,181,000
10	Outlet Pipe System (600 mm)	320,000	48,000	96,000	464,000
11	Outlet Pipe System (900 mm)	168,000	25,000	51,000	244,000
	Outlet Pipe System (600 mm)	128,000	19,000	39,000	186,000
	600 mm Outfall into Creek	100,000	15,000	30,000	145,000
TOTAL (\$)		8,317,000	1,247,000	2,496,000	12,060,000

Notes:

1. Cost estimates include allowances for engineering (15%) and contingency (30%).
2. SWMF costs are excluded since they are the responsibility of the developer as per the City of Fort Saskatchewan Off-Site Levy Bylaw.
3. Outlet pipe system costs include trenching, backfill, supply and installation of trunks as well as manholes spaced at 120-150 m distances.
4. Outfall to creek is flared end with c/w grate, sediment trap/sump, riprap and geotextile.

The cost estimates for the Yorkville Ditch re-alignment are shown in **Table 5.7**. The total estimated cost for the ditch re-location is estimated to be \$2.5 M.

Table 5.7: Yorkville Ditch Re-Alignment Cost Estimate

Item	Description	Unit Rate (\$/unit)	Unit	Quantity (unit)	Cost Estimate (\$)	Engineering (\$)	Contingency (\$)	Total (\$)
1	Excavation (5.5 m ² x 5,500 m)	7	m ³	30,525	214,000	32,000	64,000	310,000
2	Topsoil and Hydroseeding (10 m x 5,500 m)	8	m ²	55,500	444,000	67,000	133,000	644,000
3	Landscaping	100,000	L.S.	1	100,000	15,000	30,000	145,000
4	1,650 mm CSP Culvert Crossing	11,000	m	20	220,000	33,000	66,000	319,000
5	Land Acquisition	250,000	ha	3.0	750,000	113,000	225,000	1,088,000
TOTAL (\$)					1,728,000	260,000	518,000	2,506,000

Notes:

1. Cost estimates include allowances for engineering (15%) and contingency (30%). The contingency of 30% accounts for additional culverts required at approaches along the re-aligned ditch ROW.
2. Ditch cross-section (5.5 m²) and culvert size (1,650 mm) are conceptually sized based on a 1:100-year event over the Yorkville ditch watershed (1.6 L/s/ha release rate).
3. Re-location of the Yorkville ditch will require Water Act approval which will have budget implications.
4. Land acquisition costs assume approximately \$100,000/acre and include the 2 km section of land south of Township Road 542 and approximately 1 km of pipeline ROW before it is expected that the ditch will cross over to the inside of the annexation boundary.
5. Ditch ROW within the annexation area is assumed to be land swapped with available land from the abandoned existing ditch.
6. Culvert assumes full installation including all seals, riprap and CSP material.

Table 5.8 summarizes the cost estimates for the stormwater management facilities which are to be paid for by developers.

Table 5.8: Stormwater Management Facility Cost Estimate

SWMF	Cost (\$)	Engineering (\$)	Contingency (\$)	Total (\$)
1	658,000	99,000	198,000	955,000
2	1,400,000	210,000	421,000	2,031,000
3	754,000	114,000	227,000	1,095,000
4	820,000	124,000	247,000	1,191,000
5	1,383,000	208,000	416,000	2,007,000
6	1,145,000	173,000	344,000	1,662,000
7	1,145,000	173,000	344,000	1,662,000
8	1,197,000	180,000	360,000	1,737,000
9	1,292,000	195,000	389,000	1,876,000
10	1,145,000	173,000	344,000	1,662,000
11	1,379,000	207,000	414,000	2,000,000
TOTAL (\$)	12,318,000	1,856,000	3,704,000	17,878,000

Notes:

1. Cost estimates include allowances for engineering (15%) and contingency (30%).
2. These costs are presented for information purposes and are to be paid by developers as each quarter section begins development.

6.0 Water

6.1 Existing System Overview

6.1.1 Water Transmission Mains

The City is currently serviced by the Capital Region Northeast Water Services Commission (CRNWSC), primarily from the Northside Line servicing the Main Reservoir. The 300 mm transmission main from the CRNWSC Northside Line has limited capacity and the CRNWSC is planning on twinning this line.

The City is also fed from the CRNWSC Southside Line from Strathcona County, which feeds both the Westpark and Main Reservoirs. The CRNWSC generally does not use the Southside Line based on the higher unit costs for water.

The City is currently reviewing its options for water supply, including the potential to connect directly to the EPCOR transmission main north of the North Saskatchewan River.

6.1.2 Main Reservoir

The Main Reservoir is east of the Highway 15 exit ramp onto 95 Street. The CRNWSC services the Main Reservoir and Pumphouse through a 170 m, 400 mm diameter steel fill line. The fill line passes through a 250 mm pressure control valve and a 250 mm flow control valve prior to entering the Main Reservoir. The CRNWSC Master Plan, Associated Engineering, 2016, indicates that the current Main Reservoir filling rates are set at 29.1 L/s and 66.7 L/s.

The total distribution pump capacity in the Main Reservoir is 330 L/s. There are four pumps with three in operation and fourth pump as a back-up pump, as summarized in **Table 6.1**. The Main Reservoir provides approximately 13,638 m³ of storage.

Table 6.1: Summary of Existing Main Reservoir Pumps

Reservoir	Number of Pumps	Design Flow (L/s)	Design Head (m)
Main Reservoir Pump	4	110	42

6.1.3 Westpark Reservoir

The Westpark Reservoir and Pumphouse was constructed in 2000 and is northwest of Highway 21 and Westpark Boulevard, adjacent to a residential area walking trail. It is serviced by a 2,260 m long lateral that is 300 mm in diameter (PVC DR 18) that passes through a 200 mm pressure control valve and a 200 mm flow control valve. This lateral pipe turns west off the Southside Line parallel to Meadowview Drive towards Southfort Drive, north towards Southfort Boulevard, and then west along Southfort Boulevard towards the reservoir. The CRNWSC Master Plan, Associated Engineering, 2016, indicates that the current Westpark Reservoir filling rates are set at 36.1 L/s and 55.6 L/s.

Current total Westpark distribution pump capacity is 120 L/s, and 303 L/s for fire pump capacity as shown in **Table 6.2**. The Westpark Reservoir provides approximately 10,000 m³ of storage.

Table 6.2: Summary of Existing Westpark Reservoir Pumps

Reservoir	Number of Pumps	Design Flow (L/s)	Design Head (m)
Westpark Reservoir Distribution Pump	2	60	56
Westpark Reservoir Fire Pump	1	303	46

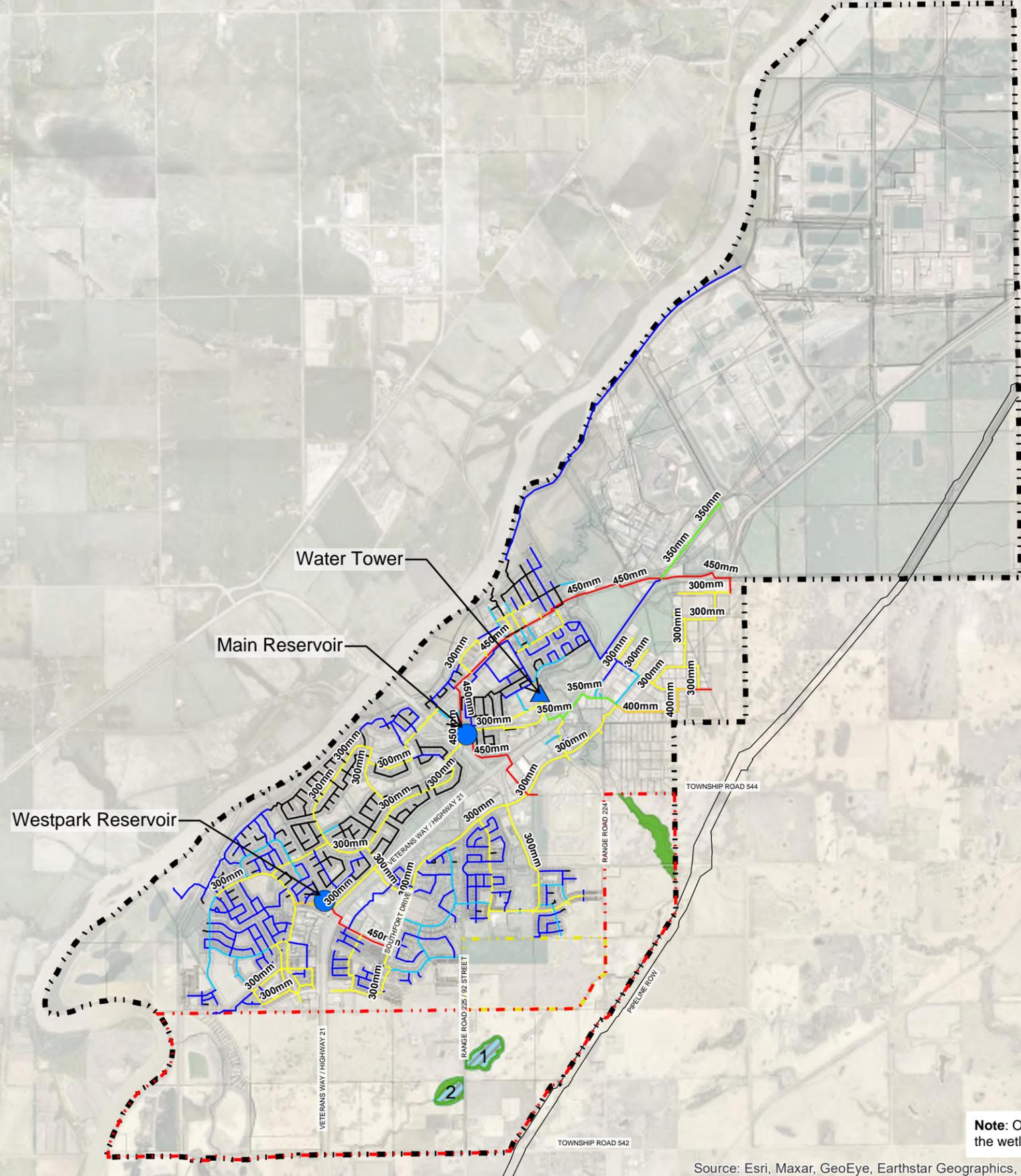
6.1.4 Water Tower

The water tower is at 9421 – 101 Street and provides approximately 946 m³ of storage. The current operation philosophy between the water tower and the pumphouses is such that when the maximum water elevation within the water tower is at 669.9 m, no pumps are on at either pumphouse. When hydraulic grade line (HGL) drops below 662 m, the fire pump will be in operation.

6.1.5 Water Distribution System

The existing water pipes in Fort Saskatchewan are comprised of cast iron, asbestos cement, Hyprescon, steel and PVC. The diameter of the system ranges from 100 mm to 450 mm. The existing water system is shown in **Figure 6.1**.

- Legend**
- Municipal Boundary
 - - - Southfort Development Area
 - · - Annexation Area
 - ▨ Potentially Crown Claimable Wetland
 - 🍀 Environmental Reserve
 - Reservoirs
 - ▲ Water Tower
- Water Mains Diameter**
- Existing System, Less than 150 mm
 - Existing System, 200 mm
 - Existing System, 250 mm
 - Existing System, 300 mm
 - Existing System, 350 mm
 - Existing System, 400 mm
 - Existing System, 450 mm
 - Proposed Road Network



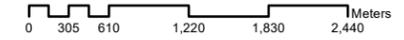
Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Existing Water Distribution System

FIGURE 6.1

1:55,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS



6.2 Proposed Servicing of Pre-Annexation Area

In 2020, the City engaged Associated Engineering to undertake a study entitled 2020 Water Modeling and Hydraulic Network Analysis (2020 HNA). This study, which was completed in November 2021, focuses on short-term and ultimate servicing within the pre-annexation boundary. This study is directly relevant to the servicing of the annexation area and highlights of the report are presented below:

- Models were developed for existing (2020) conditions, short-term development in 2025 which includes upgrades to satisfy fire flow criteria and new watermain for general development areas for an approximate population of 31,612, and ultimate development of the pre-annexation area.
- The report indicated that the water tower could remain in service or could be removed with little impact on the water system performance.
- A water truck fill was included in the water model with a design flow rate of 45 L/s located at 8614 – 111 Street.
- The existing system analysis recommended local upgrades within the pre-annexation area to address fire flow deficiencies. Recommended local upgrades to the existing system will not impact flow to the annexation area.
- The short-term development is based on the projected 2025 population of 31,612, representing five years of growth from 2020.
- Upgrades as recommended by the report to the main reservoir pumping capacity to meet PHD, as well as MDD plus fire flows under the short-term development condition, were completed in 2021 according to the City.
- An additional 4,325 m³ of storage will be needed in 2034 at the main reservoir according to the 2020 HNA.
- The 2020 HNA also recommended upgrading of the Westpark reservoir pumps in 2038 to meet PHD scenarios of 470 L/s which correspond to a population of 47,142.
- The ultimate development scenario included full buildout of the pre-annexation area (residential and industrial but excludes most of northern portion of heavy industrial) plus 15% densification of the currently developed areas through infill development.

The short-term development was considered to be the most relevant to the interim servicing of the annexation area. Thus, ISL used the short-term development model for annexation area interim servicing scenarios. The 15% densification is expected to occur over a very long period of time and thus will only apply to the full buildout of the post-annexation ultimate servicing scenario.

The assumed population and water demands for the pre- and post-annexation areas are shown in the following section.

6.3 Future Growth and Demand

The total water demand for the annexation area is shown in **Table 6.3**. The total projected population growth for the pre- and post-annexation areas and water demands are shown in **Table 6.4**. The pre-annexation area growth projections and water demands are based on the 2020 HNA. The two undeveloped quarter sections in Southfort are shown separately. The per-capita and non-residential water demands are also based on the 2020 HNA.

Population and growth projections for the annexation area are based on projected land uses and densities presented in Section 2. The combined population/growth projections for the pre-annexation area plus annexation area were based on the following assumptions:

- Annexation development starts with nominal development within the 5-year (2025) development horizon; and
- Growth within the pre-annexation and annexation areas will occur concurrently until both areas are fully developed.

Table 6.3: Annexation Area Demand per Quarter Section

Quarter Section	Legal	Population	Residential Demand (L/S)	Total ICI Area (HA)	ICI Demand (L/s)	ADD (L/s)	MDD (L/s)	PHD (L/s)
C	NE14-54-23-4	207	0.6	0.5	0.0	0.6	1.2	1.9
F	NW13-54-23-4	1,003	2.9	2.6	0.1	3.0	6.0	9.1
J	NE13-54-23-4	2,549	7.4	19.1	0.9	8.2	16.5	24.7
K	SE13-54-23-4	2,496	7.2	18.0	0.8	8.0	16.1	24.1
M	NW18-54-22-4	1,717	5.0	23.8	1.1	6.0	12.1	18.1
N	SW18-54-22-4	1,609	4.7	23.9	1.1	5.7	11.5	17.2
Q	NE18-54-22-4	3,635	10.5	9.6	0.4	11.0	21.9	32.9
R	SE18-54-22-4	3,191	9.2	7.8	0.4	9.6	19.2	28.7
S	NW17-54-22-4	2,972	8.6	7.9	0.4	9.0	17.9	26.9
T	SW17-54-22-4	3,198	9.3	9.6	0.4	9.7	19.4	29.1
V	SE20-54-22-4	375	1.1	0.9	0.0	1.1	2.2	3.4
W	NE17-54-22-4	2,516	7.3	7.0	0.3	7.6	15.2	22.8
X	SE17-54-22-4	314	0.9	0.8	0.0	0.9	1.9	2.8
Z	SW28-54-22-4	2,958	8.6	7.5	0.3	8.9	17.8	26.7
AA	NW21-54-22-4	3,473	10.0	8.6	0.4	10.4	20.9	31.3
AB	SW21-54-22-4	1,540	4.5	4.0	0.2	4.6	9.3	13.9
AC	NW16-54-22-4	30	0.1	0.1	0.0	0.1	0.2	0.3
TOTAL		33,783	97.8	151.6	6.8	104.6	209.1	313.7

Note: The population, ICI area, and water demands in Quarter Section R could be higher if the existing wetland is developed. This should be reviewed at the ASP stage.

Table 6.4: Population and Growth Projection for Pre-Annexation Area and Annexation Area

Scenario	Existing	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	Stage 10	Ultimate
Pre-Annexation Area												
Population excluding Southfort	27,669	28,325	29,731	31,891	32,339	34,158	36,144	38,063	39,982	41,713	42,113	42,113
Southfort Population	0	0	0	1,263	3,287	4,602	5,847	5,847	5,847	5,847	5,847	5,847
Total Pre-annexation Population	27,669	28,325	29,731	33,154	35,626	38,759	41,991	43,910	45,829	47,560	47,960	47,960
Average Day Demand (L/s)	131	133	137	147	155	164	174	179	185	193	196	196
Annexation Area												
Residential Area (ha)	0	16	50	65	90	108	125	154	184	245	262	324
ICI Area (ha)	0	14	45	62	87	92	97	105	113	131	135	152
Total Population	0	1,675	5,269	6,846	9,374	11,241	13,009	16,090	19,171	22,440	27,040	33,782
Average Day Demand (L/s)	0	5	17	23	31	37	42	51	61	80	90	105
Total Population	27,669	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000	70,000	75,000	81,742
Total Average Day Demand (L/s)	131	138	155	170	186	201	216	231	246	272	286	301
Total Max Day Demand (L/s)	217	232	264	295	326	357	386	416	446	500	528	556
Total Peak Hour Demand (L/s)	303	325	374	420	467	513	557	602	647	727	769	812

Notes:

1. The discrepancy between the pre-annexation area demand from the other disciplines is referenced in point 3 in Section 2.3.
2. It should be noted that the population projections between water and wastewater are identical; however, due to peaking factor calculations and assumptions from the background servicing studies, the flow demands are not necessarily identical.
3. The population and water demands in the annexation area will be higher if the wetland in Quarter Section R is developed

6.4 Reservoir Storage Requirements

The City’s reservoir storage requirements will be based on the total system demands within the pre-annexation and annexation areas. The 2020 HNA report indicated that an additional 5,271 m³ of storage would be needed at full buildout of the pre-annexation area. When the annexation area is fully developed, the additional storage required increases to 23,313 m³, as shown in **Table 6.5**.

Table 6.5: Water Storage Requirements for Pre-Annexation and Full Development Scenarios

Staging	Existing Storage	Estimated Population	Max Day Demand (m ³)	Fire Flow (m ³)	Bulk Water Station (m ³)	Total Storage Required (m ³)	Additional Storage Needed (m ³)	Cumulative Additional Storage Needed
Existing	23,638	27,669	14,857	2,516	270	17,643	0	0
Pre-Annexation	23,638	47,960	26,123	2,516	270	28,909	5,271	5,271
Total Including Annexation Area	23,638	81,742	44,164	2,516	270	46,951	18,042	23,313

Notes:

1. A bulk water station with a design flow rate of 45 L/s with no peaking factor is included as indicated in the 2020 HNA.
2. The existing storage assumes that the water tower will be decommissioned and no longer providing storage.
3. The storage needed for the pre-annexation ultimate will be higher (additional 946 m³) than documented in the 2020 HNA due to the additional water tower storage.
4. The annexation area storage requirements will increase slightly if the wetland in Quarter Station R is developed. Refer to Appendix D for details.

Based on the growth and demand projections listed in Section 6.3, the storage requirements for a range of total city growth horizons are shown in **Figure 6.2**. The 2020 HNA report proposed to add 5,271 m³ of storage at the Main Reservoir to address this storage deficit. With a total storage deficit of 23,313 m³ when the annexation area is considered, the future storage can be staged and constructed within the available space at the Main Reservoir, within a new reservoir in the annexation area, or a combination of both. **Figure 6.2** shows storage being constructed as needed for growth, with construction assumed to occur roughly every 10 years with a minimum of 5,000 m³ of storage constructed at a time.

The evaluation of preferred storage locations is presented in Section 6.6.

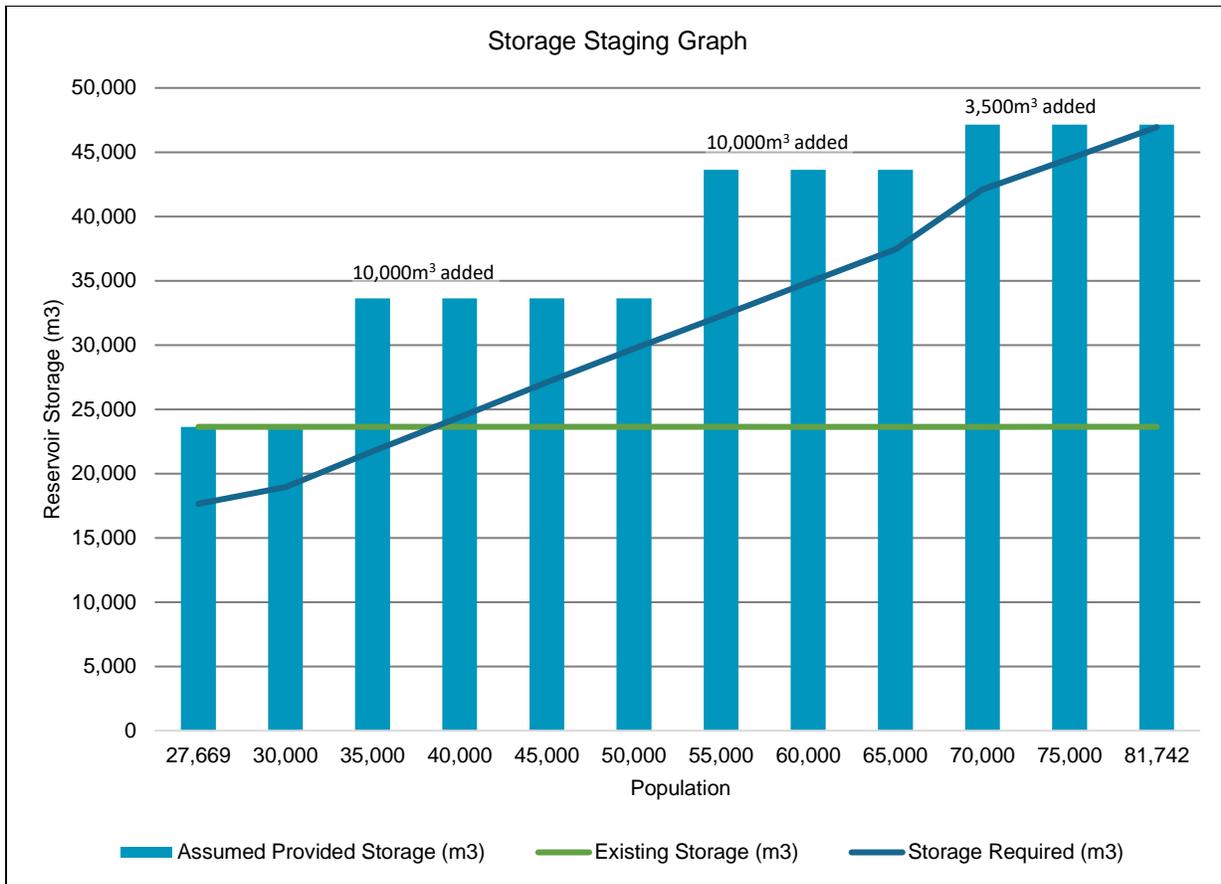


Figure 6.2: Storage Staging Based on Population Growth

6.5 Ultimate Servicing Options

The water distribution system within the annexation area depends on the location of the water reservoirs, including whether there is a reservoir within the annexation area and its location. It is understood that the main reservoir has space available for expansion and could potentially be used in combination with the Westpark reservoir to service the annexation area.

Two ultimate water distribution servicing options were developed for the annexation area:

- Servicing from the main and Westpark reservoirs only; and
- Servicing from the main and Westpark reservoirs, plus a new reservoir within the annexation area (location of reservoir within annexation area to be reviewed later in this section).

The ultimate water distribution system is assumed to be developed through a 300 mm grid, typically running through the middle of each quarter section. These mains would connect to existing and proposed 300 mm mains in the pre-annexation area. The 2020 HNA was used to establish the watermain sizes and locations within the pre-annexation area. The hydraulic model was then used to refine the water distribution systems for each of the above options.

Option 1 Upgrade Main Reservoir and Off-site Pipes

Option 1 proposes to upgrade the main reservoir for all future storage requirements and upgrade the main and Westpark reservoirs for all future pumping capacity upgrading. Hydraulic modelling was carried out for this option to determine the impact on the water distribution system and determine what off-site piping upgrades would be required. As the total water demands are significantly higher than that required in the 2020 HNA for the pre-annexation area, the pumping upgrades at both existing reservoirs were higher than that specified in the 2020 HNA.

The hydraulic analysis indicated that significant piping upgrades would be needed between the main reservoir and the annexation area to meet the PHD as well as MDD plus fire flow conditions. A 1.7 km long 350 mm transmission main would be needed from 101 Street south of 86 Avenue, running along 101 Street and connecting into the 300 mm stub at Sienna Boulevard. The off-site 350 mm pipe is needed to boost the southwest annexation corner to meet minimum pressure standard during PHD and to ensure that the upgrades from the main reservoir are being fully utilized. This option is shown in **Figure 6.3**.

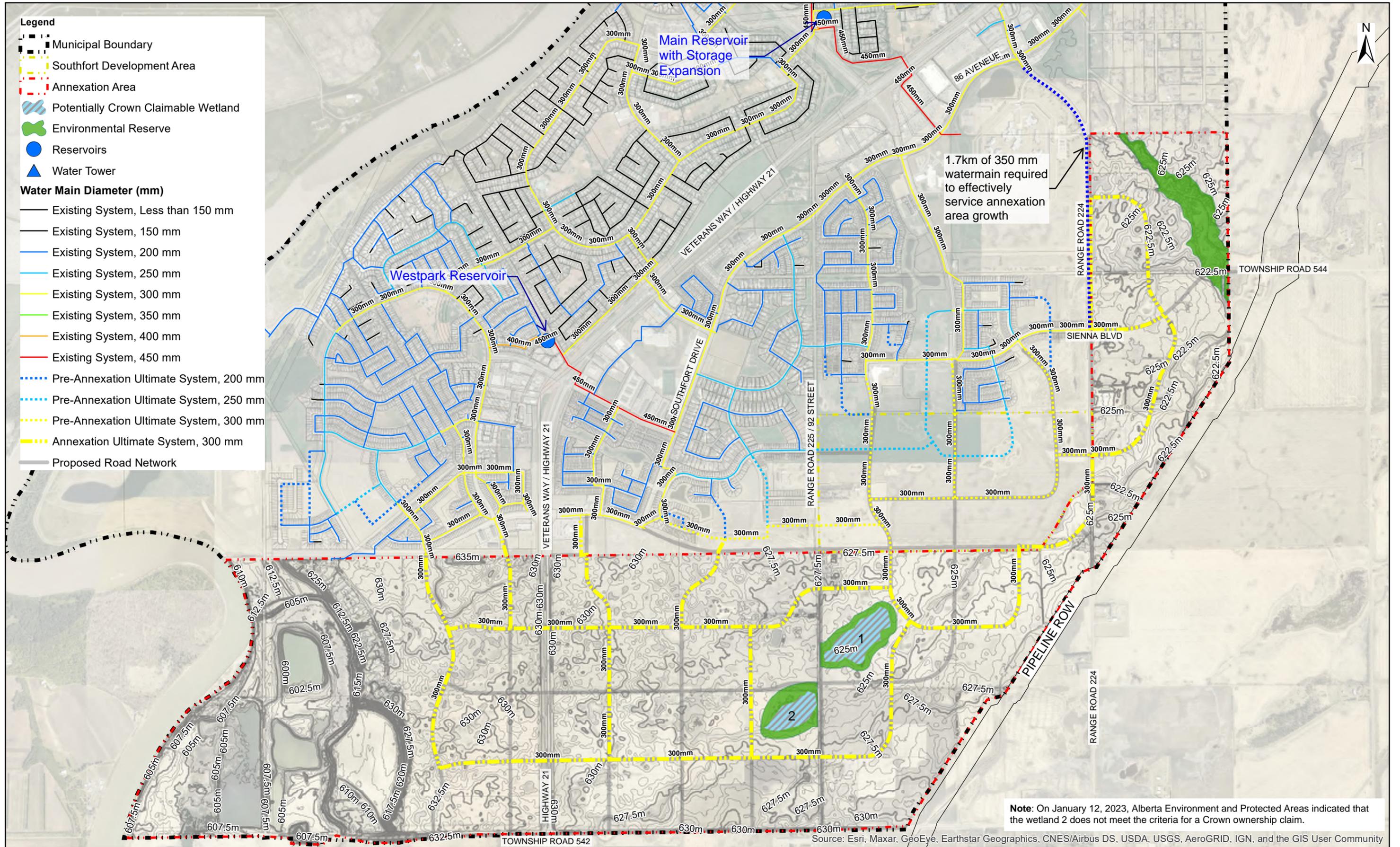
Hydraulic modelling was used to check for pipe velocities under the PHD conditions around the main reservoir (largest total demand scenario at main reservoir). There are short segments of piping downstream of the main reservoir with velocities greater than 3.0 m/s and 1.5 m/s that would have to be upgraded as part of the future main reservoir upgrading for this option.

Option 2 New Annexation Area Reservoir

Option 2 assumes that a new reservoir would be constructed within the annexation area which would work with the main and Westpark reservoirs to meet the ultimate city water demands. It is assumed that all or the majority of the future storage requirements would be constructed at the new reservoir site. Some storage could be constructed at the main reservoir if additional storage was needed and the City wanted to defer the construction of the new reservoir. The reservoir was assumed to be located in the central part of the annexation area, with other locations considered in **Section 6.6**.

The water distribution system for Option 2 is shown in **Figure 6.4**. The reservoir is shown east Highway 21 along the quarter line 800 m north of Township Road 542. This location provides some flexibility in which quarter section that requires a PUL dedication. However, placing the reservoir at this location does result in higher velocities and headlosses as it only connects to two 300 mm pipes. This can be addressed by either shifting the location to a 300 mm grid junction or by upsizing the connecting pipes to 400 mm. The 400 mm connections are shown in **Figure 6.4**.

As the three reservoirs are centrally located within their respective service areas, no additional distribution piping upgrades are needed. Pipe velocities for the PHD condition in this option remains below 1.5 m/s in the overall system, thus this is considered to be more efficient.



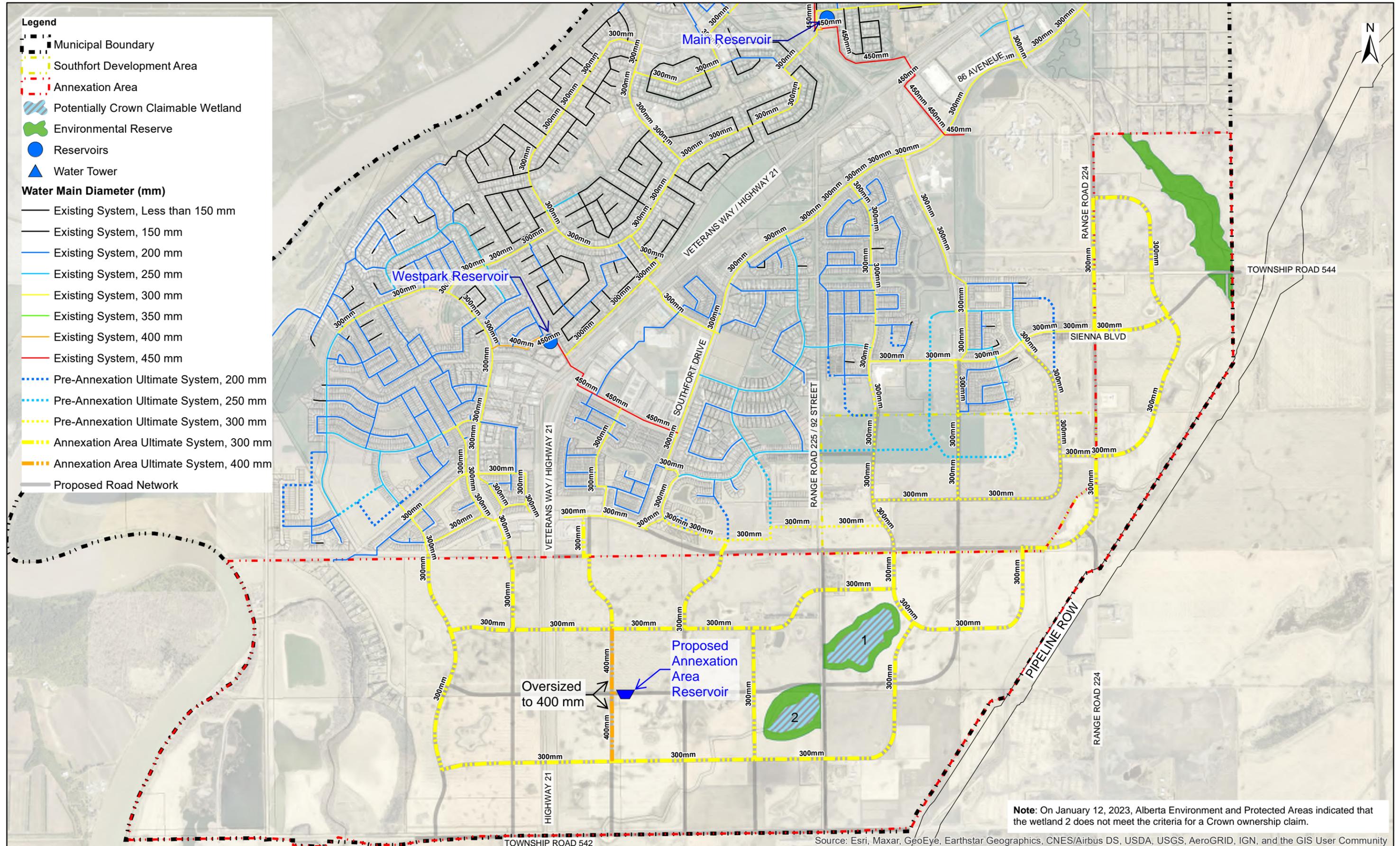
**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**
Option 1 - Main Reservoir with Off-Site Watermain

FIGURE 6.3

1:20,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS



- Legend**
- Municipal Boundary
 - - - Southfort Development Area
 - · - · Annexation Area
 - ▨ Potentially Crown Claimable Wetland
 - Environmental Reserve
 - Reservoirs
 - ▲ Water Tower
- Water Main Diameter (mm)**
- Existing System, Less than 150 mm
 - Existing System, 150 mm
 - Existing System, 200 mm
 - Existing System, 250 mm
 - Existing System, 300 mm
 - Existing System, 350 mm
 - Existing System, 400 mm
 - Existing System, 450 mm
 - · · Pre-Annexation Ultimate System, 200 mm
 - · · Pre-Annexation Ultimate System, 250 mm
 - · · Pre-Annexation Ultimate System, 300 mm
 - · · Annexation Area Ultimate System, 300 mm
 - · · Annexation Area Ultimate System, 400 mm
 - Proposed Road Network

Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**
Option 2 - New Annexation Area Reservoir with Upsized Grid

FIGURE 6.4
1:20,000

Evaluation of Options

The two ultimate servicing options are summarized in **Table 6.6**.

Table 6.6: Ultimate Water Servicing Comparison

	Option 1 Upgrade Main Reservoir	Option 2 New Reservoir in Annexation Area
Water Distribution Upgrading Requirements	1.7 km of 350 mm off-site transmission main	Oversize 800 mm of distribution mains from 300 mm to 400 mm
Concept Level Cost Estimate	\$1.6 million	\$0.4 million
Other Upgrading Requirements	Local distribution mains surrounding main reservoir	None
Proximity to CRNWSC Transmission Main	Upgrading CRNWSC from northside line (per CRNWSC master plan)	800 m new transmission from CRNWSC southside line
Proximity to EPCOR Supply	7.5 km away, greenfield and brownfield construction	7.3 km away, greenfield construction
Reservoir Construction	Brownfield, assumed to be relatively similar to greenfield	Greenfield

The key advantages and disadvantages for each option are listed in **Table 6.7**.

Table 6.7: Ultimate Water Servicing Advantages and Disadvantages

Option 1 Upgrade Main Reservoir	Option 2 New Reservoir in Annexation Area
Advantages	
<ol style="list-style-type: none"> Existing available land and space for upgrades and expansion. 	<ol style="list-style-type: none"> Centrally located within the annexation area. Efficiently services the annexation area with lower velocities during fire flow and peak hour condition. Proximity to CRNWSC southside line. No land acquisition for off-site pipes. Greenfield construction.
Disadvantages	
<ol style="list-style-type: none"> Requires 1.7 km of off-site 350 mm main to provide required flows to annexation area. Requires CRNWSC to upgrade transmission main to the reservoir. Higher velocities in pipes between main reservoir and annexation area, and thus not as efficient servicing. Additional pipe upgrades required around the main reservoir for efficient water distribution. Uncertainty in the cost of upgrading and retrofitting the main reservoir. 	<ol style="list-style-type: none"> Uses up developable land. Requires upsizing of 800 m of watermain for the reservoir to effectively service the area.

Notes:

- Cost estimates include allowances for engineering (15%) and contingency (30%).
- Main reservoir upgrading construction costs were not reviewed in detail as Option 2 was preferred.

Based on the lower distribution system piping costs and more efficient servicing, Option 2 is preferred. Thus, the water distribution system for the annexation area will be based on a new reservoir located in the annexation area. The following section considers the optimal location for the new reservoir within the annexation area.

6.6 Annexation Area Reservoir Location

Having determined that a new reservoir is needed within the annexation area, it was necessary to review potential reservoir locations to determine if the central location proposed is the optimal location. The following criteria were considered in selecting a preferred reservoir location:

- Elevation – higher ground elevation results in lower required pumping pressures.
- Hydraulics – is it efficient for meeting PHD as well as MDD plus fire flow?
- Proximity to water supply – either CRNWSC or EPCOR

Four potential reservoir locations were considered, as shown in **Figure 6.5**, including northwest, southwest, central and southeast. Each location is relatively high compared to surrounding areas and within about 5 m in elevation from each other. The central and southeast locations are closest to the CRNWSC southside line, while the northwest location is closest to a potential connection to EPCOR.

Hydraulic modelling was used to assess the hydraulics for each location, including both PHD as well as MDD plus fire flows. The modelling was also used to assess the relative contributions from each of the three reservoirs. The results are summarized in **Table 6.8**.

Table 6.8: Hydraulic Analysis Results for Alternate Annexation Area Reservoir Locations

Location	Elevation	Reservoir Contribution (L/s) for Max Day Demand and 233 L/s Fire Flow at Critical Location		
		Main Reservoir	Westpark Reservoir	Annexation Reservoir
Central	630 m	204	262	305
Northwest	632.5 m	238	272	261
Southwest	632.5 m	183	207	381
Southeast	630 m	233	334	204

Note: Critical fire flow location is in the southwest-most corner of the proposed annexation area water network due to higher elevation.

The four potential reservoir locations are summarized below.

Central Reservoir

- The central location is the best in terms of reservoir usage, service to the majority of the annexation area with balanced reservoir contributions between the main and Westpark reservoirs, and overall lower pipe velocity.
- In the interim, it is adjacent to the first stage of development.
- The central location can best service all Stage 1 developments as well as Stage 2 developments without extensive piping.

Northwest Reservoir

- The northwest location is close to the Westpark reservoir, thus, relies heavily on the main reservoir to support the flow to the northeast annexation area which results in higher pipe velocities to the east.
- It will require extra piping to connect to the grid (pipe is shown going through developing properties but it is only drawn schematically for modelling and not representative of actual design).

Southwest Reservoir

- The southwest location is not efficient in servicing the quarter section to the east and more heavily relies on the main and Westpark reservoirs to service the east side of the annexation area with higher pipe velocities.
- It will require extensive piping through undeveloped land as the quarter sections develop by Highway 21 near the north annexation boundary.

Southeast Reservoir

- The southeast location is far into the annexation area and will require extensive piping through undeveloped land to service the area by Highway 21.
- It is closer to the CRNWSC southside transmission line than all the other reservoir locations and is more central to the entire annexation area.
- The quarter section where the southeast reservoir is located is reduced due to the pipeline ROW. With a proposed reservoir, this quarter section may lose a lot of developable lands and may not be seen as desirable to develop.

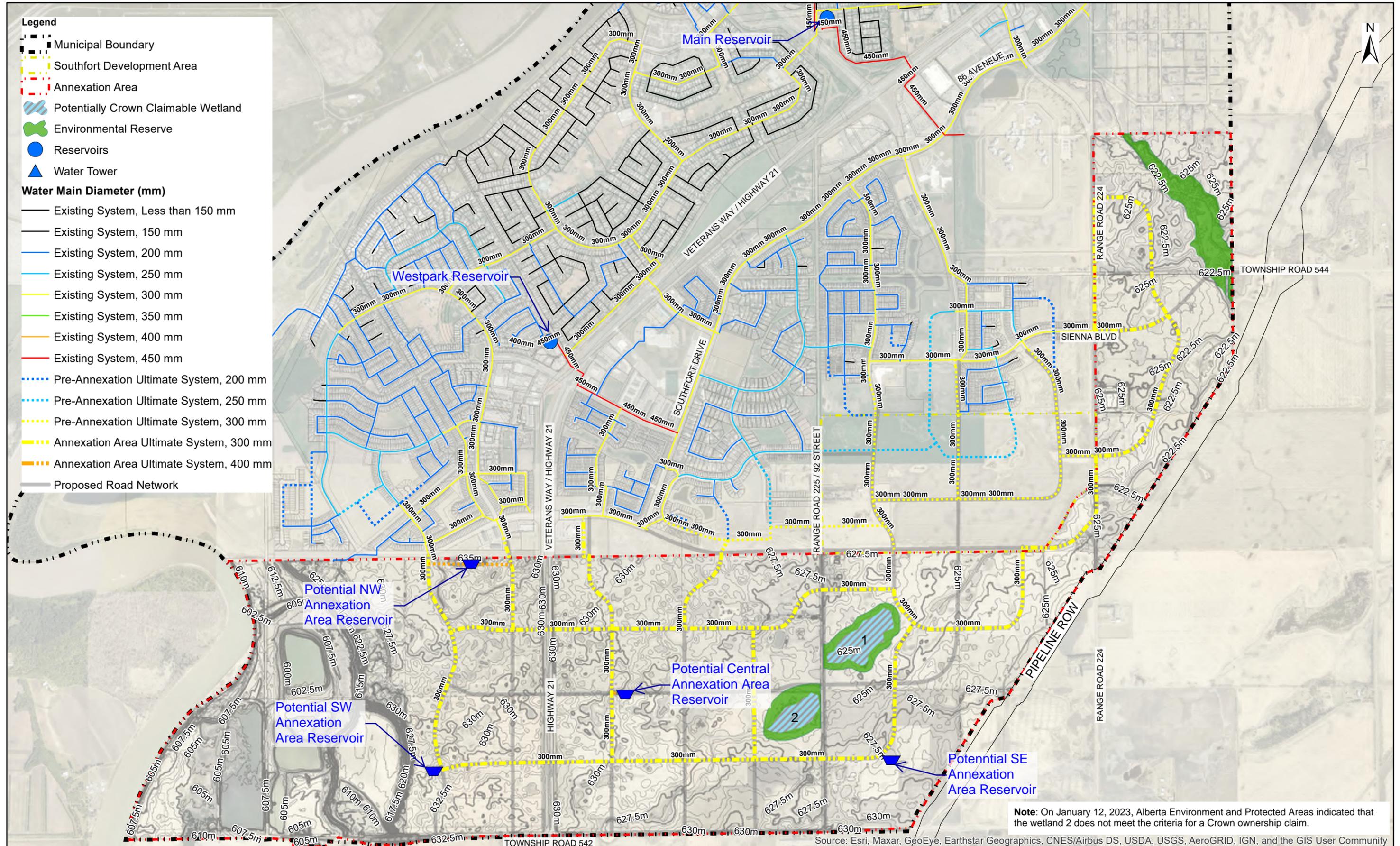
Based on the above, the central location is recommended for the annexation reservoir.

6.7 Recommended Water Distribution System

The recommended water distribution system for the annexation area is shown in **Figure 6.4**. It is comprised of a 300 mm grid at 800 m spacing. Local oversizing is recommended adjacent to the reservoir if the reservoir is not located at a junction in the grid (i.e., connecting to only two large diameter distribution lines). The reservoir is proposed to be located east of Highway 21 in the central part of the annexation area.

The water transmission main options to the new reservoir are also shown on **Figure 6.6**, and include:

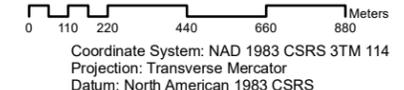
- Approximately 7.3 km to potential EPCOR connection (near northside meter vault); and
- Approximately 1.8 km to the CRNWSC southside transmission line.

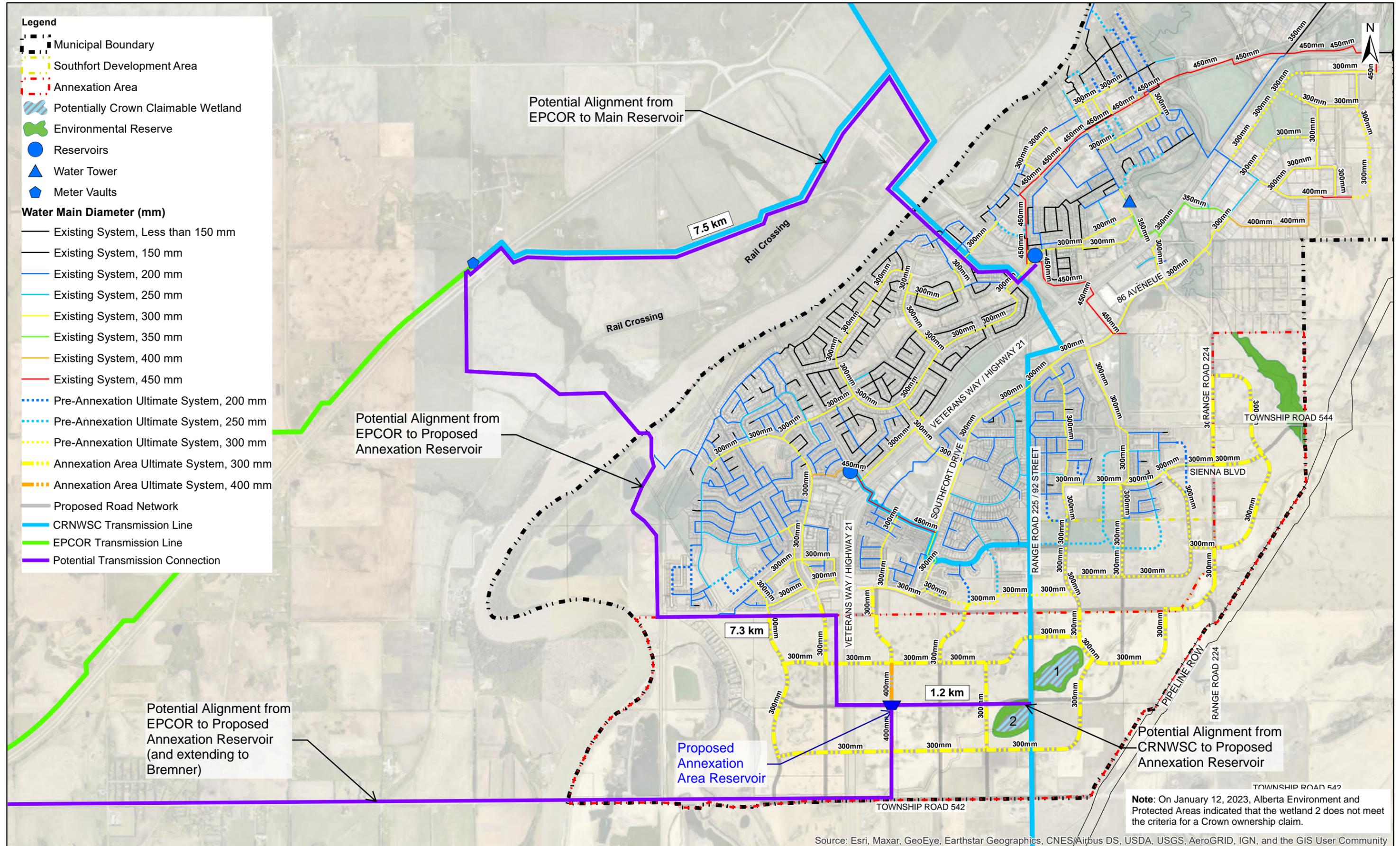


**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**
Option 2 - New Annexation Area Reservoir Location Option

FIGURE 6.5

1:20,000





FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Potential Transmission Line Alignment

FIGURE 6.6

1:30,000

0 165 330 660 990 1,320 Meters
 Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS

6.8 Interim Servicing

Interim water servicing for the annexation area is available through multiple connection points to the existing water system. These include 300 mm watermains on Willow Link, Westpark Drive, and at Southridge Boulevard approximately 250 m east of Highway 21.

Three different interim servicing concepts were developed assuming that development starts near Highway 21 immediately south of the pre-annexation area. Hydraulic modelling was conducted to confirm that adequate fire flows could be provided in the annexation area from the proposed interim servicing to the existing watermains. Interim servicing assessment assumed that the pre-annexation area is fully built and the annexation area was added in stages to assess the system capacity. It is noted that the interim servicing staging is different from the population and growth projection staging presented in **Section 6.3**.

At Interim Stage 1, it is assumed that the annexation area development will include about two quarter sections east and west of Highway 21, south of annexation boundary. The proposed water system will loop along the proposed road ROW transecting the two quarter sections at 400 m south of the north annexation area boundary. Connection to the existing water system will be made at three locations as indicated in **Figure 6.7**. **Figure 6.7** shows the modelling results of the MDD with fire flow scenario which is the critical scenario for assessing the proposed system. Blue nodes represent the system's capability to deliver greater than 90% of the required fire flow at each location. The required fire flow at the annexation area is assumed to be 233 L/s as per the standard for any potential apartments and commercial developments.

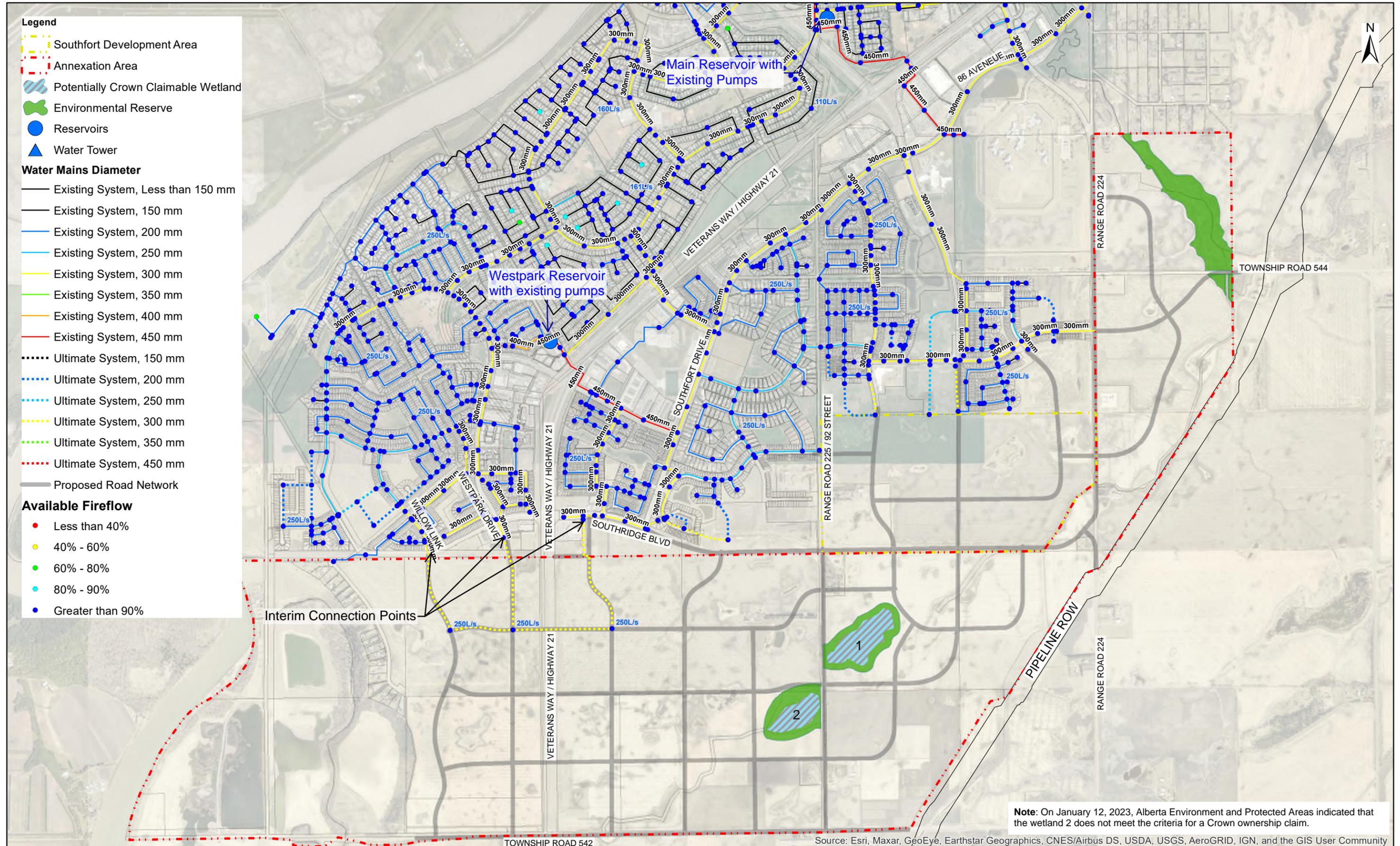
For Interim Stage 2, it is assumed that the development will include about two quarter sections in the annexation area south of Stage 1 and one Southfort quarter section within pre-annexation boundary. The proposed water system will loop along the proposed road ROW transecting the two quarter sections and connect to the system built in Stage 1. The Southfort water system is assumed to be built along proposed road ROW and connect to the existing system at Allard Way and Meadowview Drive as shown in **Figure 6.8**. With the proposed water system loop, the existing system is capable of supporting the Stage 2 development as shown with sufficient fire flow indicated by the blue nodes.

At Interim Stage 3, it is assumed that the development will include one quarter section in the annexation area east of Interim Stage 1, west of Range Road 225. At this stage, the existing system requires an upgrade to the overall city distribution system pumping capacity to be able to provide sufficient PHD to the pre-annexation and annexation areas. Two options are available to address the pumping need:

- Upgrade Westpark reservoir pumps as recommended by the 2020 HNA; and
- Build a new annexation area reservoir.

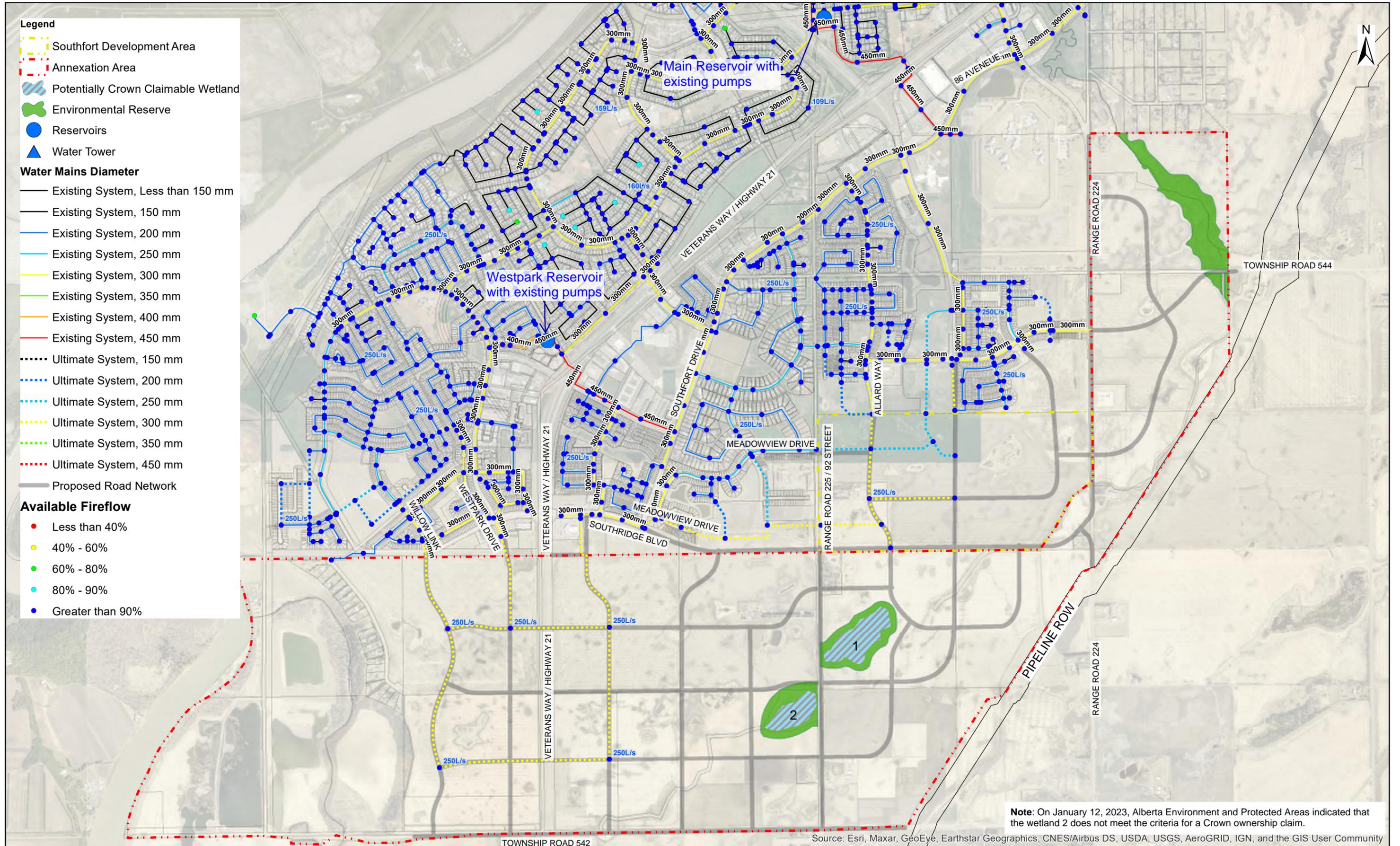
One of these options will need to be implemented for Interim Stage 3 (assuming full buildout of the pre-annexation areas). If the City chooses to upgrade Westpark reservoir pumps, then the City can defer the new annexation area reservoir.

Figure 6.9 shows the hydraulic modelling results based on upgrading the Westpark reservoir pumps. Should the City construct the new annexation area reservoir, the interim water distribution system would easily provide the required PHD pressures.



- Legend**
- Southfort Development Area
 - Annexation Area
 - Potentially Crown Claimable Wetland
 - Environmental Reserve
 - Reservoirs
 - ▲ Water Tower
- Water Mains Diameter**
- Existing System, Less than 150 mm
 - Existing System, 150 mm
 - Existing System, 200 mm
 - Existing System, 250 mm
 - Existing System, 300 mm
 - Existing System, 350 mm
 - Existing System, 400 mm
 - Existing System, 450 mm
 - Ultimate System, 150 mm
 - Ultimate System, 200 mm
 - Ultimate System, 250 mm
 - Ultimate System, 300 mm
 - Ultimate System, 350 mm
 - Ultimate System, 450 mm
 - Proposed Road Network
- Available Fireflow**
- Less than 40%
 - 40% - 60%
 - 60% - 80%
 - 80% - 90%
 - Greater than 90%

Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.



Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FORT SASKATCHEWAN ANNEXATION AREA

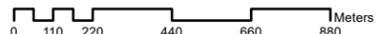
SERVICING DESIGN BRIEF

Interim Water Servicing Plan - Stage 2 Max Day Demand with Fire Flow Scenario

Available Fireflow

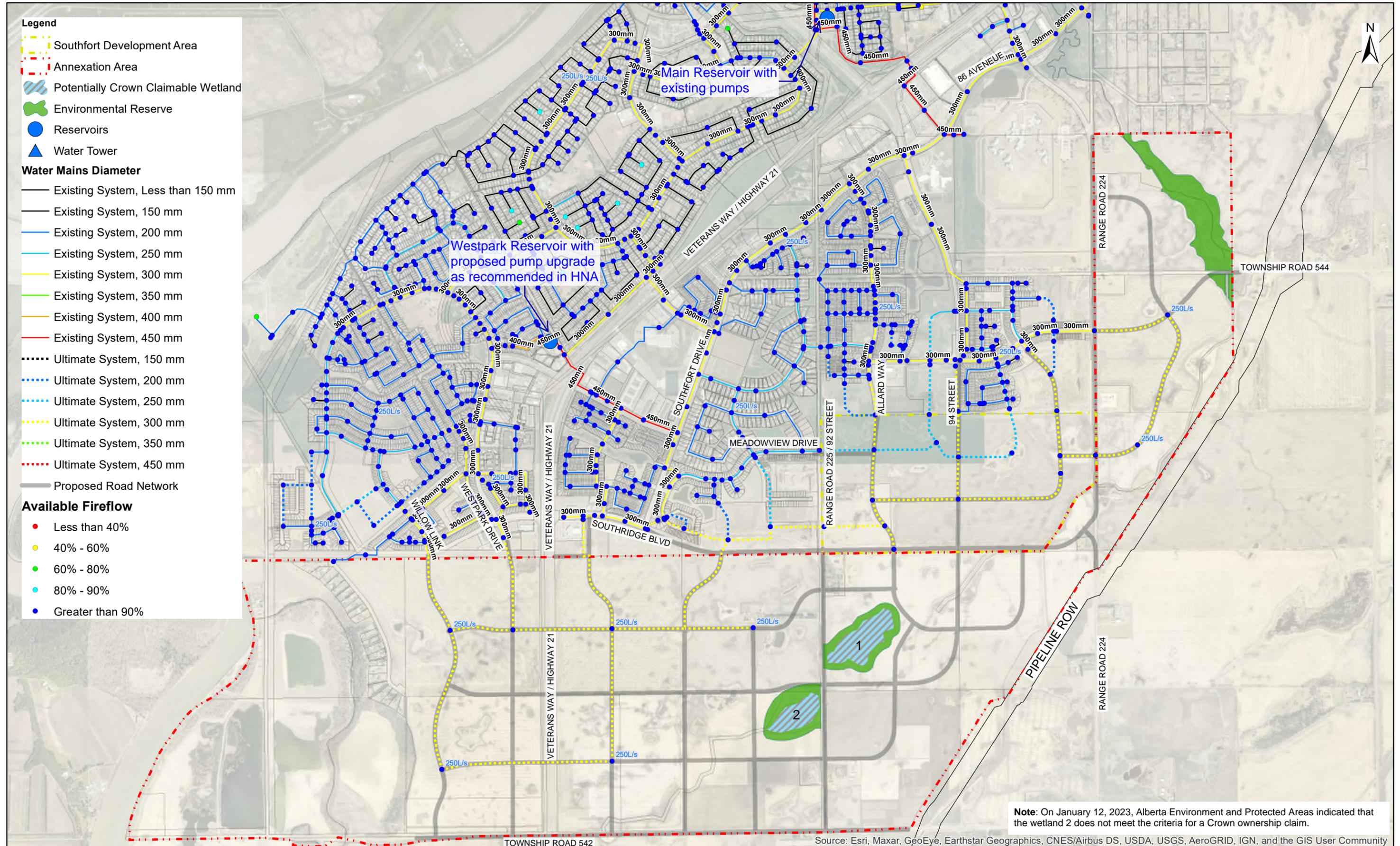
FIGURE 6.8

1:20,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS





- Legend**
- Southfort Development Area
 - Annexation Area
 - Potentially Crown Claimable Wetland
 - Environmental Reserve
 - Reservoirs
 - ▲ Water Tower
- Water Mains Diameter**
- Existing System, Less than 150 mm
 - Existing System, 150 mm
 - Existing System, 200 mm
 - Existing System, 250 mm
 - Existing System, 300 mm
 - Existing System, 350 mm
 - Existing System, 400 mm
 - Existing System, 450 mm
 - Ultimate System, 150 mm
 - Ultimate System, 200 mm
 - Ultimate System, 250 mm
 - Ultimate System, 300 mm
 - Ultimate System, 350 mm
 - Ultimate System, 450 mm
 - Proposed Road Network
- Available Fireflow**
- Less than 40%
 - 40% - 60%
 - 60% - 80%
 - 80% - 90%
 - Greater than 90%

6.9 Off-Site Levy Cost Estimates

The only off-site levy water infrastructure is the proposed water reservoir. The cost estimate for the reservoir assumes that the reservoir will provide all future storage and pumping capacity for the City, including full build out of the pre-annexation area plus the annexation area. The breakdown for cost sharing the reservoir between the pre-annexation area and the annexation area is provided in **Table 6.9**.

Table 6.9: Water Storage Breakdown for Off-Site Levy Purposes

Staging	Existing Storage (m ³)	Storage Required (m ³)	Additional Storage Needed (m ³)	Allocation
Pre-Annexation Area	23,638	28,909	5,271	23%
Annexation Area		18,042	18,042	77%
Total Including Annexation Area		46,951	23,313	100%

Notes:

1. Storage required for the annexation area represents the net increase in overall storage requirements for the City due to the annexation.
2. The annexation area storage volume requirements will increase slightly if the wetland in Quarter Section R is developed. The off-site levy areas would also increase.

Table 6.10 summarizes the cost for the proposed annexation area reservoir and pump house. Cost of land for the water reservoir and pumphouse is included.

Table 6.10: New Annexation Area Reservoir and Pumphouse Cost Estimate

Items	Cost
General Requirements	\$ 300,000
Site Civil, Access Road, and Landscaping	\$ 1,200,000
Process / Mechanical	\$ 2,000,000
Structural / Foundation / Concrete Tanks	\$ 14,000,000
Building Superstructure / Architectural	\$ 1,000,000
HVAC / Plumbing System	\$ 700,000
Electrical / Instrumentation / Control	\$ 1,700,000
Water Reservoir and Pumphouse Land (0.5ha)	\$ 500,000
Subtotal	\$ 21,400,000
Engineering (15%)	\$3,200,000
Contingency (30%)	\$6,400,000
Total	\$31,000,000

7.0 Wastewater

7.1 Existing and Planned Wastewater Collection System

The existing City of Fort Saskatchewan wastewater collection system is shown in **Figure 7.1**. It is comprised of wastewater sewers and trunks ranging up to 1200 mm in diameter connecting to the ACRWC Fort Saskatchewan syphon. There are two wastewater lift stations in Fort Saskatchewan:

1. **River Road Lift Station:** Located along River Road, this lift station services a portion of the Sherritt Industrial Park northeast of the city. The lift station consists of two pumps, with a design capacity of 220 L/s and total dynamic head (TDH) of 12 m which pumps into a 1,356 m long, 600 mm forcemain.
2. **Westpark Lift Station:** Located in the greenspace between Riverpark Drive and 100 Avenue, adjacent to the river, this lift station services a portion of the low-lying Westpark neighbourhood that is close to the river. The lift station consists of two submersible pumps with a design capacity of 21 L/s and TDH of 11.7 m which pumps into a 1,380 m long, 250 mm forcemain.
3. **Windsor Pointe Lift Station:** Located by the neighbourhood of Windsor Pointe and recently constructed.

The 2020 Sanitary Sewer Flow Monitoring Program and Inflow & Infiltration (I/I) Assessment Report recently reviewed available flow monitoring and rain gauge data in order to update and calibrate the existing wastewater system model in PCSWMM, assessed the existing wastewater system for I/I potential, and recommended upgrades for areas that exceed the standard I/I rate of 0.28 L/s/ha.

The 2020 I/I model was calibrated based on flow monitoring records from 10 temporary flow meters where each flow meter was used for calibration of the upstream contributing sewershed area flowing into it. Calibration was completed by first matching dry-weather flow parameters including residential / non-residential generation rates and diurnal curves (variation in sewershed flow throughout the day) in the model to flow meter records during periods of no rainfall. Then, large precipitation events were noted and the resulting peak flows from the flow meter data were then replicated in the model by adjusting rainfall dependent inflow and infiltration parameters (RDII).

The I/I report drew the following conclusions:

- The results showed no areas within the city exceeded 0.28 L/s/ha during the 1:5-year 4-hour and 1:25-year 24-hour design storms showing that the existing system has capacity for wet weather events and has low I/I; and
- Recommendations included continuation of the flow monitoring program to better calibrate the model in the future and further investigation of sewersheds to identify potential I/I sources (smoke testing and/or identification of sag manholes).

1:25-year 24-hour existing sewer modelling results are shown on **Figure 7.2**. The results show the maximum flow in each sewer as a ratio of pipe capacity, where values less than 1.0 indicate available pipe capacity and values greater than 1.0 indicate that the pipe is overutilized. The manholes are colour-coded based on the minimum depth to the HGL; thus, the greater the depth, the lower the risk of basement flooding. A minimum depth to HGL of 2.5 m indicates a risk of basement flooding and a minimum depth to HGL of 1.5 m indicates likely basement flooding. The results show that the existing sanitary sewer system has sufficient capacity for the 1:25-year 24-hour design storm.

The only large undeveloped area within the pre-annexation border is two quarter sections in the southeast part of Southfort. Development engineering reports show the location of the local trunks within this undeveloped area.

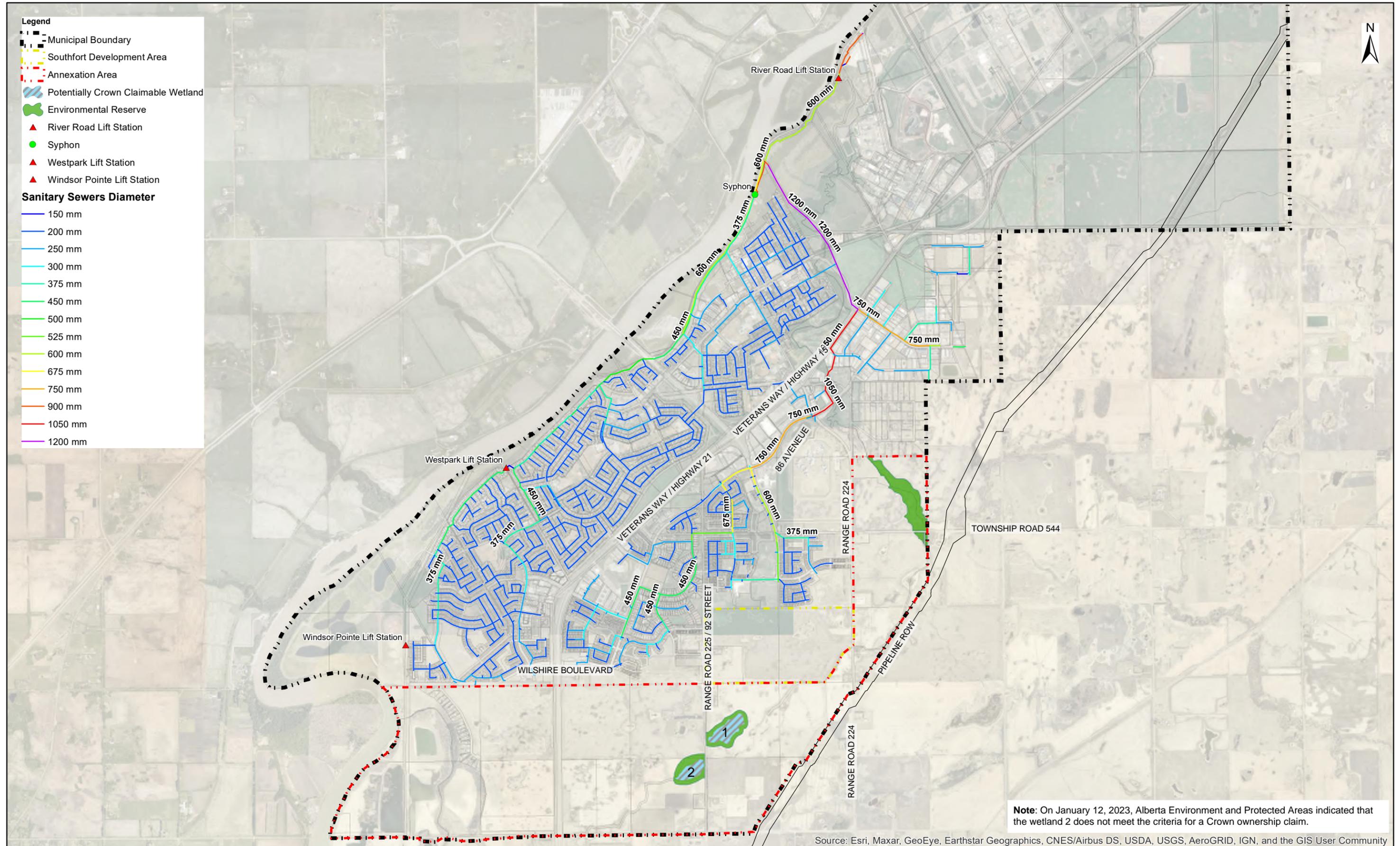
It is noted that the existing wastewater collection system was designed to service the lands within the pre-annexation boundary and thus were not oversized to accept flows from the annexation area. Hydraulic modelling was conducted to assess the capacity of the larger trunks to accept flows from the annexation area, refer to **Section 7.5.3**.

Legend

- Municipal Boundary
- Southfort Development Area
- Annexation Area
- Potentially Crown Claimable Wetland
- Environmental Reserve
- River Road Lift Station
- Syphon
- Westpark Lift Station
- Windsor Pointe Lift Station

Sanitary Sewers Diameter

- 150 mm
- 200 mm
- 250 mm
- 300 mm
- 375 mm
- 450 mm
- 500 mm
- 525 mm
- 600 mm
- 675 mm
- 750 mm
- 900 mm
- 1050 mm
- 1200 mm



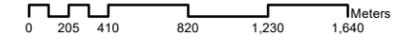
Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

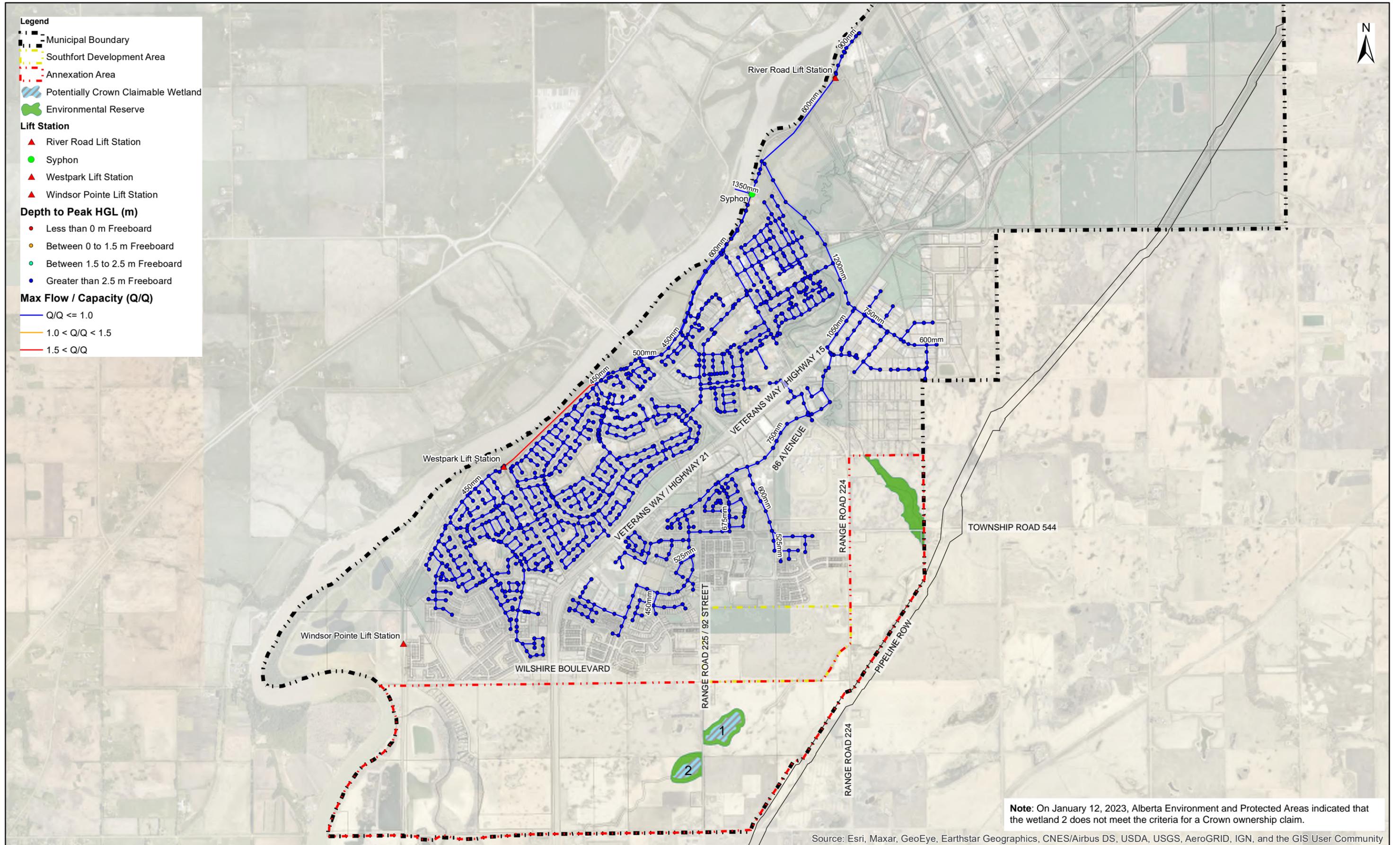
FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Existing Sanitary System

FIGURE 7.1

1:37,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS



FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Existing Sanitary System Capacity

FIGURE 7.2

1:37,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS

7.2 ACRWC System

7.2.1 Overview

The City of Fort Saskatchewan is a member municipality of the Alberta Capital Region Wastewater Commission (ACRWC) and conveys its wastewater flows through the ACRWC's Northeast Regional Transmission System (NERTS). This includes the Fort Saskatchewan Syphon, the ACRWC Fort Saskatchewan Pump Station and Forcemain, the gravity NERTS trunk, and the NERTS syphon that connects to the ACRWC Southeast Regional Trunk Sewer (SERTS) north section to the ACRWC treatment plant.

Thus, the city's wastewater is conveyed through two North Saskatchewan River syphon crossings plus a major wastewater pump station prior to reaching the ACRWC treatment plant. ACRWC has expressed concerns with the long-term capacity of this system, especially the Fort Saskatchewan syphon capacity. As part of this project, the ACRWC provided a copy of the 2018 GHD Hydraulic Model Update – NERTS and SERTS-North Wastewater Transmission System report.

This report summarized the calibration of the ACRWC NERTS and SERTS-North system using flow monitoring and rain gauge data from the ACRWC, as well as modelling analysis for the 2017 (existing), 2020, 2025, 2040 and 2055 growth projections. Conclusions from this study included:

1. The Fort Saskatchewan Pump Station (FSPS) requires additional storage as soon as 2025; and
2. The inverted syphon (existing capacity modelled as 423 L/s) from Fort Saskatchewan has adequate capacity for the peak wet weather flow (PWWF) from the 1:25-year storm event but will require the second syphon active beyond 2025.

The GHD study recommendations include increasing the existing FSPS pumping capacity from 0.8 m³/s to 1.3 m³/s after 2020 and increasing the storage by 2,500 m³ by 2055. The total cost for this recommendation is estimated to be \$2.1M (2017 dollars).

ACRWC mentioned a preference to always maintain one syphon on standby as a redundancy, due to the uncertainty in the existing condition. Recent syphon monitoring work has concluded that there are some suspicious areas along the syphon that may be vulnerable. Syphon upgrading has been considered; however, based on new construction technologies, a trenchless shaft would require a large amount of construction space potentially closing the trailer park and adjacent park space for a few years.

7.2.2 Syphon Capacity

The existing inverted syphon consists of an inlet control structure to which the entire city drains through a 750 mm trunk from the south and a 900 mm trunk from the north. This inlet structure is located at the Fort Lions Campground which outlets to two 550 mm syphons (one active, one standby) that pressurize as they cross under the North Saskatchewan River towards the FSPS. The details of the existing syphon are summarized in **Table 7.1**.

Table 7.1: Existing Fort Saskatchewan Syphon Properties

Property	Value
Syphon Configuration	2 (1 Active; 1 Standby)
Diameter (mm)	550
Syphon Inlet Structure Location	Fort Lions Campground
Syphon Outlet Structure Location	Fort Saskatchewan Pump Station
Syphon Inlet (m)	606.200
Syphon Outlet Invert (m)	601.300
Syphon Length (m)	331.0

From the 2018 GHD study, the syphon capacity was modelled as 423 L/s; however, the syphon capacity was not directly calculated but rather interpreted from results. Thus, ISL conducted a sensitivity analysis on the syphon capacity using the following methodology:

1. It is assumed that one syphon is always on standby.
2. Manning’s equation was used to estimate the flow in the syphon assuming that the energy grade slope was at the obvert of both the inlet and outlet structures. With the length of the syphon, the slope of the energy grade line is calculated.
3. A hydraulic loss factor was introduced to account for complex losses within the syphon system.
4. A sensitivity analysis on capacity was plotted by testing different roughness and hydraulic loss values.

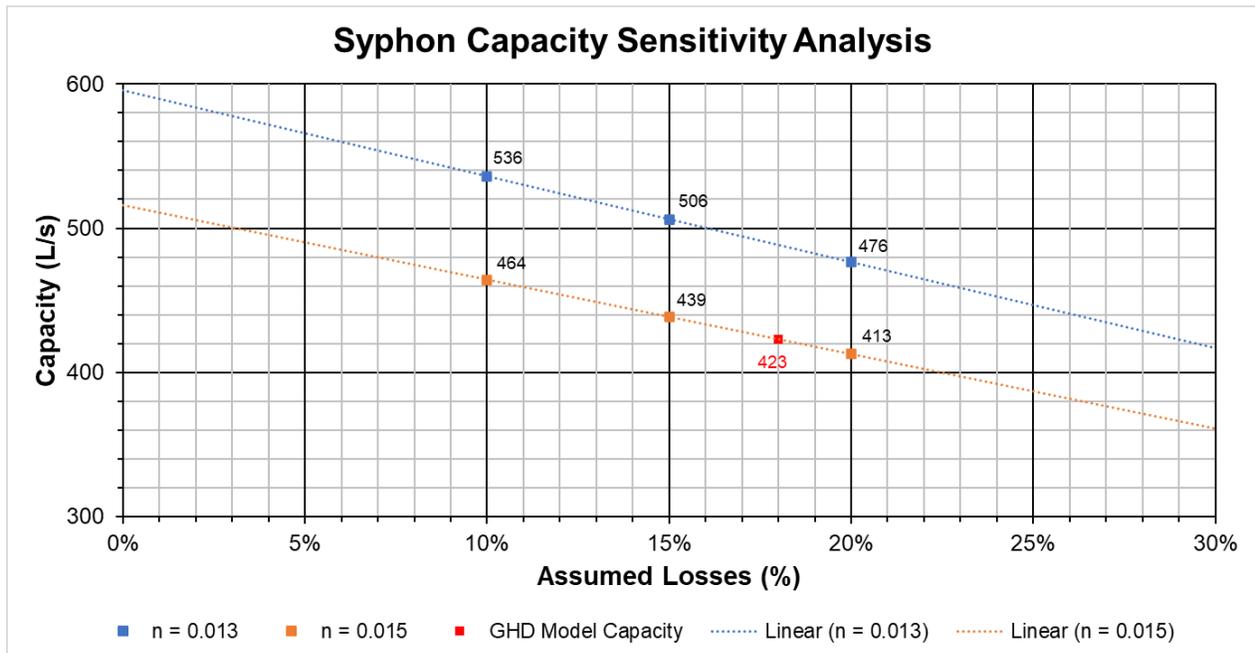


Figure 7.3: Fort Saskatchewan Syphon Capacity Sensitivity Analysis

Based on the sensitivity analysis, GHD reports a capacity more conservative and near the lower end of capacity. Depending on the condition of the syphon, the capacity could range from 413 to 536 L/s.

7.3 Existing and Future Wastewater Flows

7.3.1 Existing and Projected Wastewater Flows in Pre-annexation Area

The pre-annexation area was planned as part of the 2015 ISL Growth Study which shows the areas of future growth within the pre-annexation boundary. Some changes since 2015 were noted where relevant. The ultimate pre-annexation wastewater demands are summarized in **Table 7.2**. The pre-annexation area and annexation area flows were evaluated separately based on the source of information used to generate the projected wastewater demands.

Table 7.2: Existing and Ultimate Pre-Annexation ADWF, PDWF and PWWF

Scenario	Stages	
	Existing	Ultimate
Population (c)	27,669	47,942
Pre-Annexation Area Flows		
Existing ADWF (L/s)	92	92
Sherritt Industrial ADWF (L/s)	56	56
Josephburg Industrial ADWF (L/s)	0	55
Southfort ADWF (L/s)	0	17
Infill ADWF (L/s)	0	34
Total Demands		
Total ADWF (L/s)	148	254
PDWF Factor	1.37	1.41
Total PDWF (L/s)	203	358
PWWF Factor	2.11	1.74
Total PWWF (L/s)	312	442

Notes:

1. The existing flow demands are based on the 2020 I/I calibrated existing system model. This model and I/I report did not evaluate ultimate buildout of the pre-annexation municipal boundary.
2. Full build-out of the pre-annexation area was based on available land use supply and growth projections from the Fort Saskatchewan Growth Study (2015).
3. ADWF – average dry weather flow.
4. PDWF – peak dry weather flow.
5. PWWF – peak wet weather flow.
6. The peaking factors are calculated using the calibrated I/I model from the syphon inlet control structure and accounts for routing in the model.

7.3.2 Annexation Area Wastewater Flows

The total projected population growth for the annexation areas and wastewater flows are shown in **Table 7.3**. Population and growth projections for the annexation area are based on projected land uses and densities presented in Section 2.0. The per capita and non-residential wastewater flows are also based on servicing standards as shown in Section 3.0 of this report.

Table 7.3: Wastewater Flows for Annexation Area

Quarter Section	Legal Lot	Net Res. (ha)	Non-Res (ha)	Population (c)	Residential (L/c/d)	ICI (L/s/ha)	ADWF (L/s)	I/I (L/s)	Total PWWF
C	NE14-54-23-4	1.99	0.47	207	250	0.045	0.6	0.7	-
D	SE14-54-23-4	0.00	0.00	0	250	0.045	0.0	0.0	-
F	NW13-54-23-4	9.15	2.58	1,003	250	0.045	3.0	3.3	-
G	NE13-54-23-4	0.10	0.02	17	250	0.045	0.1	0.0	-
J	SE13-54-23-4	24.51	19.12	2,549	250	0.045	8.2	12.2	-
K	NW18-54-22-4	24.00	18.04	2,496	250	0.045	8.0	11.8	-
M	SW18-54-22-4	16.51	23.77	1,717	250	0.045	6.0	11.3	-
N	NE18-54-22-4	15.47	23.90	1,609	250	0.045	5.7	11.0	-
Q	SE18-54-22-4	34.95	9.60	3,635	250	0.045	11.0	12.5	-
R	NW17-54-22-4	30.68	7.80	3,191	250	0.045	9.6	10.8	-
S	SW17-54-22-4	28.57	7.91	2,972	250	0.045	9.0	10.2	-
T	SE20-54-22-4	30.75	9.61	3,198	250	0.045	9.7	11.3	-
V	NE17-54-22-4	3.60	0.86	375	250	0.045	1.1	1.2	-
W	SE17-54-22-4	24.19	7.00	2,516	250	0.045	7.6	8.7	-
X	SW28-54-22-4	3.02	0.76	314	250	0.045	0.9	1.1	-
Z	NW21-54-22-4	28.45	7.52	2,958	250	0.045	8.9	10.1	-
AA	SW21-54-22-4	33.40	8.57	3,473	250	0.045	10.4	11.8	-
AB	NW16-54-22-4	14.80	4.01	1,540	250	0.045	4.6	5.3	-
AC	NW13-54-23-4	0.29	0.07	30	250	0.045	0.1	0.1	-
TOTAL	-	324.45	151.61	33,800	-	-	104.6	133.3	377

Notes:

1. 250 L/c/d and 0.045 L/s/ha generation rates are based on the existing system model calibration from the 2020 I/I report.
2. Residential Peaking Factor: $P_f = 2.6P^{-0.1} \geq 1.5$ where P is the population in thousands.
3. Non-residential Peaking Factor: $P_f = 10Q_{avg}^{-0.45}$ where $2.5 \leq P_f \leq 25$ and Q_{avg} is the ADWF.
4. I/I is 0.28 L/s/ha for residential areas and 0.05 L/s/ha for non-residential areas.
5. Peak wet weather flows only shown for the total annexation area as the peaking factor changes with contributing area/flows.
6. The developable areas in Quarter Section R will increase if the wetland in that quarter is developed.

7.4 Ultimate On-Site System

7.4.1 Introduction

The topography of the annexation area generally slopes to the east towards Yorkville Ditch and Ross Creek. The far west edge of the annexation area (developable area above the Pointe-aux-Pins Creek floodplain) is slightly lower than the remainder of the lands west of Veterans Way. Overall, the optimal way to service the annexation area is west to east.

The on-site servicing plan depends somewhat on the selected off-site servicing plan, refer to Section 7.5. Thus, an iterative approach was used to develop the on-site and off-site servicing options. Three different on-site servicing concepts were developed:

- **Option 1a:** A gravity servicing concept to an ultimate lift station located in the east end of the annexation area. This on-site servicing concept works with off-site pumping options to the north or south.

- **Option 1b:** Similar to Option 1a above, except that the west part of the annexation area is intercepted to an off-site gravity trunk directed south. It was specifically developed for the gravity servicing option to the ACRWC treatment plant.
- **Option 2:** A gravity servicing concept directed to the northeast. This option was specifically developed to work with the off-site option with gravity servicing to the existing city trunks near 86 Avenue and Ross Creek.

For the off-site options directed south to the ACRWC plant, a sub-option was prepared to direct the two undeveloped Southfort quarter sections to the annexation areas wastewater system. The objective of this sub-option was to maximize the service area to the ACRWC plant and thus minimize the flows to the ACRWC syphon.

7.4.2 Option 1a: Servicing to Ultimate Lift Station in East

The proposed on-site wastewater servicing concept for Option 1a is shown in **Figure 7.4** and is described below:

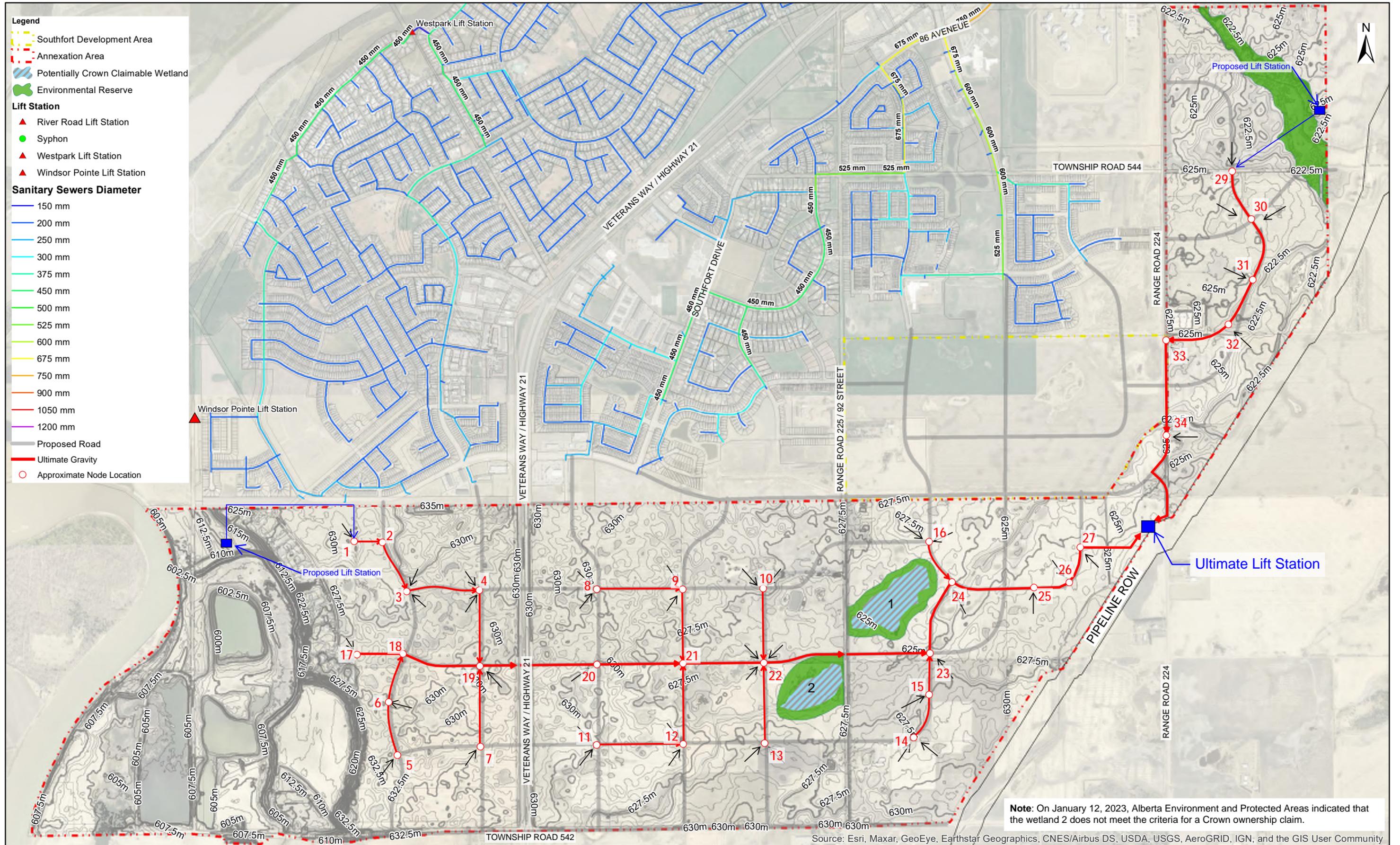
- An east-west trunk is used to service the south annexation area to an ultimate lift station located in the southeast corner of the annexation area. This trunk is located along the quarter section line midway through the south annexation area. Only one crossing of Highway 21 is proposed.
- The local trunk in the northeast annexation area follows the local collector roadway.
- The servicing concept includes optional lift stations servicing the small potential development areas east of Ross Creek and north of Pointe-aux-Pins Creek. The service areas for both lift stations are very small and are not expected to be economically viable to service.

Alternate locations for the annexation area lift station were investigated. The criteria used to select a lift station location included minimizing length and depth of sewer construction, minimizing length of forcemain, and flexibility for interim servicing to existing sewers in the pre-annexation area.

The lowest ground elevations are along the east side of the annexation area, with the lowest ground being next to Ross Creek in the northeast part of the annexation area. To minimize sewer and forcemain lengths, the lift station is proposed to be in the southeast part of the annexation area. The ground elevation is similar to that further north and this location will minimize the total length of sewers and forcemain. This lift station location is also relatively close to local trunk sewers in the Southfort area. The lift station location should be optimized during subsequent servicing studies.

The wastewater sewer design table is presented in **Table 7.4**. The sewer design was compared to the stormwater outfall trunks to check for potential conflicts. Some of the local wastewater sewers were adjusted to maintain adequate separation between the wastewater sewers and the storm trunks as noted in **Table 7.4**.

A sub-option was prepared for directing the two undeveloped Southfort quarter sections to the ultimate lift station. This sub-option included a local sub-trunk servicing these Southfort quarter sections east to Range Road 224 / 101 Street and south to the ultimate lift station. In this case, the lift station and forcemain would require a slightly larger design capacity to accommodate the two additional quarter sections.



FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF

Ultimate On-Site Wastewater Servicing Concept Option 1a – Ultimate East Lift Station

FIGURE 7.4

1:17,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS

Table 7.4: Ultimate On-Site Wastewater Servicing Concept Option 1a – Sewer Design Table

Manning's n = 0.013

FROM M.H.	TO M.H.	RES. AREA		POPULATION				AVG. FLOW (RES) (L/s)	PEAK FACTOR (RES.)	NON-RESIDENTIAL AREA		AVG. FLOW (NON-RES) (L/s)	PEAK FACTOR (NON-RES.)	I/I (L/s)	ESTIMATED DESIGN FLOW (L/s)	CAP. (L/s)	Percentage Full	VEL. (m/s)	NOMINAL DIA. (mm)	LENGTH (m)	SLOPE (%)	
		ADDED Ha	TOTAL Ha	RESIDENTIAL						ADDED Ha	TOTAL Ha											
				# of units	Per./unit	POP.	SUM POP.															
1	2	6.57	6.57	272	2.60	708	708	2.05	2.69	3.05	3.05	0.14	24.44	1.99	12.6	20.7	60.9%	0.66	200	140.00	0.40%	
2	3	0.00	6.57	0	2.60	0	708	2.05	2.69	0.00	3.05	0.14	24.44	1.99	12.6	20.7	60.9%	0.66	200	275.00	0.40%	
3	4	16.34	22.91	654	2.60	1,700	2,408	6.97	2.38	1.91	4.96	0.22	19.63	6.66	32.1	45.4	70.9%	0.64	300	368.00	0.22%	
4	19	8.17	31.08	327	2.60	850	3,258	9.43	2.31	17.21	22.17	1.00	10.01	9.81	48.3	67.9	71.2%	0.61	375	374.00	0.15%	
5	6	8.00	8.00	320	2.60	832	832	2.41	2.65	0.00	0.00	0.00	0.00	2.24	10.0	20.7	48.3%	0.66	200	260.00	0.40%	
6	18	8.00	16.00	320	2.60	832	1,664	4.82	2.47	0.00	0.00	0.00	0.00	4.48	19.0	31.5	60.5%	0.64	250	260.00	0.28%	
7	19	4.00	4.00	160	2.60	416	416	1.20	2.84	9.02	9.02	0.41	15.01	1.57	12.9	20.7	62.1%	0.66	200	400.00	0.40%	
8	9	0.00	0.00	0	2.60	0	0	0.00	0.00	23.77	23.77	1.07	9.70	1.19	13.4	31.5	42.7%	0.64	250	427.00	0.28%	
9	21	16.51	16.51	661	2.60	1,717	1,717	4.97	2.46	0.00	23.77	1.07	9.70	5.81	33.1	45.4	72.9%	0.64	300	373.00	0.22%	
11	12	0.00	0.00	0	2.60	0	0	0.00	0.00	23.90	23.90	1.08	9.68	1.19	13.5	33.6	40.1%	0.69	250	435.00	0.32%	
12	21	15.47	15.47	619	2.60	1,609	1,609	4.66	2.48	0.00	23.90	1.08	9.68	5.53	32.0	49.3	64.8%	0.70	300	400.00	0.26%	
10	22	17.48	17.48	699	2.60	1,818	1,818	5.26	2.45	4.80	4.80	0.22	19.93	5.13	26.0	31.5	82.5%	0.64	250	370.00	0.28%	
13	22	15.34	15.34	614	2.60	1,595	1,595	4.62	2.48	7.80	7.80	0.35	16.02	4.69	25.3	31.5	80.4%	0.64	250	400.00	0.28%	
14	15	15.37	15.37	615	2.60	1,599	1,599	4.63	2.48	3.20	3.20	0.14	23.90	4.46	22.5	31.5	71.6%	0.64	250	235.00	0.28%	
15	23	7.69	23.06	307	2.60	799	2,398	6.94	2.38	3.20	6.41	0.29	17.50	6.78	33.0	70.4	46.8%	1.00	300	208.00	0.53%	
16	24	14.29	14.29	571	2.60	1,486	1,486	4.30	2.50	3.96	3.96	0.18	21.74	4.20	21.9	31.5	69.5%	0.64	250	234.00	0.28%	
17	18	4.58	4.58	193	2.60	501	501	1.45	2.79	0.00	0.00	0.00	0.00	1.28	6.2	20.7	29.8%	0.66	200	236.00	0.40%	
18	19	0.00	20.58	0	2.60	0	2,166	6.27	2.41	0.00	0.00	0.00	0.00	5.76	24.2	31.5	77.0%	0.64	250	392.00	0.28%	
19	20	4.00	59.66	160	2.60	416	6,255	18.10	2.16	9.02	40.21	1.81	7.66	18.72	83.4	98.8	84.5%	0.62	450	582.00	0.12%	
20	21	0.00	59.66	0	2.60	0	6,255	18.10	2.16	0.00	40.21	1.81	7.66	18.72	83.4	98.8	84.5%	0.62	450	431.00	0.12%	
21	22	0.00	91.64	0	2.60	0	9,582	27.73	2.07	0.00	87.88	3.95	5.39	30.05	126.6	194.2	65.2%	0.69	600	402.00	0.10%	
22	23	32.82	157.28	1,313	2.60	3,413	16,408	47.48	1.97	4.80	105.28	4.74	4.97	49.30	193.2	265.8	72.7%	0.74	675	832.00	0.10%	
23	24	7.69	188.03	307	2.60	799	19,606	56.73	1.93	3.20	114.89	5.17	4.77	58.39	224.0	265.8	84.3%	0.74	675	383.00	0.10%	
24	25	14.29	216.60	571	2.60	1,486	22,577	65.33	1.90	3.96	122.80	5.53	4.63	66.79	252.0	352.0	71.6%	0.80	750	418.00	0.10%	
25	26	11.08	227.68	443	2.60	1,152	23,729	68.66	1.89	4.26	127.06	5.72	4.56	70.10	263.1	352.0	74.7%	0.80	750	181.00	0.10%	
26	27	8.06	235.74	323	2.60	839	24,568	71.09	1.89	3.50	130.56	5.88	4.51	72.53	271.2	352.0	77.0%	0.80	750	187.00	0.10%	
27	Lift Station	8.06	243.80	323	2.60	839	25,406	73.51	1.88	0.00	130.56	5.88	4.51	74.79	278.6	352.0	79.1%	0.80	750	386.00	0.10%	
29	30	28.45	28.45	1,138	2.60	2,958	2,958	8.56	2.33	7.52	7.52	0.34	16.29	8.34	39.3	45.4	86.7%	0.64	300	263.00	0.22%	
30	31	16.70	45.15	668	2.60	1,737	4,695	13.59	2.23	8.57	16.09	0.72	11.57	13.44	60.6	67.9	89.2%	0.61	375	322.00	0.15%	
31	32	16.70	61.84	668	2.60	1,737	6,432	18.61	2.16	0.00	16.09	0.72	11.57	18.12	77.5	98.8	78.5%	0.62	450	260.00	0.12%	
32	33	4.93	66.78	197	2.60	513	6,945	20.10	2.14	0.00	16.09	0.72	11.57	19.50	82.5	98.8	83.5%	0.62	450	330.00	0.12%	
33	34	4.93	71.71	197	2.60	513	7,458	21.58	2.13	4.01	20.09	0.90	10.46	21.08	88.9	98.8	90.0%	0.62	450	471.00	0.12%	
34	Lift Station	8.83	80.54	353	2.60	918	8,376	24.24	2.10	0.93	21.02	0.95	10.25	23.60	98.0	194.2	50.5%	0.69	600	571.00	0.10%	
Lift Station			324.34	12,993			33,783				151.58	6.82		376.6								

Note:
 1. On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland in Quarter Section R does not meet the criteria for a Crown ownership claim. As a result, it could be developed (with compensation), which would increase the developable area for MH# 22.

7.4.3 Option 1b: West Area Serviced South to ACRWC by Gravity, Remainder Serviced with Ultimate Lift Station in Southeast

On-site servicing Option 1b is similar to Option 1a except that the southwest part of the annexation area is intercepted by a gravity trunk directed south to the ACRWC treatment plant. Approximately four quarter sections of developable land could be directed south by gravity to the ACRWC plant. The remainder of the annexation area that is below a ground elevation of about 628 m required a lift station. As this off-site option was significantly more expensive than all other options, a detailed on-site option was not developed.

7.4.4 Option 2: Gravity Servicing to the Northeast

On-site servicing Option 2 is also similar to Option 1a, with gravity servicing west to east and then north, refer to **Figure 7.5**. The primary consideration for this option was to confirm gravity servicing to the existing 1050 mm trunk (off-site gravity servicing option). The servicing concept was adjusted to accommodate the low-lying area in the northwest of annexation area. The alternative on-site system is shifted approximately 400 m further north to minimize the overall length of on-site sewer system. The alignment then shifts north to Township Road 543 and then follows Range Road 224 / 101 Street to 86 Avenue where it connects to the existing 1050 mm trunk.

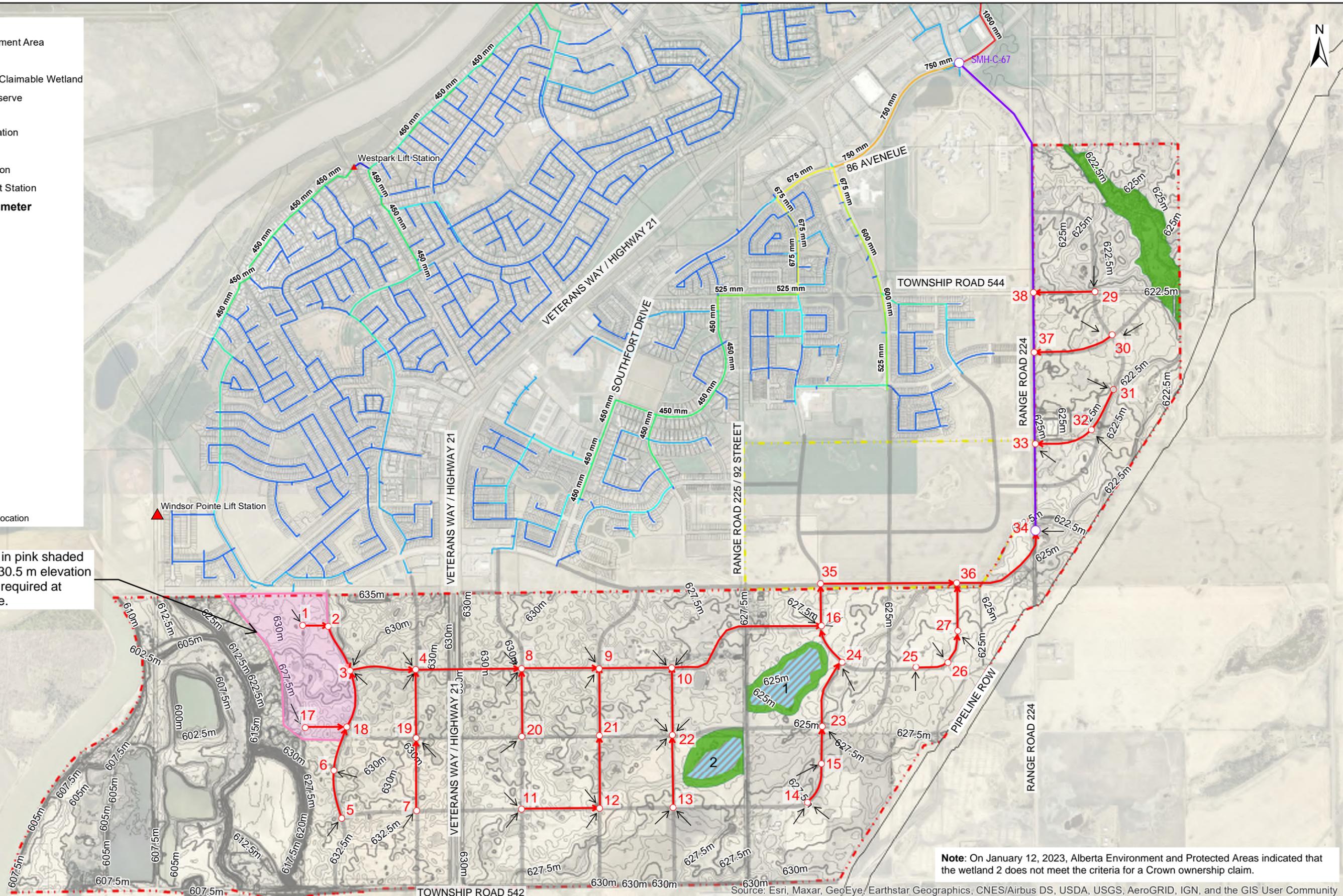
The northwest annexation area has low areas that may not be serviceable to the 1050 mm trunk by gravity, refer to shaded area in **Figure 7.5**. This area may be serviceable if engineering fill is used to raise the area to 630.0 m to 630.5 m. Part of this area is proposed to be a SWMF and engineered fill may be a viable solution. If detailed engineering analysis determines that engineering fill is not feasible, then a local lift station will be required for the northwest area. Refinement of the on-site servicing concept would be needed to minimize the area serviced by the lift station.

The wastewater sewer design table is presented in **Table 7.5**. Again, the sewer design was compared to the stormwater outfall trunks to check for potential conflicts. Some of the local wastewater sewers were lowered by up to 0.57 m to allow for 0.5 m separation between the wastewater pipe invert and the storm pipe invert as noted in **Table 7.5**.

This option does not include a sub-option to intercept the two Southfort quarter sections as all flows are directed north to the 1050 mm trunk and Southfort is already serviced by a local 525 mm trunk.

- Legend**
- Southfort Development Area
 - Annexation Area
 - Potentially Crown Claimable Wetland
 - Environmental Reserve
- Lift Station**
- River Road Lift Station
 - Syphon
 - Westpark Lift Station
 - Windsor Pointe Lift Station
- Sanitary Sewers Diameter**
- 150 mm
 - 200 mm
 - 250 mm
 - 300 mm
 - 375 mm
 - 450 mm
 - 500 mm
 - 525 mm
 - 600 mm
 - 675 mm
 - 750 mm
 - 900 mm
 - 1050 mm
 - 1200 mm
- Proposed Road
 - Ultimate Gravity
 - Approximate Node Location

Raise ground in pink shaded area to 630-630.5 m elevation or Lift Station required at indicated node.



Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FORT SASKATCHEWAN ANNEXATION AREA SERVICING DESIGN BRIEF

Ultimate On-Site Wastewater Servicing Concept Option 2 – Gravity Servicing to the Northeast

FIGURE 7.5

1:20,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS



Table 7.5: Ultimate On-Site Wastewater Servicing Concept Option 2 – Sewer Design Table

Manning's n = 0.013

FROM M.H.	TO M.H.	RES. AREA		POPULATION				AVG. FLOW (RES) (L/s)	PEAK FACTOR (RES.)	NON-RESIDENTIAL AREA		AVG. FLOW (NON-RES) (L/s)	PEAK FACTOR (NON-RES.)	I/I (L/s)	ESTIMATED DESIGN FLOW (L/s)	CAP. (L/s)	Percentage Full	VEL. (m/s)	NOMINAL DIA. (mm)	LENGTH (m)	SLOPE (%)
		ADDED	TOTAL	RESIDENTIAL						ADDED	TOTAL										
		Ha	Ha	# of units	Per./unit	POP.	SUM POP.			Ha	Ha										
1	2	6.57	6.57	272	2.60	708	708	2.05	2.69	3.05	3.05	0.14	24.44	1.99	12.6	20.7	60.9%	0.66	200	134	0.40%
2	3	0.00	6.57	0	2.60	0	708	2.05	2.69	0.00	3.05	0.14	24.44	1.99	12.6	20.7	60.9%	0.66	200	277	0.40%
3	4	16.34	43.49	654	2.60	1,700	4,574	13.23	2.23	1.91	4.96	0.22	19.63	12.42	53.9	67.9	79.4%	0.61	375	368	0.15%
4	8	8.17	59.66	327	2.60	850	6,255	18.10	2.16	17.21	40.21	1.81	7.66	18.72	83.4	98.8	84.5%	0.62	450	584	0.12%
8	9	0.00	59.66	0	2.60	0	6,255	18.10	2.16	23.77	75.93	3.42	5.75	20.50	92.2	98.8	93.4%	0.62	450	431	0.12%
9	10	16.51	91.64	661	2.60	1,717	9,582	27.73	2.07	0.00	87.88	3.95	5.39	30.05	126.6	136.0	93.1%	0.63	525	402	0.10%
10	16	17.48	157.28	699	2.60	1,818	16,408	47.48	1.97	4.80	105.28	4.74	4.97	49.30	193.2	194.2	99.5%	0.69	600	937	0.10%
16	35	14.29	216.60	571	2.60	1,486	22,577	65.33	1.90	3.96	122.80	5.53	4.63	66.79	252.0	265.8	94.8%	0.74	675	232	0.10%
35	36	0.00	216.60	0	2.60	0	22,577	65.33	1.90	0.00	122.80	5.53	4.63	66.79	252.0	265.8	94.8%	0.74	675	753	0.10%
36	34	0.00	243.80	0	2.60	0	25,406	73.51	1.88	0.00	130.56	5.88	4.51	74.79	278.6	352.0	79.1%	0.80	750	603	0.10%
34	33	8.83	252.63	353	2.60	918	26,324	76.17	1.87	0.93	131.49	5.92	4.49	77.31	286.9	352.0	81.5%	0.80	750	482	0.10%
33	37	4.93	279.20	197	2.60	513	29,087	84.17	1.86	4.01	135.50	6.10	4.43	84.95	311.9	352.0	88.6%	0.80	750	503	0.10%
37	38	0.00	295.90	0	2.60	0	30,824	89.19	1.85	0.00	144.06	6.48	4.31	90.05	328.6	352.0	93.3%	0.80	750	332	0.10%
38	SMH-C-67	0.00	324.34	0	2.60	0	33,783	97.75	1.83	0.00	151.58	6.82	4.21	98.39	355.7	572.5	62.1%	0.90	900	1426	0.10%
17	18	4.58	4.58	193	2.60	501	501	1.45	2.79	0.00	0.00	0.00	0.00	1.28	6.2	20.7	29.8%	0.66	200	236	0.40%
5	6	8.00	8.00	320	2.60	832	832	2.41	2.65	0.00	0.00	0.00	0.00	2.24	10.0	20.7	48.3%	0.66	200	265	0.40%
6	18	8.00	16.00	320	2.60	832	1,664	4.82	2.47	0.00	0.00	0.00	0.00	4.48	19.0	31.5	60.5%	0.64	250	255	0.28%
18	3	0.00	20.58	0.00	2.60	0	2,166	6.27	2.41	0.00	0.00	0.00	0.00	5.76	24.2	31.5	77.0%	0.64	250	325	0.28%
7	19	4.00	4.00	160	2.60	416	416	1.20	2.84	9.02	9.02	0.41	15.01	1.57	12.9	20.7	62.1%	0.66	200	400	0.40%
19	4	4.00	8.00	160	2.60	416	832	2.41	2.65	9.02	18.04	0.81	10.98	3.14	21.4	31.5	68.1%	0.64	250	371	0.28%
20	8	0.00	0.00	0	2.60	0	0	0.00	0.00	11.95	11.95	0.54	13.22	0.60	9.0	20.7	43.2%	0.66	200	378	0.40%
11	12	0.00	0.00	0	2.60	0	0	0.00	0.00	11.95	11.95	0.54	13.22	0.60	9.0	20.7	43.2%	0.66	200	435	0.40%
12	21	15.47	15.47	619	2.60	1,609	1,609	4.66	2.48	0.00	11.95	0.54	13.22	4.93	27.4	31.5	87.1%	0.64	250	400	0.28%
21	9	0.00	15.47	0	2.60	0	1,609	4.66	2.48	0.00	11.95	0.54	13.22	4.93	27.4	31.5	87.1%	0.64	250	374	0.28%
13	22	15.34	15.34	614	2.60	1,595	1,595	4.62	2.48	7.80	7.80	0.35	16.02	4.69	25.3	31.5	80.4%	0.64	250	400	0.28%
22	10	32.82	48.16	1,313	2.60	3,413	5,008	14.49	2.21	4.80	12.60	0.57	12.91	14.11	62.2	67.9	91.6%	0.61	375	370	0.15%
14	15	15.37	15.37	615	2.60	1,599	1,599	4.63	2.48	3.20	3.20	0.14	23.90	4.46	22.5	31.5	71.6%	0.64	250	235	0.28%
15	23	7.69	23.06	307	2.60	799	2,398	6.94	2.38	3.20	6.41	0.29	17.50	6.78	33.0	69.1	47.7%	0.98	300	208	0.51%
23	24	7.69	30.75	307	2.60	799	3,198	9.25	2.31	3.20	9.61	0.43	14.58	9.09	42.8	67.9	63.0%	0.61	375	379	0.15%
24	16	14.29	45.03	571	2.60	1,486	4,684	13.55	2.23	3.96	13.57	0.61	12.48	13.29	59.4	67.9	87.5%	0.61	375	238	0.15%
25	26	11.08	11.08	443	2.60	1,152	1,152	3.33	2.56	4.26	4.26	0.19	21.03	3.31	18.5	20.7	89.1%	0.66	200	178	0.40%
26	27	8.06	19.14	323	2.60	839	1,991	5.76	2.43	3.50	7.76	0.35	16.06	5.75	29.5	31.5	93.6%	0.64	250	189	0.28%
27	36	8.06	27.20	323	2.60	839	2,829	8.19	2.34	0.00	7.76	0.35	16.06	8.00	38.1	45.4	84.1%	0.64	300	260	0.22%
31	32	16.70	16.70	668	2.60	1,737	1,737	5.02	2.46	0.00	0.00	0.00	0.00	4.68	19.8	20.7	95.5%	0.66	200	253	0.40%
32	33	4.93	21.63	197	2.60	513	2,250	6.51	2.40	0.00	0.00	0.00	0.00	6.06	25.2	31.5	80.1%	0.64	250	340	0.28%
30	37	16.70	16.70	668	2.60	1,737	1,737	5.02	2.46	8.57	8.57	0.39	15.35	5.10	27.2	31.5	86.4%	0.64	250	450	0.28%
29	38	28.45	28.45	1,138	2.60	2,958	2,958	8.56	2.33	7.52	7.52	0.34	16.29	8.34	39.3	45.4	86.7%	0.64	300	345	0.22%

Notes:

1. Adding Southfort upsizes 750 mm trunk requirement to 900 mm.
2. Sub-brach 13 to 10 has been lowered by 0.37m to allow for 0.5m separation between the stormwater pipe crossing the sanitary pipe.
3. On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland in Quarter Section R does not meet the criteria for a Crown ownership claim. As a result, it could be developed (with compensation), which would increase the developable area for MH# 22.

7.5 Ultimate Off-Site System

7.5.1 Introduction

The potential off-site ultimate wastewater system options to service the annexation area include:

- Gravity system to ACRWC treatment plant via SERTS-North;
- Gravity system to ACRWC SERTS-North with on-site lift station to service low-lying lands in the northeast annexation area;
- Gravity system to a new on-site lift station with forcemain to ACRWC SERTS-North;
- Gravity system connected to the ACRWC syphon via the existing city wastewater network; or
- Gravity servicing to a lift station discharging to ACRWC syphon via the existing city wastewater network.

The option of gravity servicing of the entire annexation area to the ACRWC SERTS-North was ruled out based on inadequate grade available from the northeast part of the annexation area to SERTS-North. The remaining options are described in further detail below and the on-site sanitary sewer servicing options are discussed in Section 7.4 above.

Prior to developing these remaining options, it is necessary to review the hydraulics of the ACRWC system in SERTS-North upstream of the treatment plant, the available capacity in the ACRWC syphon, and the available capacity within the city wastewater collection system.

7.5.2 ACRWC Treatment Plant / SERTS-North Connection Constraints

The ACRWC treatment plant is located approximately 1 km west of Range Road 232 on the north side of Township Road 540. The most logical connection point to the ACRWC plant would be at Township Road 540 and Range Road 232 where the ACRWC Southeast Regional Trunk Sewer (SERTS) North joins the Northeast Regional Trunk Sewer (NERTS) before extending west to the treatment plant (location shown on off-site servicing maps later in this section).

The SERTS-North and NERTS system is pressurized from the north side of the river (NERTS) to about 800 m south of Township Road 540 and continues to be pressurized as it connects to the treatment plant. Hydraulic modelling by GHD on behalf of the ACRWC indicated that the HGL (HGL) at the SERTS-North connection will range from 614.1 to 614.4 m during dry weather flow conditions, which is about 2.2 to 2.5 m below the ground elevation of 616.6 m but surcharged 1.0 to 1.3 m above the SERTS-North trunk invert. However, during the 1:25-year 24-hour storm, the peak HGL can reach up to 617.5 m, which is 0.9 m above the ground elevation. This range in design HGL at the downstream connection point needs to be considered when developing any options connecting to this pressurized system.

Strathcona County's long-term wastewater servicing plans for the Bremner development include an option that follows Township Road 540 between Range Roads 231 and 232. This represents an opportunity to potentially integrate the Fort Saskatchewan and Bremner off-site systems at this location. However, the ACRWC indicated that the ultimate servicing for Bremner is likely decades away and there is too much uncertainty in the selection of the Bremner off-site trunk alignment to consider this option.

7.5.3 Capacity Review of Ultimate Pre-annexation City System

A capacity review of the existing Fort Saskatchewan wastewater collection system was completed by building in the ultimate pre-annexation flow demands from **Table 7.2** into the model. The flows were discretized by sewershed based on future growth and available land use supply polygons from the 2015 Fort Saskatchewan Growth Study and were added into the model at sewer trunks at representative locations.

The ultimate pre-annexation city system available capacity is shown on **Figure 7.6** which colour codes the available capacity in each pipe based on the amount that is available. Available capacity is determined by subtracting the maximum flow within each pipe from the pipe capacity. The total PWWF for the entire annexation area is about 377 L/s, the downstream system will be required about 400 L/s or higher of available capacity to accommodate the annexation area flow. The red colour represents pipes with less than 400 L/s of available capacity, and the yellow represents available capacity between 400 to 600 L/s. Modelling results show that there is capacity within the city along 86 Avenue to service ultimate pre-annexation development; however, there is one short section of 1050 mm that is below 400 L/s for available capacity. The pipe depth is around 7 m which means a slight surcharge can be allowed with minimal impact on the surrounding area.

The impact of the annexation area was added to the model assuming that the annexation area is serviced to the existing 1,050 mm trunk near 86 Avenue due to the surplus capacity available. The impact of servicing the annexation area through existing city trunks is shown on **Figure 7.7**. The model shows sufficient capacity in the east trunk that wraps around the east side of the city up until the 900 mm trunk along River Road, northeast of the existing syphon inlet chamber. In **Figure 7.6**, the ultimate pre-annexation spare capacity shows that there is some spare capacity left, but not much. Thus, servicing the annexation area through the east trunk will require upgrades along the 900 mm trunk. Thus, off-site levy costs for the annexation area will need to consider an additional section of trunk along River Road upstream of the syphon.

7.5.4 Syphon Capacity

The ACRWC is concerned about the current condition and capacity of the syphon to convey future annexation flows. Thus, the ACRWC prefers servicing options that tie into SERTS-North, i.e., Options 1 and 2 below.

The sensitivity analysis in Section 7.2.2 showed that each syphon pipe could have a capacity ranging from 413 to 536 L/s. The ultimate pre-annexation PWWF is 442 L/s (see **Table 7.2**) which potentially exceeds the syphon capacity. Thus, if ultimate development of the annexation area is to be serviced by the existing city wastewater network, the syphon will require upgrading at some point in the future.

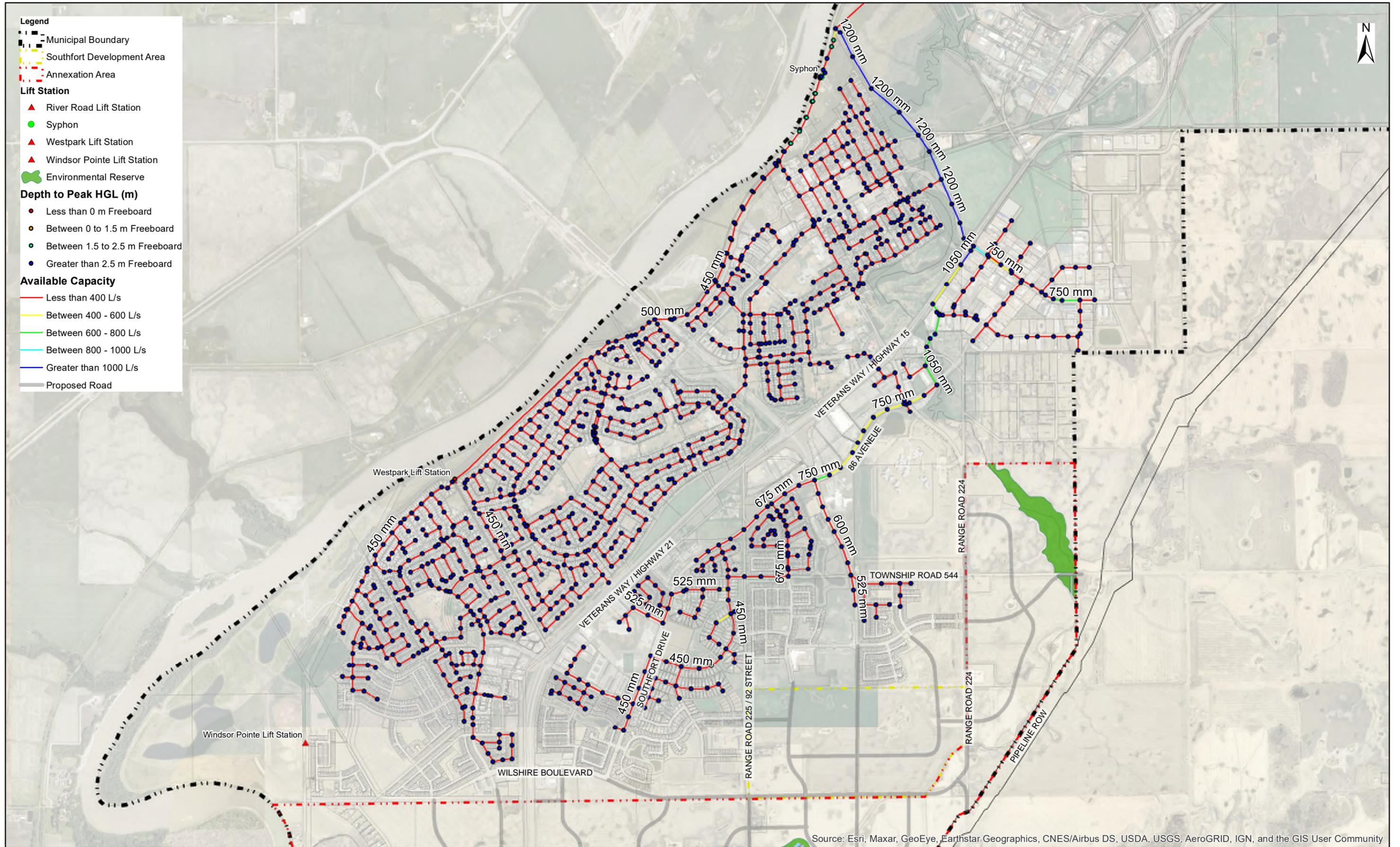
Detailed staging of future growth to estimate when the syphon requires upgrading is described in Section 7.6.

7.5.5 Option 1 Gravity Outfall to ACRWC SERTS North

This option proposes to utilize a gravity outfall to service the western part of the annexation area with higher ground elevations. It maximizes the lands that can be serviced by gravity with Parcels 2, 6, 10, 11, 14, 15 and a portion of 19 serviced by a gravity trunk that will connect with the gravity outfall at Township Road 542 and Highway 21 intersection. Parcels 18, 19 (portion), 22, 23, 28, 29, 33, 34, 35 and 36 would be serviced by the ultimate lift station to the forcemain to Range Road 225 where it will join the gravity trunk.

The gravity outfall would need to terminate immediately upstream of Pointe-aux-Pins Creek with the remaining section being pressurized prior to connecting to SERTS-North. This would be necessary to provide the pressure needed at the connection to SERTS-North at Township Road 540 and Range Road 232. SERTS-North is a pressure pipe from this intersection to the ACRWC treatment plant.

A concept level plan of this option is shown in **Figure 7.8**.



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FORT SASKATCHEWAN ANNEXATION AREA SERVICING DESIGN BRIEF

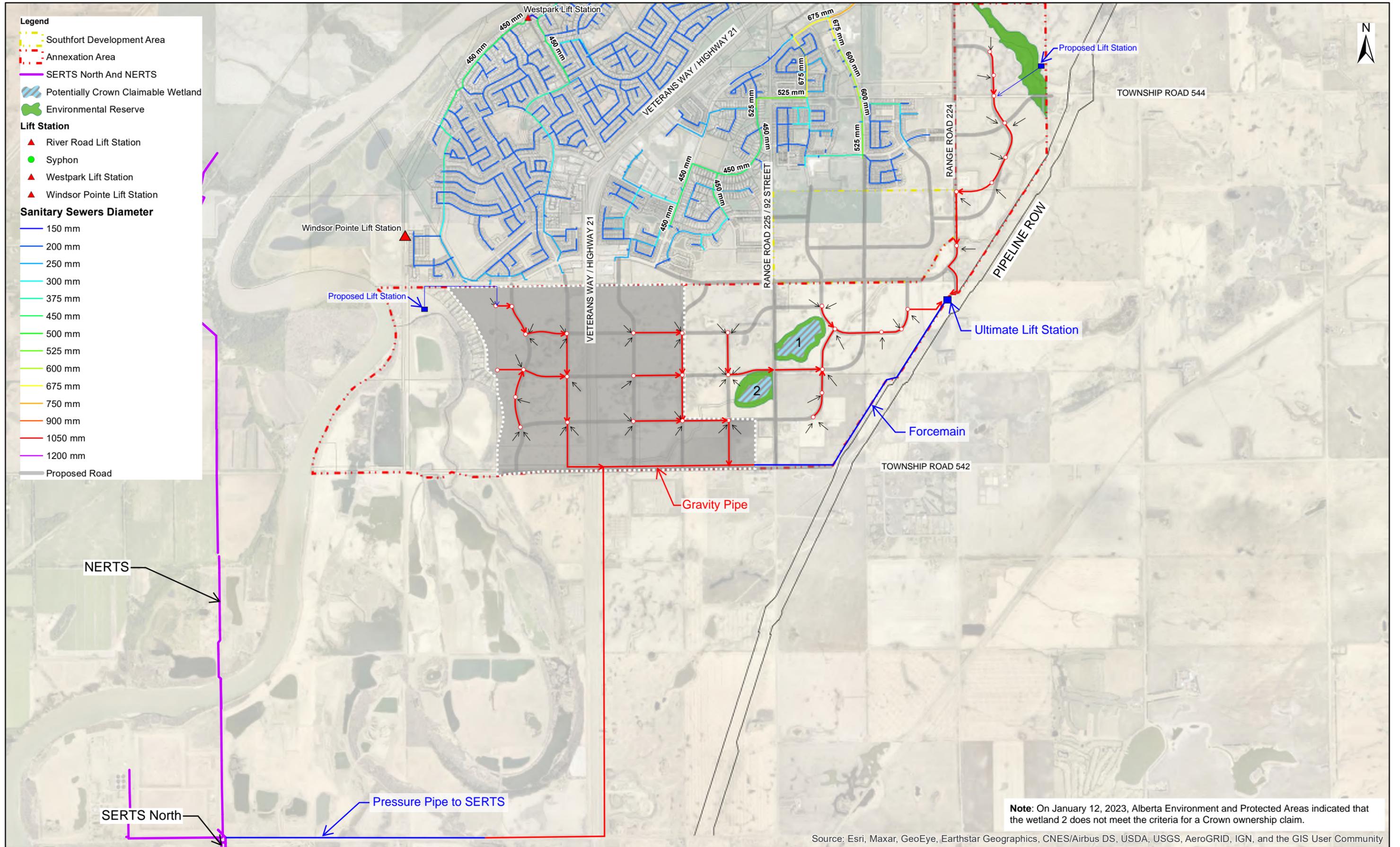
Ultimate Pre-Annexation Sanitary System Available Capacity for Annexation Area Connection

FIGURE 7.6

1:25,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS



**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**

Conceptual Off-Site Sanitary System Option 1 - Gravity Outfall to ACRWC SERTS North

FIGURE 7.8

1:30,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS



7.5.6 Option 2 Lift Station and Forcemain to ACRWC SERTS North

This option utilizes a large lift station servicing the entire annexation area with a forcemain running along the pipeline corridor, Township Road 542, Highway 21, and Township Road 540 to SERTS-North. A concept level plan of this option is shown in **Figure 7.9**. There is potential the two undeveloped Southfort quarter sections to be serviced by this lift station.

The topographic relief along Township Road 542 will result in some design challenges for the forcemain due to potential vacuum pressures. Also, having the forcemain connect directly to SERTS-North could result in some transient pressures. For this reason, it is proposed to discharge the forcemain into a short section of gravity sewer west of Point-aux-Pins Creek. The gravity sewer would then discharge into a pressure pipe that would connect to the SERTS-North pressure pipe.

The total design flow for the ultimate lift station is 377 L/s, based on the PWWF from the entire annexation area. The lift station is expected to have two to three duty pumps plus a standby pump. The preliminary forcemain size is 600 mm, which results in a total dynamic head (TDH) at the lift station of 31 m.

The forcemain will discharge to the gravity sewer immediately west of Point-aux-Pins Creek and will have a total length of 9 km. The preliminary size of the gravity trunk is 525 mm at 1% slope to convey the 430 L/s design flow. The preliminary size of the pressure pipe is 600 mm based on a HGL differential of 7 m. It is assumed that the SERTS-North connection will have a HGL elevation of 614.2 m at Township Road 540 and Range Road 232 based on the findings in the GHD report.

7.5.7 Option 3 Pumped Connection to Existing 1050 mm Pipe on 86 Avenue

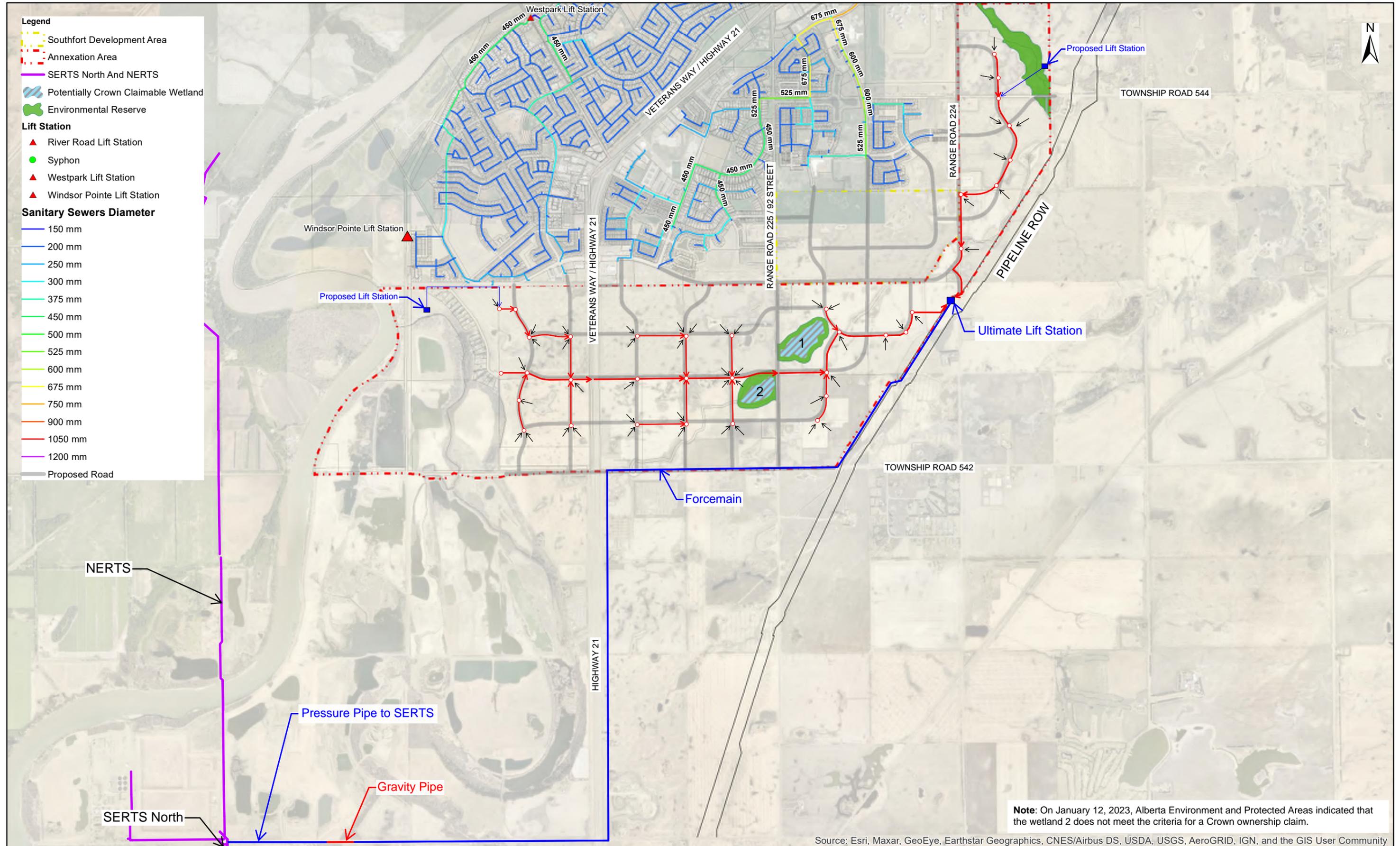
This option utilizes a lift station servicing the entire annexation area with a forcemain running along 101 Street and connecting to the 1050 mm pipe on 86 Avenue as shown in **Figure 7.10**. This option will include the lift station located at the same location as Option 2; however, this option is more cost-effective due to the shortened length of forcemain required. The trunk along River Road upstream of the syphon will need to be twinned (conceptually sized as 900 mm) to ensure adequate capacity to convey flows from the annexation area.

7.5.8 Option 4 Gravity Connection to Existing 1050 mm Pipe on 86 Avenue

This option utilizes the gravity on-site system to service the entire annexation area by bringing the flow along 101 Street and connecting to the 1050 mm pipe on 86 Avenue as shown in **Figure 7.11**. The gravity trunk to 1050 mm trunk is directly impacted by the on-site gravity system; therefore, the on-site system will need to be carefully reviewed to ensure that the downstream system will have enough allowance to connect to the 1050 mm trunk. The on-site system follows the proposed road ROW that transects the quarter section directly south of the annexation boundary; changes to the road ROW will require analysis on the gravity system to ensure adequate depth at the 1050 mm trunk connection.

There is low-lying area located northwest of the annexation area which will require the developers to either fill in the low-lying area to an approximate elevation of 630 to 630.5 m or provide a lift station to allow for the gravity system to connect to the 1050 mm pipe at obvert level.

Similar to Section 7.5.7, a 900 mm sewer is required to ensure adequate conveyance capacity within the pre-annexation ultimate system along River Road.



Note: On January 12, 2023, Alberta Environment and Protected Areas indicated that the wetland 2 does not meet the criteria for a Crown ownership claim.

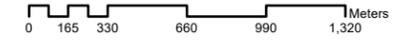
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FORT SASKATCHEWAN ANNEXATION AREA SERVICING DESIGN BRIEF

Conceptual Off-Site Sanitary System Option 2 - Lift Station and Forcemain to ACRWC SERTS North

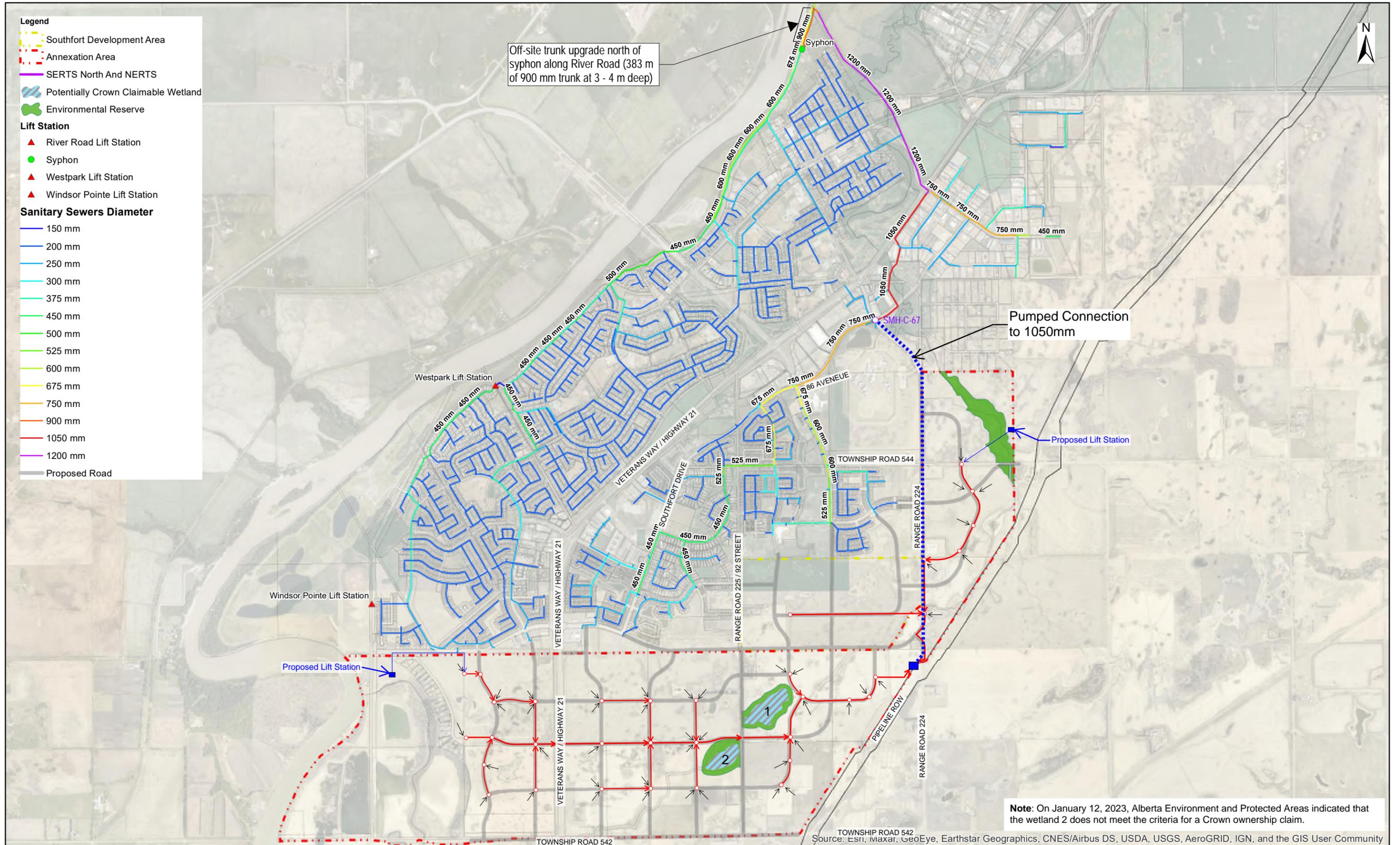
FIGURE 7.9

1:30,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS



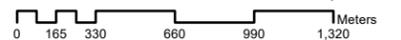


**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**

Conceptual Off-Site Sanitary System Option 3 - Lift Station and Forcemain to Existing 1050 mm on 86 Avenue

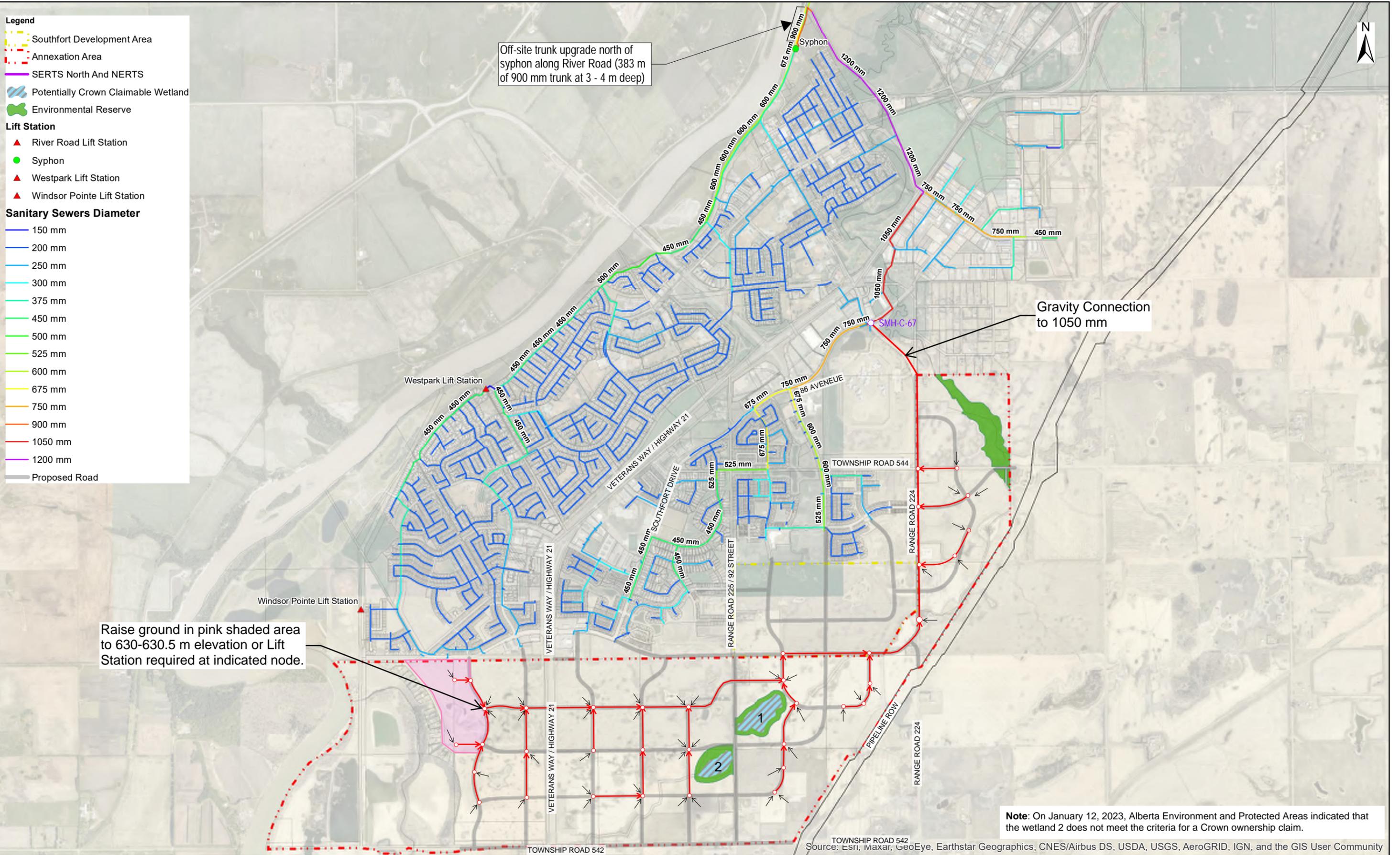
FIGURE 7.10

1:30,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

- Legend**
- Southfort Development Area
 - Annexation Area
 - SERTS North And NERTS
 - Potentially Crown Claimable Wetland
 - Environmental Reserve
- Lift Station**
- River Road Lift Station
 - Syphon
 - Westpark Lift Station
 - Windsor Pointe Lift Station
- Sanitary Sewers Diameter**
- 150 mm
 - 200 mm
 - 250 mm
 - 300 mm
 - 375 mm
 - 450 mm
 - 500 mm
 - 525 mm
 - 600 mm
 - 675 mm
 - 750 mm
 - 900 mm
 - 1050 mm
 - 1200 mm
 - Proposed Road

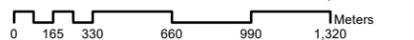


**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**

Conceptual Off-Site Sanitary System Option 4 - Gravity Connection to Existing 1050 mm on 86 Avenue

FIGURE 7.11

1:30,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

7.5.9 Option Evaluation

The above options were evaluated on the basis of total capital costs. Concept level cost estimates are shown in **Table 7.6**. As shown in this table, the gravity outfall to SERTS-North option is much more expensive due to the depth of excavation of the gravity outfall trunk, especially along Highway 21.

Table 7.6: Conceptual Cost Estimate per Option

Item	Option 1 Gravity Outfall to SERTS-North	Option 2 Pumped Outfall to SERTS-North	Option 3 Pumped Connection to Existing City 1050 mm Trunk	Option 4 Gravity Connection to Existing City 1050 mm Trunk
Lift Station	\$8,845,000	\$13,257,000	\$13,257,000	\$1,954,000
Forcemain	\$4,495,000	\$19,158,000	\$6,786,000	-
Gravity Trunk	\$34,866,000	\$439,000	-	\$9,457,000
Pressured Main	\$5,760,000	\$2,088,000	-	-
Total	\$53,966,000	\$34,942,000	\$20,043,000	\$11,411,000

Notes:

1. Required lift station design capacity for each option is:
 - a. Option 1 – 255 L/s;
 - b. Option 2 – 377 L/s;
 - c. Option 3 – 377 L/s; and
 - d. Option 4 – 54 L/s.
2. The overall design flow for the annexation area is 377 L/s, excluding the undeveloped Southfort quarter sections. Including these two quarter sections, the overall design flow increases to 451 L/s.
3. It may be possible to eliminate the lift station for Option 4 using engineering fill to raise the elevation of the serviced land. The costs are included here for comparison purposes only.
4. Option 4 costs include the large diameter trunk on Range Road 224. It also includes the costs for a potential lift station needed for the low-lying area at the northwest annexation area for comparison purposes. This potential lift station would only be needed for Option 4.

Based on this concept level cost comparison, the City has selected Option 4, the gravity connection to existing City 1050 mm trunk on 86 Avenue at 101 Street.

7.6 Interim Servicing of Annexation Area to ACRWC Syphon

Table 7.7 summarizes the pre-annexation and annexation area demands broken down into 5,000 population increments up until the ultimate population scenario. ADWF for the pre-annexation and annexation areas are shown and are discretized into separate rows and the total ADWF, PDWF and PWWF were calculated using peaking factors from the I/I wastewater model at the syphon (to reflect routing most accurately in the trunk sewers).

Key assumptions and notes regarding **Table 7.7** are listed below:

- The syphon capacity shown is based on the reported value from the 2018 GHD NERTS and SERTS-North Study.
- The 2015 Growth Plan projects that pre-annexation city development will roughly progress on the following time frames:
 - Residential by Stage 3 (~2027). Total residential infill is projected at 27.8 L/s.
 - Commercial by Stage 1 (~2021). Total commercial development is 0.8 L/s.
 - Industrial by Ultimate (~2076). Industrial (excluding Josephburg) is 4.7 L/s.
 - Institutional following residential development.
- The existing ADWF of 92 L/s is based on the 2020 calibrated I/I assessment wastewater model.
- Sherritt Industrial ADWF is based on water use records as reported in the 2018 GHD study.
- Josephburg Industrial ADWF is based on projected growth from the Josephburg Road North Industrial ASP knowing that 192 gross hectares will be developed with gravity sewers and 401 gross hectares will develop as low-pressure sewers. Josephburg was assumed to finish development in stage 10 since ultimate industrial development is not anticipated until 2076 as per the 2015 Growth Study.
- The existing and ultimate model runs were used to determine the expected PDWF and PWWF peaking factors. Peaking factors for interim stages 1 through 10 were assumed based on interpolation between the existing and ultimate values.

Table 7.7: Population and Growth Projection for Pre-Annexation Area and Annexation Area (update)

Scenario	Stages											
	Existing	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	Stage 10	Ultimate
Population (c)	27,669	30,000	35,000	40,000	45,000	50,000	55,000	60,000	65,000	70,000	75,000	81,742
Syphon Capacity (L/s)	423											
Pre-Annexation Area												
Existing ADWF (L/s)	92	92	92	92	92	92	92	92	92	92	92	92
Sherritt Industrial ADWF (L/s)	56	56	56	56	56	56	56	56	56	56	56	56
Josephburg Industrial ADWF (L/s)	0	4	4	4	9	9	9	18	18	18	55	55
Southfort ADWF (L/s)	0	0	0	4	10	17	17	17	17	17	17	17
Infill ADWF (L/s)	0	10	20	29	29	29	29	29	29	29	34	34
Total Pre-Annexation ADWF(L/s)	148	163	172	185	196	203	203	212	212	212	254	254
Annexation Area												
Residential Area (ha)	0	16	50	65	90	108	125	154	184	245	262	324
ICI Area (ha)	0	14	45	62	87	92	97	105	113	131	135	152
Total Annexation ADWF (L/s)	0	5	17	23	31	37	42	51	61	80	90	105
Total Demands												
Total ADWF (L/s)	148	168	190	208	227	240	245	263	272	292	344	359
PDWF Factor	1.370	1.374	1.377	1.381	1.385	1.388	1.392	1.395	1.399	1.403	1.406	1.410
Total PDWF (L/s)	203	231	261	287	314	333	341	367	381	409	488	509
PWWF Factor	2.110	2.076	2.043	2.009	1.975	1.942	1.908	1.875	1.841	1.807	1.774	1.740
Total PWWF (L/s)	312	349	387	418	448	465	467	493	501	527	601	615

Table 7.7 shows that the syphon capacity will be reached at a city population of approximately 40,000 to 45,000. This information also provides insight into when the ultimate annexation off-site system needs to be commissioned. Knowing the pre-annexation ultimate development available sewer capacity will determine the flow rates allowed for interim servicing options and will provide insight when interim servicing will need to be upgraded to the ultimate system. For more information regarding staging of the interim on-site wastewater system, see Section 7.7.

7.7 Interim On-Site System

The interim servicing strategy is based on the ultimate on-site and off-site servicing concept with the annexation area serviced to the existing city 1050 mm trunk on 86 Avenue at 101 Street.

Potential interim connection point was assessed with the following criteria:

1. Connection pipe size that is 375 mm and higher;
2. Sufficient capacity at connection point and downstream system; and
3. Reasonable distance from annexation area to connection point.

Figure 7.12 shows the spare capacity in the existing system for pipe size 450 mm and higher.

Based on the above criteria, three potential connection points as shown in **Figure 7.13** were identified:

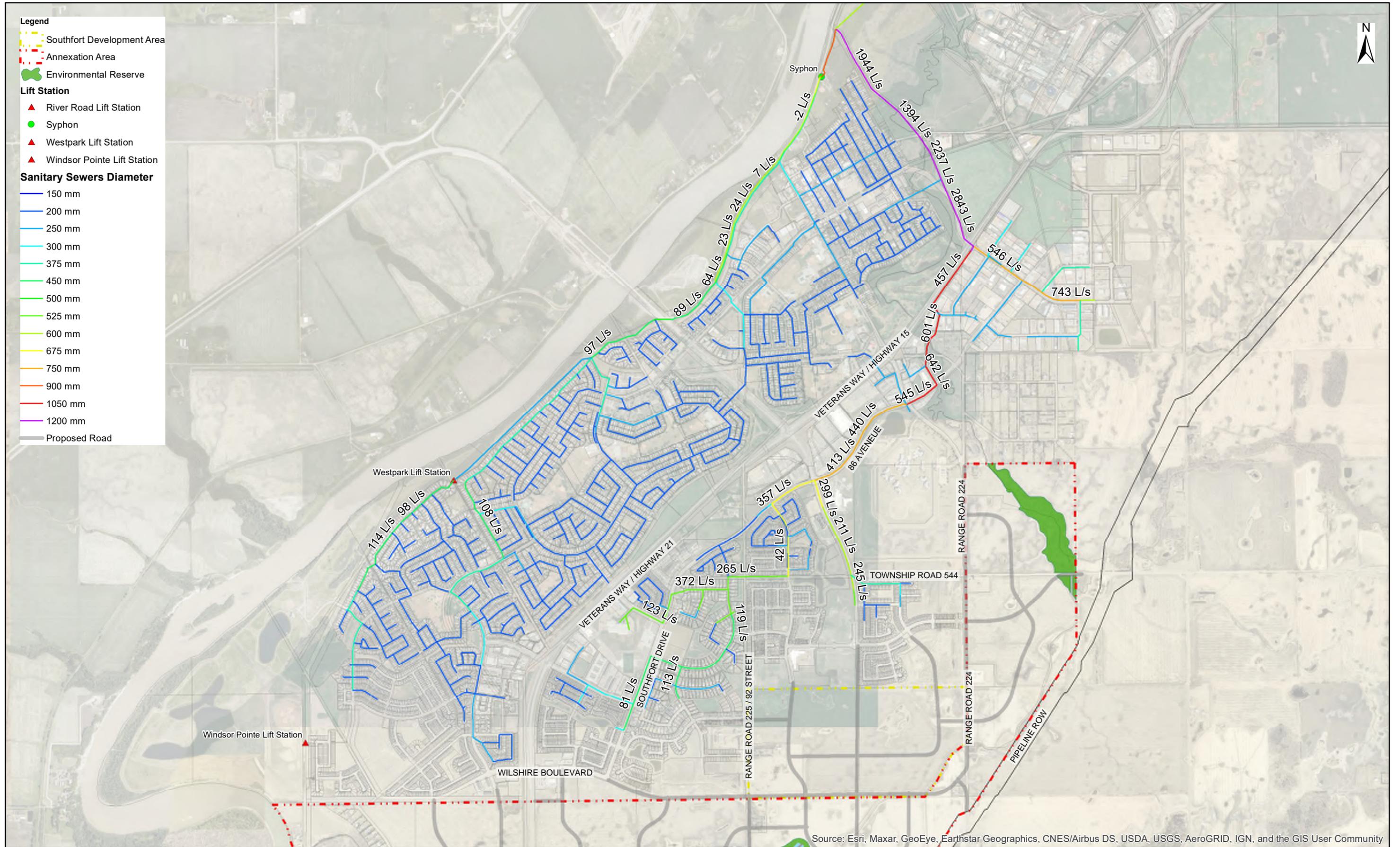
1. 450 mm on Southfort Drive with 81 L/s capacity;
2. 450 mm on Greenfield Link with 113 L/s capacity; and
3. 525 mm on 94 Street with 245 L/s capacity.

There are two connections available west of Highway 21 but there is no spare capacity downstream to accommodate annexation flow as shown in **Figure 7.12**; therefore, interim flow must be connected east of Highway 21.

Interim development assumes approximate five fully built quarter sections over three stages. **Table 7.8** summarizes the cumulative flow over the three stages.

Table 7.8: Interim Servicing Design Flows

Stage	Approximate # of quarter sections	Population	Average Day Demand (L/s)		Peak factor		Peak Dry Weather Flow (L/s)	I/I	Peak Wet Weather Flow (L/s)	Peak Design WWF (L/s)
			Res	Non-Res	Res	Non-Res				
Stage 1	2	5,476	15.8	2.1	2.2	7.2	50	17	67	77
Stage 2	3	7,973	23.1	4.0	2.1	5.4	70	26	96	111
Stage 3	5	13,217	42.9	4.4	2.0	5.1	108	45	152	177

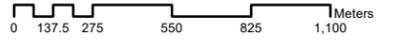


**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**

Ultimate Pre-Annexation Sanitary System Capacity Available

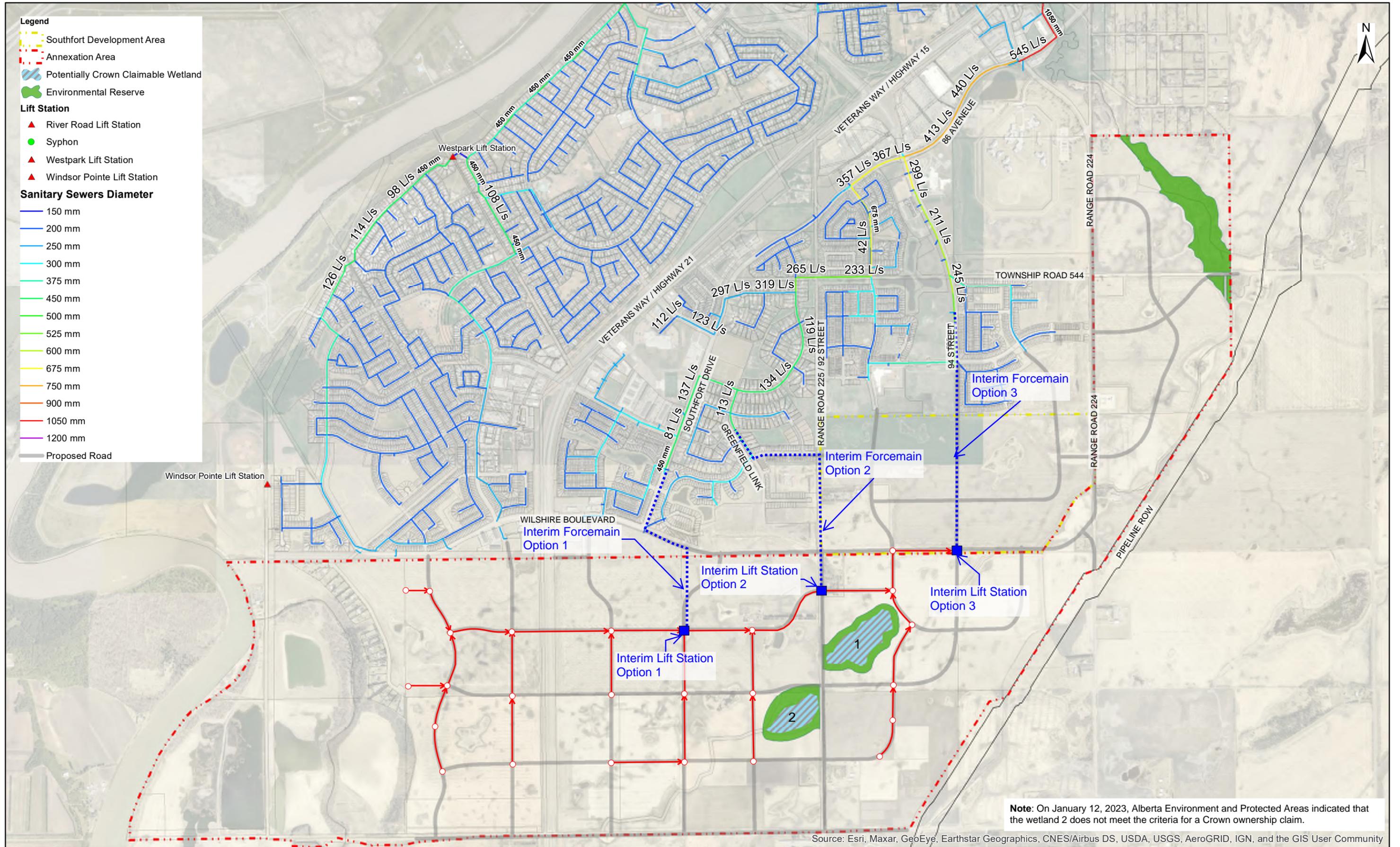
FIGURE 7.12

1:25,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

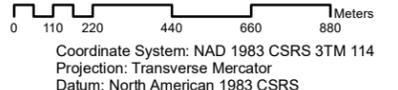




FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Conceptual Interim Sanitary System Options

FIGURE 7.13

1:20,000



Interim Sanitary System Option 1

This option connects to the 450 mm on Southfort Drive with an interim lift station located on the proposed road ROW 400 m south of the north annexation boundary. The connection point has 81 L/s of spare capacity that can accommodate approximately two quarter sections of development.

Interim Sanitary System Option 2

This option connects to the 450 mm on Greenfield Link with an interim lift station located on the proposed road ROW 200 m south of the north annexation boundary. The connection point has 113 L/s of spare capacity that can accommodate approximately three quarter sections of development.

Interim Sanitary System Option 3

This option connects to the 525 mm on 94 Street with an interim lift station on the north annexation boundary. The connection point has 245 L/s of spare capacity that can accommodate approximately six quarter sections of development.

7.8 Wastewater Off-site Levy Cost Estimates

The City uses an off-site levy to fund wastewater trunks that are 525 mm and larger. Wastewater sewers that are 450 mm and smaller are the responsibility of the local developer. Wastewater lift stations servicing multiple development areas can also be funded through off-site levies. For the annexation area, only the gravity sewers 525 mm and larger are expected to be included in the off-site levy costs. The potential lift station in the northwest part of the annexation area is assumed to be funded by the affected developer.

Cost estimates for wastewater trunks with pipe sizes 525 mm and larger are provided in **Table 7.9**. The City should use these cost estimates for developing their off-site levy unit costs for the annexation area. The off-site levy costs also include twinning of the existing trunk along River Road northeast of the syphon inlet chamber as required for servicing of the additional flows from the annexation area.

Table 7.9: Wastewater System Off-Site Levy Costs

Item	Unit Rate (\$/unit)	Unit	Quantity (unit)	Cost
525 mm 6-7 m open cut	1,130	m	400	\$452,000
600 mm 6-7 m open cut	1,167	m	940	\$1,097,000
675 mm 6-7 m open cut	1,364	m	990	\$1,350,000
750 mm 5-6 m open cut	1,310	m	1,082	\$1,417,000
750 mm 7-8 m open cut	1,790	m	503	\$900,000
750 mm 8-9 m open cut	2,110	m	332	\$701,000
900 mm 7-8 m open cut	2,520	m	1,226	\$3,090,000
900 mm 7-8 m HDD	6,000	m	200	\$1,200,000
1800 mm Manhole	9,000	vm	246	\$2,212,000
Off-site Trunk Upgrade North of Syphon Along River Rd (383 m of 900 mm Trunk at 3 – 4 m deep)	1,860	m	383	\$712,000
Subtotal				\$13,131,000
Engineering (15%)				\$1,970,000
Contingency (30%)				\$3,939,000
Total				\$19,040,000

Notes:

1. Cost estimates include allowances for engineering (15%) and contingency (30%). The contingency accounts for any miscellaneous land acquisition, road crossing restoration, washed rock bedding, and ties to existing sewers.
2. Cost estimate includes pipe sizes from 525 mm and higher.
3. Assume 38 manholes at 150 m apart, each at 6.5 m deep.
4. Lift station for the northwest annexation area is assumed to be funded by the affected developers and not included in the off-site levy cost.
5. The existing wastewater trunk that connects to the northside of the syphon inlet chamber has been identified as an off-site levy project. To estimate the cost estimate attributed to the annexation area, it was assumed that the trunk would need to be twinned with a 900 mm trunk (equivalent to the 900 mm trunk proposed) at similar depths to the existing sewer.
6. Marginal increases in the above off-site levy costs are possible if the wetland in Quarter Section R is developed due to local pipes needing to be upsized. The total length of off-site levy trunks is not expected to change. Refer to Appendix D for details.

8.0 Stakeholder Engagement

The City held a stakeholder engagement event on November 2, 2022 from 7:00 PM to 9:00 PM in the Dow Centennial Centre. 61 invitations were sent by mail to landowners in the annexation and Southfort area as well as Pointe aux Pins residents. Approximately 30 people attended. The purpose of the event was to inform stakeholders of the annexation servicing plans and gain their feedback before finalizing the recommendations. The following maps from this report were displayed during the engagement event:

- Annexation Area Context
- Proposed Roadway Classifications
- Active Transportation
- Stormwater Servicing Plan
- Interim Water Servicing Plan
- Ultimate Water Servicing Plan
- Conceptual Interim Sanitary System Option
- Ultimate Sanitary On-Site Concept Option 2

The stakeholder engagement materials are provided in Appendix C for reference. Some of the engagement materials may differ from the Figures in the main body of the report as modifications were made based on the feedback received at the event. A photo from the event is provided in the figure below.



Figure 8.1: Photo from the Stakeholder Engagement Event

Generally, no opposition to the servicing plans were shared by attendees. The following sub-sections provide an overview of the feedback received from the Stakeholder event, separated by subject area.

Land Use: If ASPs were to be on average four quarters in size, there was a desire for flexibility in configuration. For example, a row of four rather than a typical 2x2 configuration. Alternately, there was a desire to do a two-quarter interim ASP with requirement for the neighbouring owners to the south to amend ASP to expand it onto their lands.

- A landowner is expected to develop a church on the first parcel out of the quarter east of the jail. This will likely be a challenge without an ASP and will likely need to provide their own on-site servicing.
 - The representative of the church asked if they could subdivide and sell off the balance of the parcel they don't need or do a lot-line adjustment to facilitate land swap with the neighbouring landowner(s) to smooth out the southern boundary of their parcel.

- **Transportation:** Point-aux-Pins residents generally supported the proposed roadway network. Many residents expressed a desire to prohibit new roadway accesses or connections onto TWP Road 543 and were satisfied in seeing that none were being proposed.
- Two landowners noted the future roadway alignments overlapped their property at the intersection of 101 Street and Southridge Boulevard. The technical team noted that the alignments are schematic and only visual representations of the intended connections. There are not likely to overlap the affected properties.
- **Water and Wastewater:** The figures provided did not show the water lines in the far northeast part of the annexation area. ISL later modified the figure to include the water lines.
- It was noted that additional development has occurred along the south part of the pre-annexation areas that will affect the interim water and wastewater servicing.
 - This is a detail that the developer and their consultant will need to address.
- **Stormwater:** No actionable comments received regarding stormwater.

■ 9.0 Franchise Utilities

ISL reached out to franchise utilities to understand how they would expect to service the annexation area. Most utilities did not respond. ATCO noted that their natural gas distribution facilities in the southern portion of the annexation area have limited capacity and that they should be made aware of planned developments in the area as soon as possible to make the necessary alterations to the system. ATCO's distribution system does not extend to the northern quarter sections east of 101 Street/ Range Road 224.

From ISL's experience franchise utility providers are expected to service the annexation lands based on contiguous extension of existing services. This should be confirmed at the ASP stage. Developing land beyond the availability to existing extend services will be more challenging.

10.0 Conclusions and Recommendations

10.1 Conclusions

Conclusions from this study for each of the service areas are summarized below.

Land Use Planning

1. Most of the annexation area will be primarily developed with residential uses.
2. A highway commercial corridor is expected along Highway 21, as well as several neighbourhood commercial nodes scattered throughout the annexation area to support residential uses.
3. There are no major institutional uses planned for the annexation area. Following the ratio of residential to institutional uses from the Fort Saskatchewan Growth Study (2015), it is assumed that 13.4% of residential areas will be allocated to institutional uses.
4. Of the seven wetlands within the annexation area that have the highest environmental value, the two biggest ones were assumed to be Crown claimable during this study. However, on January 12, 2034, eight (8) months after requesting their response and only weeks before finalizing this study, Alberta Environment and Protected Areas responded and indicated that one of these wetlands did not meet the criteria for Crown Claimability. The impact of this wetland being developed is discussed in Appendix D.
5. The existing drainage ditch ROWs will be reconfigured in the future during the ASP/NSP stage once preliminary engineering is undertaken.
6. The overhead assumption for the conversion of gross to net residential and commercial areas is 35%, corresponding to 10% for parks and open space, 5% for public utilities, and 20% for circulation.
7. The expected average residential density in the annexation area is 40 du/nrha, and the average household size is 2.6 persons.
8. At full buildout, the annexation will have approximately 13,000 dwelling units and 33,800 residents.

Transportation

1. The transportation network proposed to service the annexation lands was developed by extending existing roadways into the annexation area, revising the Southfort ASP roadways to align with the new city boundary, applying a grid style layout, and assuming projects already planned in the TMP and off-site levy bylaw.
2. Through completion of transportation modelling, the proposed transportation network developed for the annexation lands was verified to accommodate the future growth of the annexation area.
3. Reviewing the transportation network congestion based on full buildout of pre-annexation lands helped to inform the team the level of benefit of certain roadways. The following was concluded:
 - a. Veterans Way (south of 84 Street): Veterans Way, south of 84 Street and within the annexation area is operating at low congestion levels with pre-annexation growth and widening to six lanes within this section appears to be benefiting traffic generated from the annexation lands.
 - b. Veterans Way (north of 84 Street): North of 84 Street, congestion occurs within the Veterans Way corridor with pre-annexation growth. Congestion levels do not appear to change significantly with annexation growth implying that additional roadway capacity provided through new roadways connecting to the annexation area helps to spread demand.

- c. 94 Street (Southfort Drive to Sienna Boulevard): Widening to four lanes benefits the pre-annexation growth and is already planned in the City's off-site levy bylaw. Beyond Sienna Boulevard, growth due to annexation appears to increase congestion levels, such that widening could be considered if this becomes problematic. Note it is only for a small section, south of Sienna (refer to Figure 4.10) that has congestion with annexation growth.
 - d. 101 Street and Future Industrial Bypass (Township Road 540, Range Road 223): Both connections operate with fairly low levels of congestion with pre-annexation growth. Congestion increases with annexation and both connections are maintained as 2-lane cross-sections. This route functions as an important connection to both pre-annexation and annexation growth as an alternative to the congested routes on Veterans Way. 101 Street currently exists as an unimproved rural cross-section and will need to be improved to accommodate future volumes, benefiting pre-annexation and annexation growth. Similarly, the Township Road 540/Range Road 223 corridor will need to be improved but this is outside of the city's boundaries and excluded from costs in this study.
4. Active transportation connections are provided throughout the plan area with a shared use path provided on one side of collector and arterial roads.
 5. Additional shared uses paths (not paralleling roads) are provided along the Yorkville Ditch and in the west annexation areas.
 6. The greenway along the old 92 Street alignment north of Southridge Boulevard is extended into the annexation area. 92 Street is expected to provide a shared use path on both sides of the roadway, along with additional public realm features including potential boulevard trees, benches and improved lighting. Exact ROW requirements and cross-section details are subject to further study.
 7. Generally, the transportation network aligns with safe system principals at the planning level; this is discussed in Section 4.7. Highlights which are notable as aligning with safe systems include:
 - a. Dedicated off-site shared uses paths for pedestrians and cyclists;
 - b. Application of roundabouts at intersections, where feasible; and
 - c. A grid-based network, improving overall connectivity for all users.
 8. To further direct application of safe systems policies into the annexation area, specific safe systems policies should be considered by the City for including into future ASPs.

Stormwater

1. The Yorkville and South Boundary Ditches are to be re-aligned along the south side of Township Road 542 east of Highway 21 and along the pipeline ROW bordering the southeast edge of the annexation area. At the point where the city boundary aligns northeast, a new 1650 mm culvert through Township Road 542 will route the new south boundary ditch flows northeast in a realigned Yorkville ditch system to be located immediately inside the city boundary.
2. The proposed on-site stormwater concept is shown on **Figure 5.5** and is designed to control runoff to a maximum rate of 3.0 L/s/ha during the 1:100-year event.
3. The hydraulic assessment conducted of the Ross Creek channel and culverts through the city indicates that there are no conveyance capacity constraints and that there is capacity available to accommodate a higher discharge rate from the annexation area SWMFs. However, this 3.0 L/s/ha release rate is subject to the results of the Ross Creek Erosion Study planned by the City.
4. The bridge culvert (BF00806) at the downstream end of Pointe-aux-Pins Creek is expected to be able to convey the upstream Pointe-aux-Pins watershed and proposed development within the annexation area with only minor levels of surcharging that are unlikely to cause significant flooding risks.

5. It is expected that the first areas of development within each quarter section will construct the ultimate SWMF, outlet structure and inlet/outlet pipes required up to the quarter section boundary. A levy is assumed to be established where subsequent stages of development will pay their share of the listed facility costs and the initial developer is refunded the costs of front-ending the ultimate infrastructure.
6. Ultimate SWMFs can be developed and operated before downstream off-site infrastructure has been constructed. This will require an operational commitment from the City to monitor the SWMF pond levels on a regular basis and following significant runoff events, and to pump out excess water during the summer months to ensure sufficient capacity to accommodate runoff from an extreme rainfall event. Evaporation, evapotranspiration and a few manual pump outs each year to an adjacent road ditch should be sufficient to handle the runoff volumes from typical wet weather seasons.

Water

1. Existing pumping systems have capacity to accommodate pre-annexation area and annexation area growth up to approximately five new quarter sections of development.
2. Storage expansion is required between population of 35,000 and 40,000 according to the projected population growth in pre-annexation and annexation area.
3. Building a new reservoir in the annexation area is more economical than upgrading the main reservoir to accommodate annexation area development.
4. A central location for the new annexation area reservoir is more efficient in servicing the annexation area in interim and ultimate state.
5. The Westpark pump upgrade and main reservoir expansion can be replaced with a new reservoir in the annexation area that will service both the annexation area and pre-annexation area.

Wastewater

1. The 2020 I/I report concluded after model calibration and assessment that the existing wastewater network has low I/I and adequate capacity to convey the PWWF from the 1:25-year 24-hour Huff design storm.
2. Previous ACRWC studies mention that the Fort Saskatchewan Pump Station and existing syphon will require capacity upgrades by 2025. The ACRWC prefers always maintaining one syphon on standby due to uncertain vulnerabilities detected in recent monitoring work. Each existing syphon pipe has approximately 423 to 536 L/s of capacity.
3. Based on the concept level cost comparison between the ultimate on-site and off-site servicing options, the City decided to pursue a gravity off-site trunk connecting to the existing 1050 mm sewer trunk at 101 Street and 86 Avenue (Off-site Option 4). The proposed on-site servicing option (On-site Option 2) will include a gravity sewer system that collects annexation area wastewater and conveys it eastwards towards Range Road 224 and the proposed off-site trunk.
4. Growth staging as described in Section 7.6 shows that the existing syphon capacity will be reached at a city population of approximately 40,000 to 45,000. At this point, the syphon is expected to require upgrading.
5. Three options for sanitary interim servicing were developed and included an interim lift station and forcemain connecting to the 450 mm sewer on Southfort Drive (up to two quarter sections), the 450 mm sewer on Greenfield Link (up to three quarter sections) or the 525 mm sewer on 94 Street (up to six quarter sections).

10.2 Recommendations

Recommendations from this study for each of the service areas are summarized below.

Transportation

1. It is recommended that the City implement the transportation alignments for collector and arterial roadways, the number of lanes, and the intersection controls as depicted in **Figure 4.2, 4.3, and 4.11** respectively.
2. It is recommended the City implement the active transportation plans are depicted in **Figure 4.15**.
3. It is recommended that the City develop offsite transportation levies in preparation of development in the annexation area based on the cost estimates provided in **Tables 4.5 and 4.6**.
4. It is recommended that the City complete an amendment to the Southfort Area Structure Plan (ASP) to align with the recommended transportation networks depicted in **Figures 4.2, 4.3, 4.11, and 4.15** in this study. The changes to the networks in the ASP benefit the overall connectivity of Southfort Boulevard and 101 Street.
5. It is recommended that the City complete an update to their traffic bylaw to extend the truck route along Veterans Way to the south boundary.
6. It is recommended that 101 Street be improved to accommodate future connectivity expected with growth. The City should reach out to the owners of the overhead power lines to start the process of re-aligning the lines to accommodate an urban cross section. The recommended cross section should be reviewed based on the City's discussions with the utility companies and refined as needed.
7. It is recommended that the City work with regional partners and continue to pursue the bypass along Township Road 520 and Range Road 223 as shown in the City's Transportation Master Plan. This connection provides an alternative to Veterans Way.
8. It is recommended that the City obtain ROW for a 4-lane major divided roadway for 94 Street. This is recommended as a logical continuation of the 4-lane cross-section from Arterial A to the future 4-lane section of 94 Street, north of Sienna Boulevard despite 94 Street being proposed as a 2-lane arterial. The Southfort ASP should be updated to depict 94 Street as 4-lanes.
9. Future development should follow the City's access management requirements as outlined in their Standards. Access management requirements should be clearly defined in development of any future ASPs.
10. It is recommended that the City consider adopting policies for future ASPs developed in the area to extend the grid network into the layout of local roadways and avoid building culs-de-sac and loops not providing connectivity across neighbourhoods.
11. The following policies are recommended to carry forward safe systems principals into the development of future ASPs, including;
 - a. Identifying safety areas such as intersections, corridors and areas through predictive safety analysis defining where crashes are most likely to occur. Plan to develop neighbourhoods to include proactive safety interventions to mitigate future safety issues.
 - b. Integrate high pedestrian-generated land uses into communities and transit links such that more people can travel by non-vehicle modes. For example, avoid placing large schools on vehicle-oriented roadways such that vehicle-oriented travel is only feasible.
 - c. Ensure ASPs incorporate traffic calming features into their design to produce lower speed limits where desired.
12. It is recommended that the City complete a planning study for the future 92 Street corridor as this is planned to provide a unique level of complete street elements, unlike other arterials in the annexation area. It is expected to include a wider ROW, larger public realm features, benches, and other aspects.

13. It is recommended that the City complete a functional planning study for the future widening of Veterans Way, from Westpark Drive to the south boundary.
14. It is recommended that future transportation studies be conducted as land use plans are more refined to ensure the transportation servicing plans recommended in this study are suitable.

Stormwater

1. The Yorkville Ditch should be re-aligned along the south boundary of Township Road 542 and along the west side of the pipeline ROW to intercept off-site runoff from the Yorkville Ditch watershed within the County. The cost estimate for this work is approximately \$2.5M and is detailed in **Table 5.7**.
2. It is recommended that the City adopt the proposed on-site stormwater management system shown on **Figure 5.5**, with annexation area runoff controlled to a maximum of 3.0 L/s/ha and discharging to either Pointe-aux-Pins Creek or Ross Creek.
3. It is recommended that the City develop offsite stormwater levies in preparation of development in the annexation area based on the cost estimates provided in **Tables 5.6, 5.7, and 5.8**.
4. It is recommended that the City complete the Ross Creek Basin Study to investigate erosion risks in Ross Creek which may impact the recommended release rate for the SWMFs proposed on-site.
5. The first developer within each quarter section should construct the ultimate SWMF, outlet control structure and SWMF trunks to the quarter section boundary. A levy is recommended to be established for the first developer to be refunded their front-end costs as subsequent development begins.
6. SWMFs are recommended to be operated and maintained on an interim basis by providing regular pond level monitoring as well as monitoring post rainfall event, and to pump out excess water during the summer months to ensure sufficient capacity to accommodate runoff from an extreme rainfall event. This will allow for development to occur naturally without requiring off-site downstream stormwater investments that may stall development.

Water

1. The water distribution system presented in **Figure 6.4** should be used for future water system planning.
2. It is recommended that the City develop offsite water levies in preparation of development in the annexation area based on the cost estimates provided in **Table 6.9**.
3. The location of the proposed annexation area water reservoir should be refined at the ASP stage.
4. It is recommended that the City update their existing off-site levies to include the additional storage capacity required in the pre-annexation area.

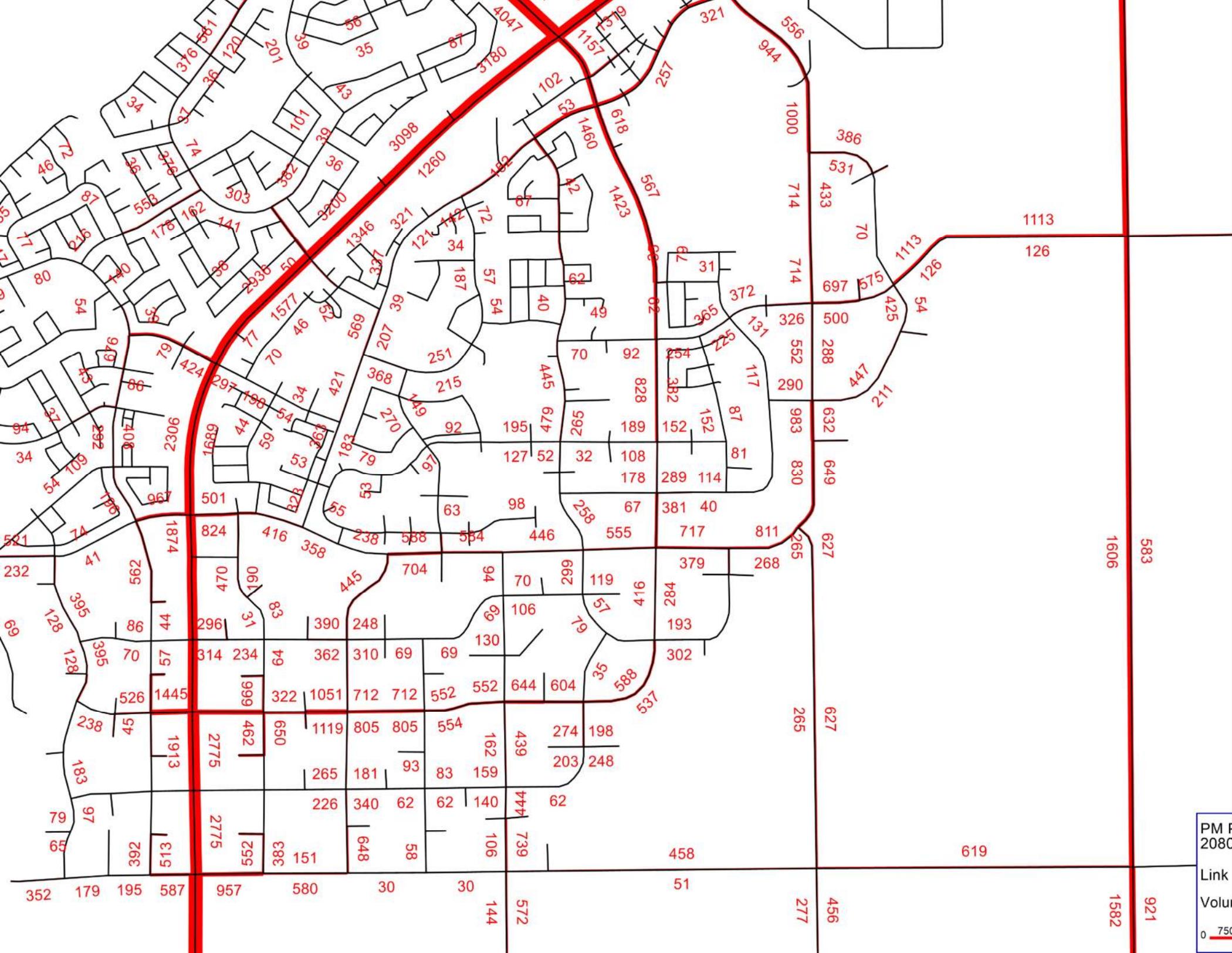
Wastewater

1. It is recommended that the City implement on-site servicing Option 2 which corresponds to off-site servicing Option 4. Collectively, they are comprised of a gravity sewer system that conveys wastewater to the existing 1050 mm trunk at 86 Avenue and 101 Street (sanitary manhole SMH-C-67). The primary on-site sewer trunk is proposed to be approximately 400 m south of the northern boundary of the annexation which will turn north at Range Road 224 and connect to the off-site 900 mm trunk.
2. Future wastewater system planning at the ASP stage should maximize the elevation of the sewer trunk along Range Road 224 and west towards Highway 21 to minimize the area near the Pointe-aux-Pins Creek escarpment that may need to be serviced by a lift station.
3. It is recommended that the developer conduct a detailed feasibility study of the northwest area to assess whether a sanitary lift station or engineered fill is required to service the land to the gravity trunk system.
4. The interim servicing options presented in **Sections 7.6** and **7.7** should be used as a guide for developers for the creation of interim servicing plans.
5. It is recommended that the City coordinate with the ACRWC to better understand the syphon capacity and when the required upgrades should be scheduled. Currently, it is recommended that the ACRWC plan to upgrade the syphon capacity when the City of Fort Saskatchewan approaches a population threshold of 40,000 to 45,000.
6. It is recommended that the City develop off-site wastewater levies in preparation of development in the annexation area based on the detailed cost estimates provided in **Table 7.9**.



APPENDIX
Transportation Appendices
(TMP excerpt, cost estimates)

A



PM P
2080
Link
Volu
0 750

583

1606

1113
126

619

921

1582

277

456

458

51

144

572

30

30

580

957

587

195

179

352

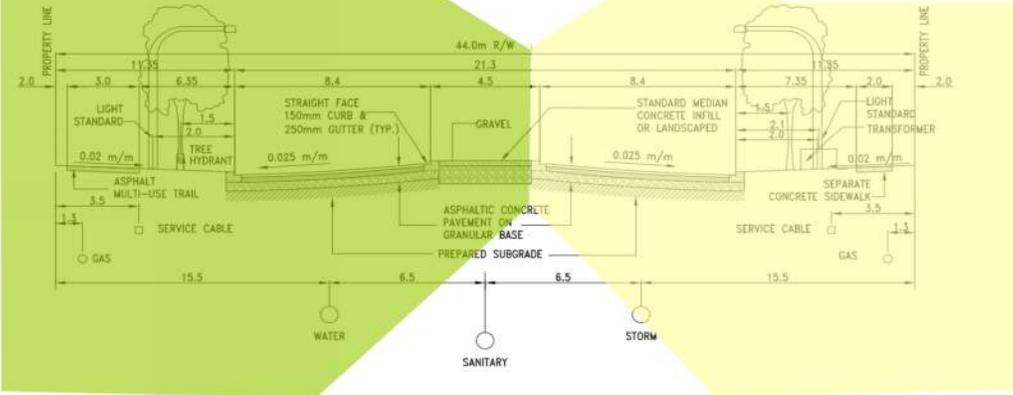
2022 Typical Cost Per Metre of Road - Fort Saskatchewan

Type: 16.8m Major Divided Arterial (T-13) Phase 2 Development * Assume rough grading completed * All mainline water, storm, and sani sewer installed X-Section: T-13					
DESCRIPTION	QTY	UNIT	2022 Estimate		Notes
			Rate	Cost	
Road Construction					
Waste Excavation - Topsoil	7.23	m3	\$33.00	\$238.59	Stripping remainder of ROW (0.3m depth) Roadway Waste Ex. (0.3m depth for road) and (0.15m depth for remainder) Common / Borrow Fill (0.3m depth for road) and (0.15m depth for remainder) Assuming concrete fill 0.15m behind back of curb/overbuild on MUT 0.15m behind back of curb 0.15m overbuild on MUT Lip of gutter to lip of gutter Lip of gutter to lip of gutter Misc. <i>Subtotal</i> Two 100m turn bays per 500m
Waste Excavation - Roadway	4.92	m3	\$33.00	\$162.36	
Common Excavation (Fill)	4.92	m3	\$10.00	\$49.20	
Curb & Gutter (250mm gutter)	2	m	\$88.00	\$176.00	
Median Fill	4.2	m2	\$90.00	\$378.00	
Stabilized Subgrade (150mm)	12.3	m2	\$9.00	\$110.70	
20mm GBC (350mm)	12.6	m2	\$70.00	\$882.00	
20mm GBC (150mm)	3.3	m2	\$50.00	\$165.00	
AC Base (150mm)	7.9	m2	\$30.00	\$237.00	
AC Surface (50mm)	7.9	m2	\$19.00	\$150.10	
AC MUT (75mm LT)	3	m2	\$25.00	\$75.00	
Miscellaneous	5% of Above			\$131.20	
<i>Straight Road</i>				\$2,755.15	
<i>Add L/R Turn Bays</i>	20% @ 500m Apart			\$369.87	
FULL ROAD SUBTOTAL				\$3,125.02	
Other Costs					
Drainage - Mainline & MHs	0	m		\$0.00	Assume mainline Drainage completed in phase 1 Assume CB and leads only, every 75m approx. (both sides of new road) Every 7m, new boulevard only
Drainage - CBs & Leads	0.029	m	\$6,000.00	\$171.43	
Topsoil Placement	8.2	m2	\$10.00	\$82.00	
Seed	8.2	m2	\$1.50	\$12.30	
Trees - one side only	0.14	m	\$600.00	\$85.71	
Misc (Pmt markings, signs)	6% of Full Road Subtotal			\$187.50	
OTHER COSTS SUBTOTAL				\$ 538.94	
2022BASIC COST					
				\$ 3,663.96	
Contingency	20%			\$732.79	12% Leduc
GST (Net)	0%			\$0.00	
Engineering Services D&C	12%			\$527.61	
Admin	0.00%			\$0.00	

TOTAL COST PER METRE	2022 \$	\$ 4,924.37
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**Phase 2
Second Half**
Assumes it is roughly graded in
phase 1.

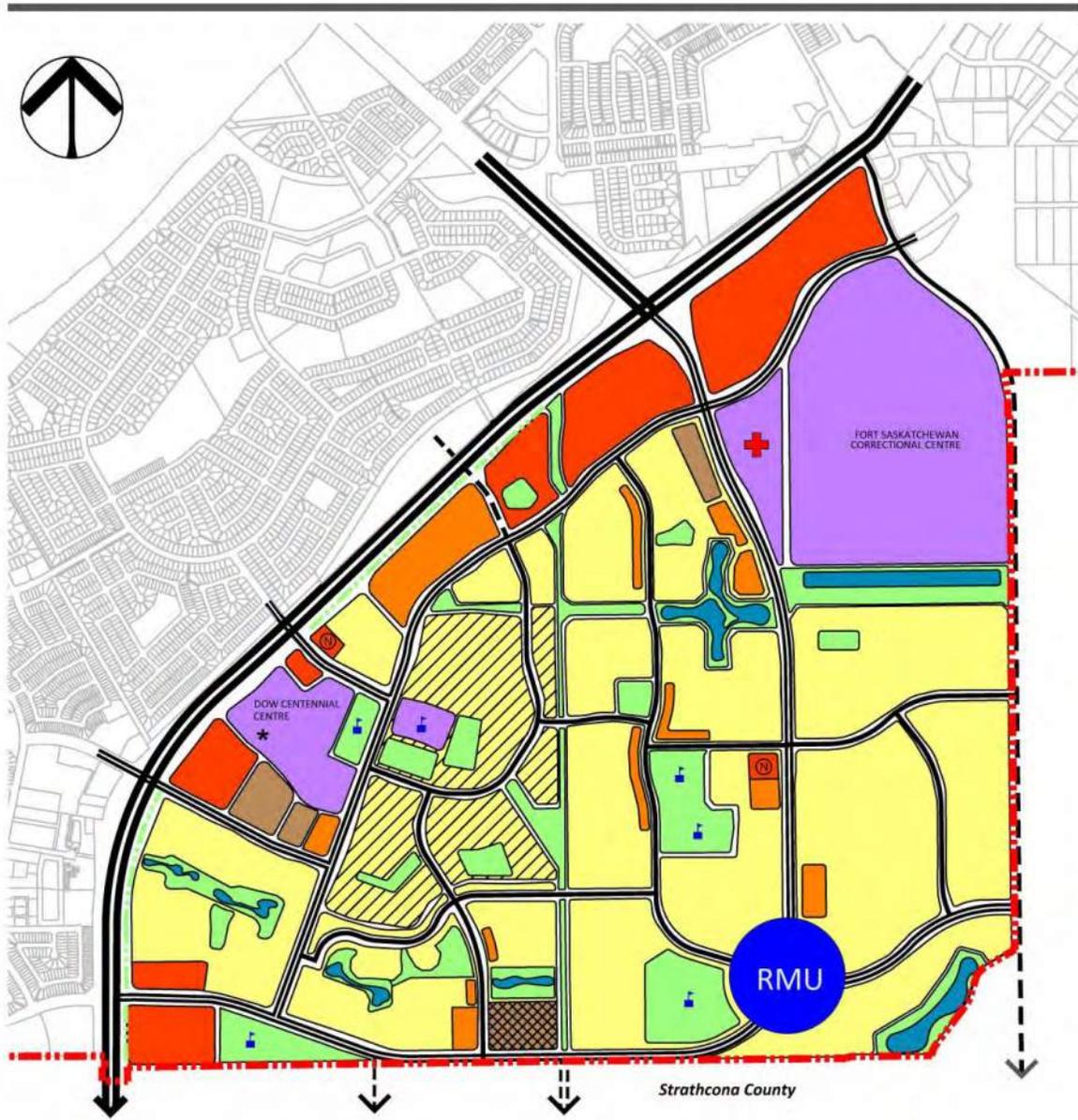
**Phase 1
First Half, excludes
median, but includes rough
grade of second half. (no
costs needed for this)**



NOTE:
- REFER TO THE ENGINEERING DESIGN STANDARDS FOR RECOMMENDED TRAVEL LANE AND PARKING WIDTHS.
- POWER POLES, STREETLIGHT POLES, TRANSFORMER BOXES, AND ALL OTHER STRUCTURES SHALL MAINTAIN A MIN. OF 3.00M CLEARANCE FROM HYDRANT AND SERVICES

ALL DIMENSIONS IN METRES
UNLESS OTHERWISE NOTED

44m RIGHT OF WAY 16.8m MAJOR DIVIDED ARTERIAL		 CITY OF FORT SASKATCHEWAN DWG. NO.
CITY OF FORT SASKATCHEWAN STANDARD DETAIL		
REVISION NUMBER: B	DATE: APRIL 2022	T-13
NOT TO SCALE	DRAWN: EWN	



Land Use Concept Plan
City of Fort Saskatchewan
Southfort Area Structure Plan

- Municipal Boundary
- Park & Ride Site
- Urban Forest Corridor

- Low Density Residential
- Estates Residential
- Medium Density Residential
- High Density Residential
- High Density Street Oriented Mixed Use
- Residential Mixed Use
- Park
- Potential School Site

- Storm Water Management Facility
- Commercial
- Neighbourhood Service
- Institutional
- Freeway
- Arterial
- Optional Arterial
- Collector
- Optional Collector

Note: All size, locations, and areas depicted are conceptual. Actual location & size will be determined through the outline plan and subdivision approval process. The number, size, and location of future school sites may change in response to student demographics. Building of new schools and other institutional uses is dependant upon provincial funding.



December 2018





Project No.:	16178
Project Ref.:	Annexation Servicing Design Briefs
Subject:	Class A Summary
Author:	Alan Kuan
Last Edit:	Jacqueline Prior
Edit Date:	2023-02-02

ITEM	DESCRIPTION	2x1 Intersection		2x1 Roundabout		1x1 Intersection		1x1 Roundabout	
		COST		COST		COST		COST	
1	ROADWORKS	\$ 1,050,000	\$ 860,000	\$ 510,000	\$ 440,000	\$ 510,000	\$ 440,000	\$ 510,000	\$ 440,000
2	ACTIVE MODES INFRASTRUCTURE AND STREETSCAPING	\$ 170,000	\$ 380,000	\$ 80,000	\$ 230,000	\$ 80,000	\$ 230,000	\$ 80,000	\$ 230,000
3	TRAFFIC SIGNALS & WAYFINDING	\$ 440,000	\$ 60,000	\$ 370,000	\$ 50,000	\$ 370,000	\$ 50,000	\$ 370,000	\$ 50,000
Construction Sub-Total (Approximate)		\$ 1,660,000	\$ 1,300,000	\$ 960,000	\$ 720,000	\$ 960,000	\$ 720,000	\$ 960,000	\$ 720,000
Contingency 30%		\$ 498,000	\$ 390,000	\$ 288,000	\$ 216,000	\$ 288,000	\$ 216,000	\$ 288,000	\$ 216,000
Engineering & Testing 15%		\$ 249,000	\$ 195,000	\$ 144,000	\$ 108,000	\$ 144,000	\$ 108,000	\$ 144,000	\$ 108,000
Subtotal		\$ 2,500,000	\$ 1,900,000	\$ 1,400,000	\$ 1,100,000	\$ 1,400,000	\$ 1,100,000	\$ 1,400,000	\$ 1,100,000
Class A Summary		\$3 M	\$2 M	\$1 M					



Project No.:	16178
Project Ref.:	Annexation Servicing Design Briefs
Subject:	Class A
Author:	Alan Kuan
Last Edit:	Jacqueline Prior
Edit Date:	2023-02-02

Notes:

- All costs are in 2022 dollars and do not account for future inflation. Total costs are rounded
- See assumptions pages for detailed notes and assumptions
- Costs are as per design at the time of June 6, 2022

ITEM	DESCRIPTION	UNIT	UNIT RATE	1x1 Intersection		1x1 Roundabout	
				QUANTITY	COST	QUANTITY	COST
1	ROADWORKS				\$ 510,000		\$ 440,000
1.01	Pavement Structure	m ²	\$ 95	3,782	\$ 359,290	2,909	\$ 276,374
1.02	Asphalt Overlays (+/- 50mm)	m ²	\$ 20		\$ -		\$ -
1.03	Asphalt Pathways (MUP)	m ²	\$ 55	1,773	\$ 97,515	1,549	\$ 85,195
1.04	Curb & Gutter (250 mm)	m	\$ 88	568	\$ 49,984	794	\$ 69,863
2	ACTIVE MODES INFRASTRUCTURE AND STREETSCAPING				\$ 80,000		\$ 230,000
2.01	Concrete surfaces (medians & islands)	m ²	\$ 150	0	\$ -	927	\$ 139,020
2.02	Sidewalks	m ²	\$ 150		\$ -		\$ -
2.03	Wheeling Lanes	m ²	\$ 55		\$ -		\$ -
2.04	Concrete Pathway	m ²	\$ 150		\$ -		\$ -
2.05	Sidewalk Railing	m ²	\$ 1,500		\$ -		\$ -
2.06	Streetscape Trees and Landscaping	LS	\$ 500,000		\$ -		\$ -
2.07	Landscaping	m ²	\$ 25	2,803	\$ 70,075	3,379	\$ 84,475
3	TRAFFIC SIGNALS & WAYFINDING				\$ 370,000		\$ 50,000
3.01	Traffic Signals - Full Intersection	ea.	\$ 350,000	1	\$ 350,000		\$ -
3.02	Signage Allowance	LS	\$ 15,000	1	\$ 15,000	2	\$ 30,000
3.03	Pavement Markings Allowance	m	\$ 10	256	\$ 2,560	1588	\$ 15,878
3.04	Street Lighting (beside road)	ea.	\$ 15,000		\$ -		\$ -
3.05	Streetlighting (sidewalk type)	ea.	\$ 10,000		\$ -		\$ -
3.06	Streetlighting (pathway type)	ea.	\$ 10,000		\$ -		\$ -
Construction Sub-Total (Approximate)					\$ 960,000		\$ 720,000
Contingency 30%					\$ 288,000		\$ 216,000
Engineering & Testing 15%					\$ 187,200		\$ 140,400
Subtotal					\$ 1,500,000		\$ 1,100,000

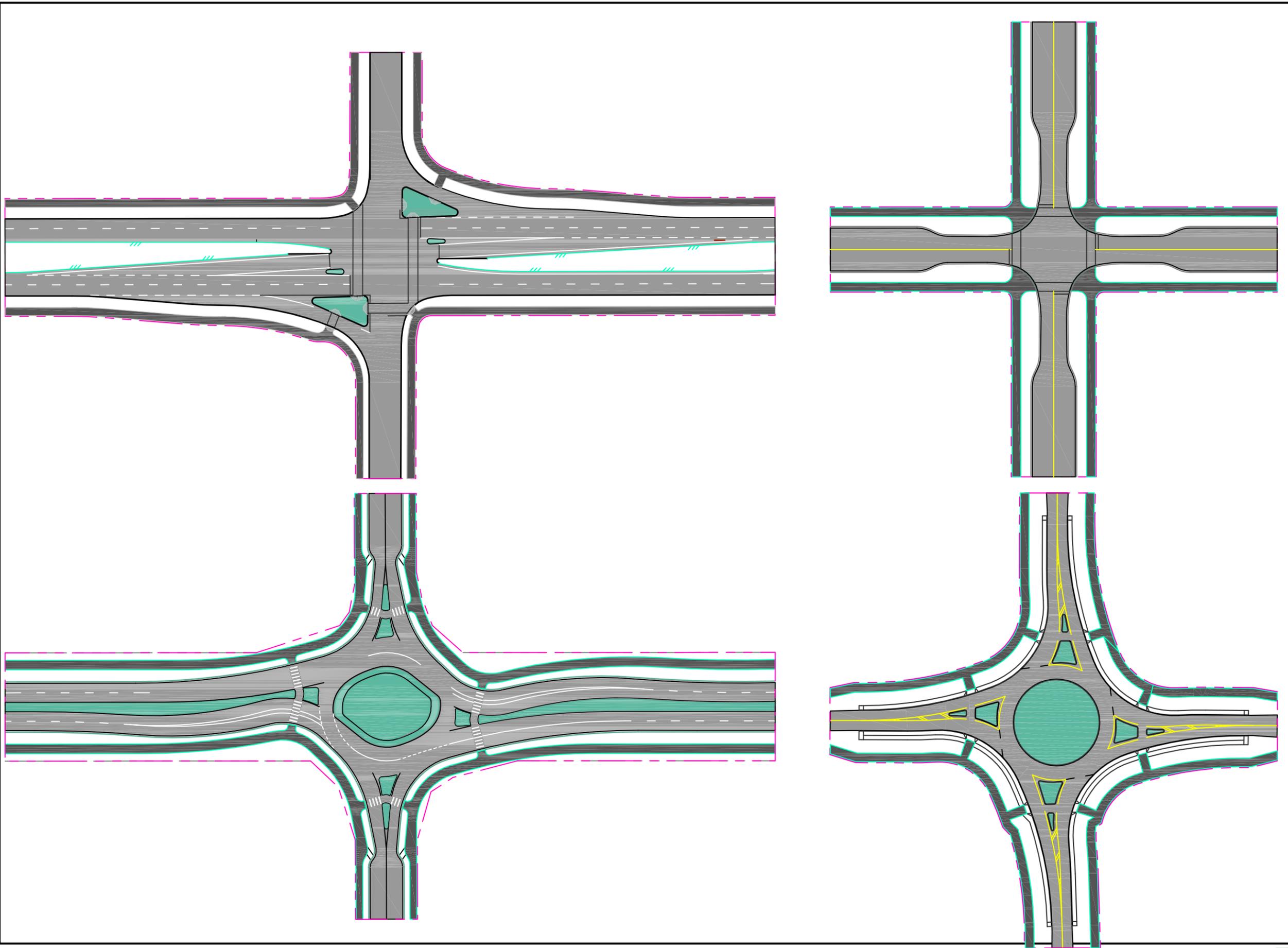


Project No.:	16178
Project Ref.:	Annexation Servicing Design Briefs
Subject:	Class A
Author:	Alan Kuan
Last Edit:	Jacqueline Prior
Edit Date:	2023-02-02

Notes:

- All costs are in 2022 dollars and do not account for future inflation. Total costs are rounded
- See assumptions pages for detailed notes and assumptions
- Costs are as per design at the time of June 6, 2022

ITEM	DESCRIPTION	UNIT	UNIT RATE	2x1 Intersection		2x1 Roundabout	
				QUANTITY	COST	QUANTITY	COST
1	ROADWORKS				\$ 1,050,000		\$ 860,000
1.01	Pavement Structure	m ²	\$ 95	8,904	\$ 845,880	6,253	\$ 594,035
1.02	Asphalt Overlays (+/- 50mm)	m ²	\$ 20		\$ -		\$ -
1.03	Asphalt Pathways (MUP)	m ²	\$ 55	2,186	\$ 120,230	2,560	\$ 140,800
1.04	Curb & Gutter (250 mm)	m	\$ 88	933	\$ 82,104	1,395	\$ 122,760
2	ACTIVE MODES INFRASTRUCTURE AND STREETSCAPING				\$ 170,000		\$ 380,000
2.01	Concrete surfaces (medians & islands)	m ²	\$ 150	300	\$ 45,000	1,737	\$ 260,550
2.02	Sidewalks	m ²	\$ 150		\$ -		\$ -
2.03	Wheeling Lanes	m ²	\$ 55		\$ -		\$ -
2.04	Concrete Pathway	m ²	\$ 150		\$ -		\$ -
2.05	Sidewalk Railing	m ²	\$ 1,500		\$ -		\$ -
2.06	Streetscape Trees and Landscaping	LS	\$ 500,000		\$ -		\$ -
2.07	Landscaping	m ²	\$ 25	4,794	\$ 119,850	4,407	\$ 110,175
3	TRAFFIC SIGNALS & WAYFINDING				\$ 440,000		\$ 60,000
3.01	Traffic Signals - Full Intersection	ea.	\$ 400,000	1	\$ 400,000		\$ -
3.02	Signage Allowance	LS	\$ 15,000	1	\$ 15,000	2	\$ 30,000
3.03	Pavement Markings Allowance	m	\$ 10	2500	\$ 25,000	2790	\$ 27,900
3.04	Street Lighting (beside road)	ea.	\$ 15,000		\$ -	0	\$ -
3.05	Streetlighting (sidewalk type)	ea.	\$ 10,000		\$ -		\$ -
3.06	Streetlighting (pathway type)	ea.	\$ 10,000		\$ -		\$ -
Construction Sub-Total (Approximate)					\$ 1,660,000		\$ 1,300,000
Contingency 30%					\$ 498,000		\$ 390,000
Engineering & Testing 15%					\$ 249,000		\$ 195,000
Subtotal					\$ 2,500,000		\$ 1,900,000



SIGNALIZED INTERSECTION AND
ROUNDBOUT TEMPLATES





APPENDIX
Ross Creek Hydraulic Assessment
Modelling Details

B

Appendix B Ross Creek Hydraulic Assessment Modelling Details

B.1 Introduction

The purpose of this appendix is to summarize the modelling methodology and hydraulic assessment of Ross Creek and culverts in response to development within the annexation area.

B.2 Ross Creek Reaches and Culverts

A plan view showing the model definition of the modelling reaches and culverts is shown on **Figure B.1**. The culvert parameters are summarized in **Table B.1**.

Table B.1: Ross Creek Culvert Information

Culvert ID	U/S Inv. (m)	D/S Inv. (m)	Road Elev. (m)	L (m)	S (%)	d (mm)	H (mm)	W (mm)	Shape	Capacity (m ³ /s)
Bridge_17	617.38	617.36	623.34	38.4	0.04	8,030	-	-	Semi-Circular	32.9
Bridge_07	616.95	616.89	621.83	29.0	0.21	3,200	-	-	Circular	14.3
Bridge_07_2	617.58	617.45	621.83	25.0	0.52	2,600	-	-	Circular	13.1
Bridge_04	617.58	616.98	623.30	49.2	1.22	-	3,000	2,200	Box	41.4
Bridge_04_2	617.58	616.98	623.30	49.2	1.22	-	3,000	2,200	Box	41.4
Bridge_04_3	617.58	616.98	623.30	49.2	1.22	3,000	-	-	Circular	29.3
Bridge_08	614.50	614.00	620.50	70.0	0.71	3,200	-	-	Circular	26.7
Bridge_08_2	614.50	614.00	620.50	70.0	0.71	3,200	-	-	Circular	26.7
Bridge_05	612.49	611.99	619.58	54.9	0.91	3,670	-	-	Circular	43.4
Bridge_05_2	612.49	611.93	619.58	59.0	0.95	3,800	-	-	Circular	48.6
Bridge_09	596.87	596.58	604.00	42.7	0.68	4,920	-	-	Circular	81.9

Notes:

1. Inlet / Outlet offsets applied to ensure culvert slopes are consistent with the digital elevation model elevations.



Legend

- Model Nodes
- ▲ Outfalls
- Creek
- Bridge
- Culvert
- Outfall
- Annexation Area
- Southfort
- Municipal Boundary

Coordinate System:
NAD 1983 CSRS 3TM 114

1:20,000

0 200 400 800 Meters

FIGURE B.1
ROSS CREEK REACHES AND CULVERT LOCATIONS



Date: 2022-06-03 Document: M:\eramp\5116178 - Fort Saskatchewan Annexation Servicing Design Brief\GIS\16178 Ross Creek Model.mxd

B.3 Modelling Methodology

B.3.1 Design Event and Allowable Release Rates

To evaluate the upstream Ross Creek system, the Alberta Flow Estimation Tool for Ungauged Watersheds (AFETUW) was used to estimate the effective area of contributing upstream watersheds. Previous monitoring work in adjacent creek systems was used as an estimate to discern 100-year pre-development release rates, which were then applied to the watersheds.

Figure B.2 shows the overall upstream watersheds with their effective areas in red boundaries. The allowable release rates from these catchments are listed below:

- Yorkville Ditch Watershed (clear) – 1.6 L/s/ha
- Ross Creek Watershed (green) – 1.6 L/s/ha
- East Tributary Watershed (yellow) – 1.6 L/s/ha

The annexation area has been evaluated using a release rate of 3.0 L/s/ha. It should be noted that the area the Yorkville Ditch Watershed overlaps with the proposed annexation area; thus, the area developed as part of the annexation area has been subtracted from this watershed as part of the modelling process.

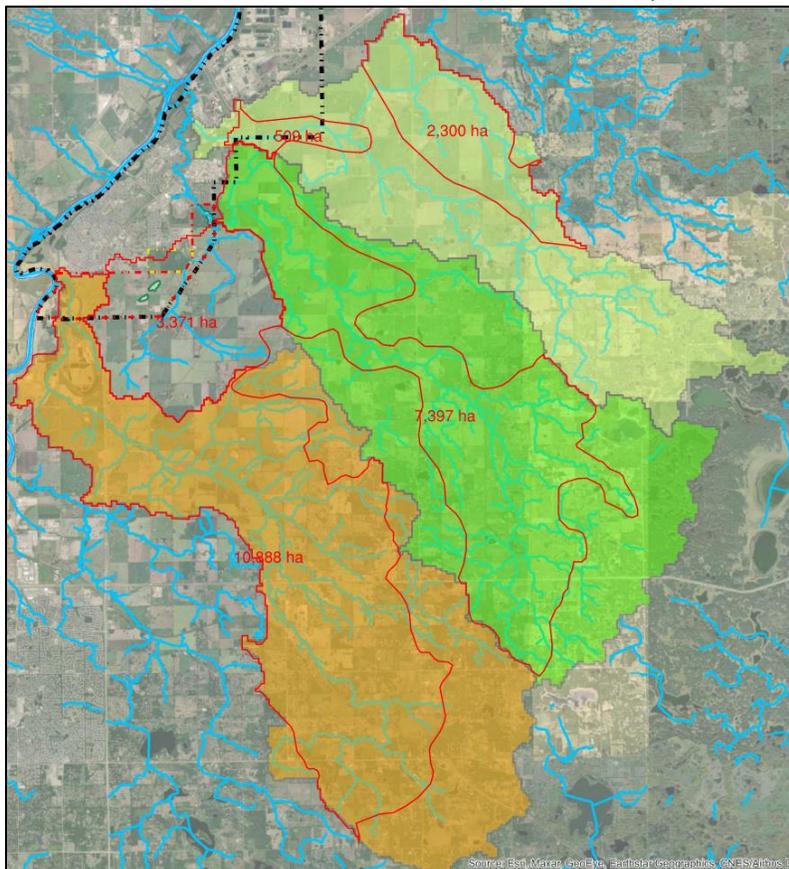


Figure B.2: Upstream Ross Creek Watersheds and Effective Areas

B.3.2 Transect Creation Tool

The Transect Creator Tool is a PCSWMM tool that generates cross-sections at user-specified intervals along the creek alignment. The transects can then be analyzed and filtered to select a cross-section that is representative for each reach. For this assessment, a transect length up to 400 m as a conservative measure to ensure the poorly defined regions were well captured. **Figure B.3** shows an example of several transects generated at 100 m intervals

along the C3 reach. The orange transects show cross-sections that were selected to represent reaches while the grey transects were filtered out of the analysis. Detailed transect information is provided in **Table B.2** at the end of this document.



Figure B.3: Example of PCSWMM Model Transect Creation

B.3.3 Urban Catchment Runoff Calculations

To evaluate the runoff contributions to Ross Creek within the City, urban catchments were delineated using topographical data from Fort Saskatchewan and the existing storm sewer network database. **Figure B.4** shows the urban catchments contributing to the Ross Creek system within the City.

A Rational Formula calculation was completed for each of the urban catchments assuming that the storm network had capacity for only the 5-year design event. The results are shown in **Table B.3**.

Table B.3: Ross Creek Urban Catchment Runoff Calculations

Catchment ID	Area (ha)	Land Use	IMP (%)	C	T _c (min)	i (mm/hr)	Q (m ³ /s)	Connection ID
1	3.59	Residential	50%	0.525	8	76.7	0.40	J24
2	5.49	Residential	50%	0.525	8	76.7	0.61	J23
3	13.31	Res. / Comm.	65%	0.653	9.2	71.0	1.71	J21
4	36.36	Residential	50%	0.525	9.2	71.0	3.76	J17
5	6.83	Residential	50%	0.525	8	76.7	0.76	J15
6	23.52	Commercial	30%	0.355	9.2	71.0	1.65	J13
7	36.01	Commercial	70%	0.695	9.2	71.0	4.93	J7
8	74.3	Industrial	55%	0.568	10.4	66.2	7.76	J14
9	24.78	Industrial	55%	0.568	9.2	71.0	2.77	J12

Notes:

1. Impervious values estimated using aerial photography.
2. Runoff Coefficient: $C = 0.95 \cdot IMP + 0.1 \cdot (1 - IMP)$.
3. Time of concentration values are based on EPCOR design values.
4. Intensity based on Fort Saskatchewan IDF curve data.

Catchments have been identified within the pre-annexation municipal boundary that appear to drain to stormwater management facilities (SWMF). These catchments are assumed to be controlled to release rates of 3.0 L/s/ha. The projected runoff is shown in **Table B.4** below.

Table B.4: Urban Catchments Controlled by SWMFs

Catchment ID	Area (ha)	Release Rate (L/s/ha)	Flow Rate (m ³ /s)	Connection ID
1	46	3.0	0.138	J7
2	313	3.0	0.938	J5
3	20	3.0	0.061	J4

Notes:

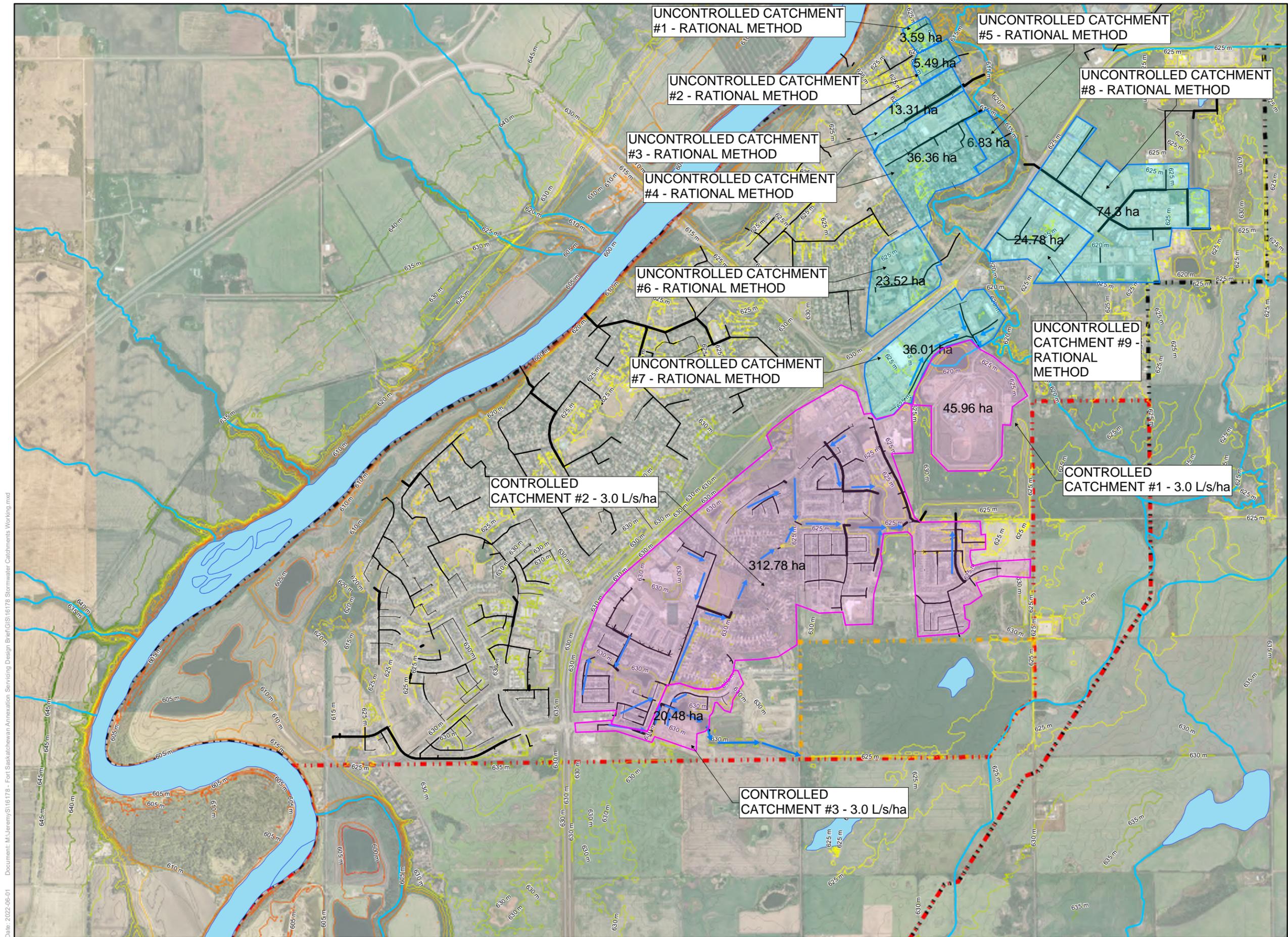
1. Catchments assume a SWMF release rate of 3.0 L/s/ha.

B.3.4 Upstream Catchment and Annexation Area Runoff

Upstream watersheds and the annexation area runoff is assumed to be controlled to the release rates described in **Section B.3.1**. **Table B.5** summarizes the upstream watershed runoff potential based on the release rate multiplied by the effective area. Note that the Yorkville Ditch catchment has been reduced to account for the area that overlaps with the annexation boundary.

Table B.5: Upstream Watersheds and Annexation Area Runoff

Catchment	Area (ha)	Effective Area (ha)	Release Rate (L/s/ha)	Flow Rate (m ³ /s)	Connection ID
Annexation Area & Southfort Quarters	718	718	3.0	2.154	J4
Yorkville Ditch	3,413	2,672	1.6	4.2752	J2
Upstream Ross Creek	14,584	7,397	1.6	11.8352	J1
Upstream East Tributary	9,599	2,809	1.6	4.4944	J26



Legend

diameter

- 150 - 375
- 376 - 900
- 901 - 1800

Water Body
Water Course

Contours (5 m)

Elevation

- 650
- 645
- 640
- 635
- 630
- 625
- 620
- 615
- 610
- 605
- 600

Contours (1 m)

Annexation Area
Southfort
Municipal Boundary

Coordinate System:
NAD 1983 CSRS 3TM 114

1:25,000

0 250 500 1,000 Meters

FIGURE B.4
ROSS CREEK URBAN CATCHMENT BOUNDARIES



Date: 2022-06-01 Document: M:\Jeremy\5116178 - Fort Saskatchewan Annexation Servicing Design Brief\GIS\16178 Stormwater Catchments Working.mxd

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

B.4 Modelling Results

The modelling results for culvert capacity utilization, Ross Creek reach flooding risks, and a sample transect for Reach C3 is shown in **Table B.6**, **Table B.7** and **Figure B.5**, respectively. The culverts show adequate capacity to convey runoff although Bridge_07 appears to be nearing full capacity at 86 – 92% full. The creek reaches have shown low risk of flooding critical infrastructure and there are minor risks of flooding out low-lying areas and some creek-adjacent areas of the golf course.

Table B.6: Culvert Capacity Utilization Modelling Results

Culvert ID	Max Flow (m ³ /s)	Capacity (m ³ /s)	Max Flow / Capacity
Bridge_17	24.4	32.9	0.74
Bridge_07	13.1	14.3	0.92
Bridge_07_2	11.3	13.1	0.86
Bridge_04	9.1	41.4	0.22
Bridge_04_2	9.1	41.4	0.22
Bridge_04_3	9.0	29.3	0.31
Bridge_08	20.5	26.7	0.77
Bridge_08_2	20.5	26.7	0.77
Bridge_05	20.9	43.4	0.48
Bridge_05_2	21.9	48.6	0.45
Bridge_09	48.3	81.9	0.59

Table B.7: Ross Creek Reach Flooding Risk Modelling Results Summary

Section	Max Flow (m ³ /s)	Creek Bed Elevation (m)	Left Top of Bank (m)	Right Top of Bank (m)	Max WSE (m)	Notes
C1	12.8	621.480	623.282	623.463	622.670	Potential to flood out low-lying areas
C2	19.4	620.858	622.660	622.841	622.560	Estimated by u/s transect; Potential to flood out low-lying areas
C3	16.2	620.093	622.705	622.824	622.020	No concerns
C4	18.5	619.522	622.134	622.253	621.260	Estimated by u/s transect; no concerns
C5	19.3	619.246	622.448	623.220	621.260	Potential to flood out low-lying areas
C6	24.4	618.710	622.887	621.951	621.240	Potential to flood out low-lying areas
C7	24.4	619.116	623.000	623.242	620.740	Estimated by d/s transect; no concerns
C8	24.4	618.120	622.004	622.246	619.970	No concerns
C9	28.8	616.329	618.440	618.375	618.290	Potential to flood low-lying areas of golf course
C10	36.6	615.485	617.043	617.004	618.130	Potential to flood low-lying areas of golf course
C11	37.3	614.966	619.920	622.462	617.910	Potential to flood out low-lying areas
C12	41.1	614.598	620.247	619.490	617.880	No concerns
C13	41.1	613.716	619.860	618.998	616.890	No concerns
C14	42.8	613.877	617.284	621.280	616.730	No concerns
C15	43.4	613.381	615.593	615.731	615.190	No concerns
C16	43.8	613.184	619.792	619.030	612.940	No concerns
C17	48.3	606.882	622.853	612.196	606.790	No concerns
C18	48.3	597.797	607.153	601.845	599.930	No concerns

Notes:

1. Creek sections consider downstream culvert capacity since the creek is not well defined along its length and has potential to spill within the densely vegetated, low-lying areas.
2. Low-lying areas are densely wooded and forested areas within the existing City that are undevelopable (environmental reserve).
3. Inverts and top of bank elevations are estimated based on transect sampling along the alignment and are not exact.

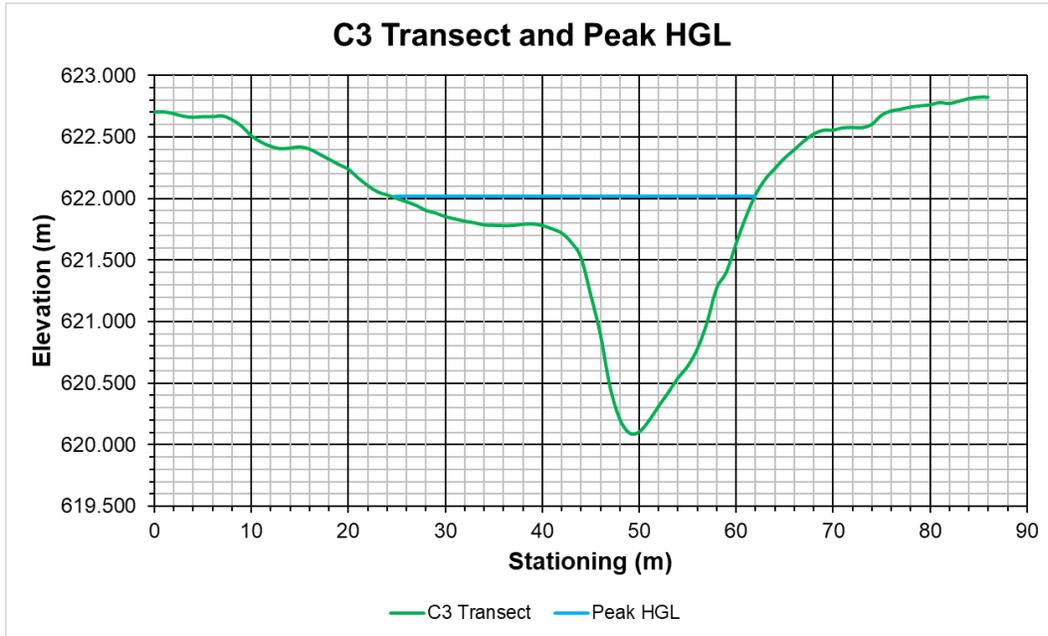
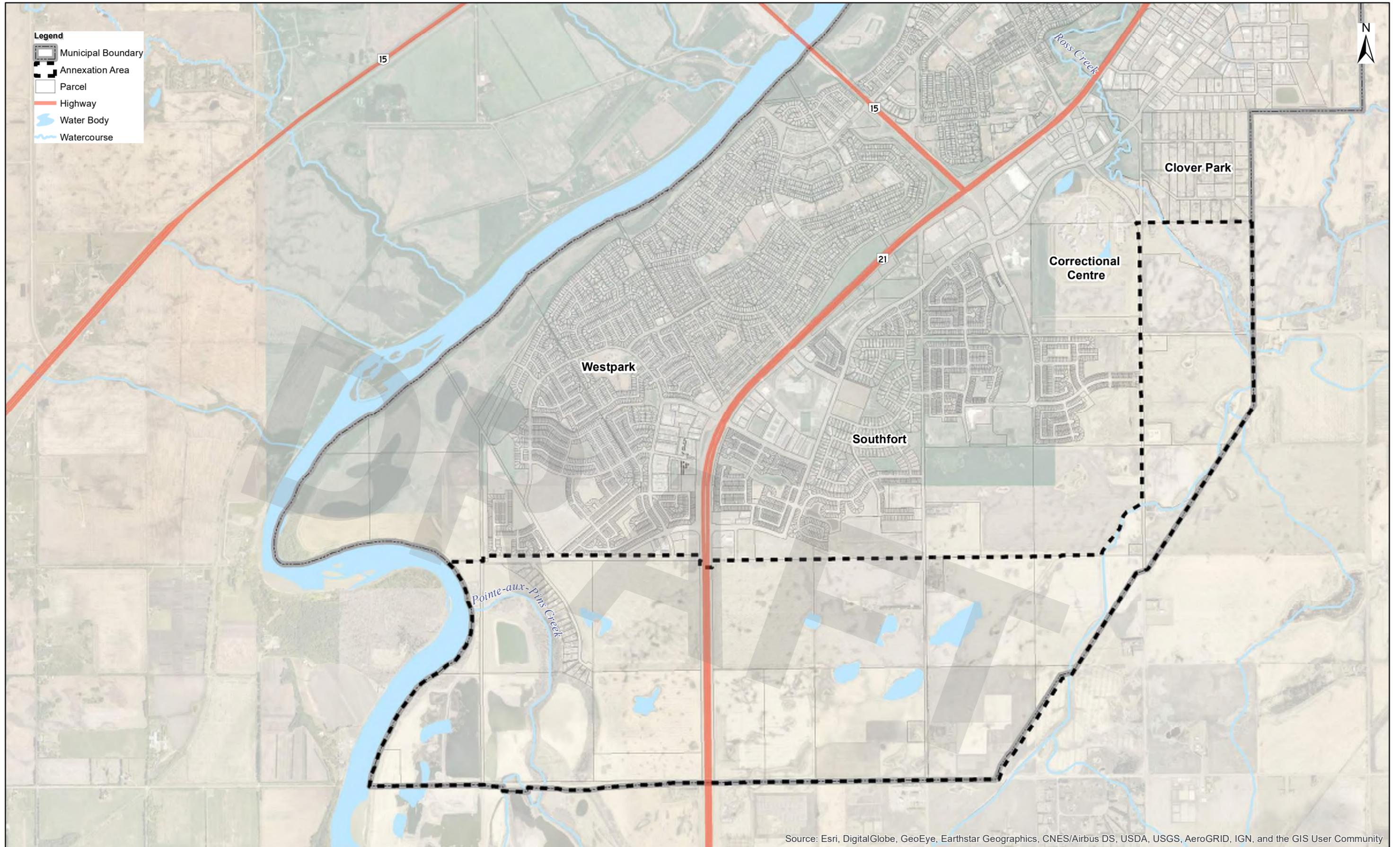


Figure B.5: Ross Creek Reach C3 Cross Section and Peak HGL Modelling Results



APPENDIX
Stakeholder Engagement Materials

C



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**

Annexation Area

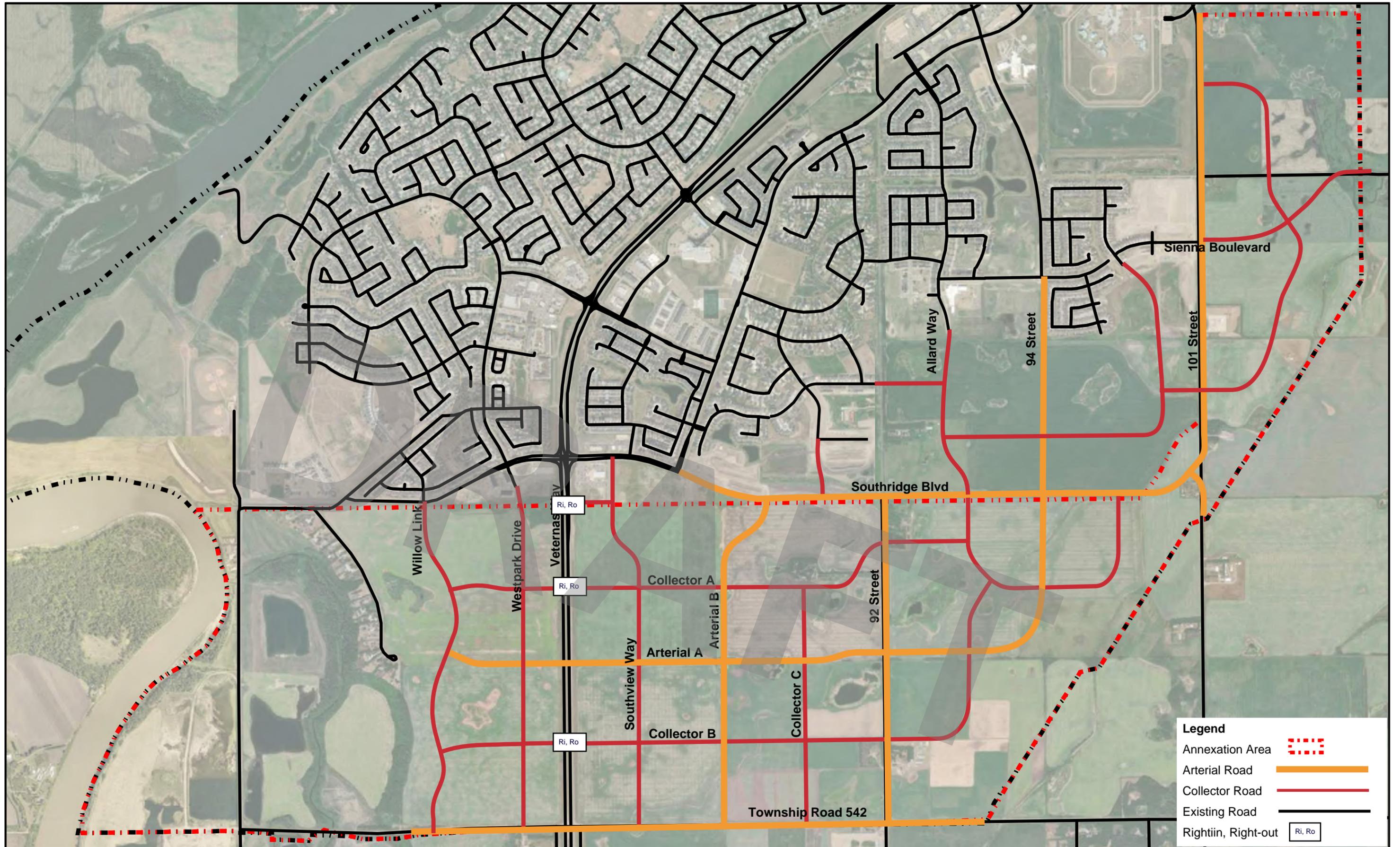
FIGURE 2.1

1:25,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS

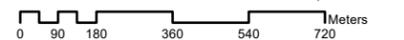




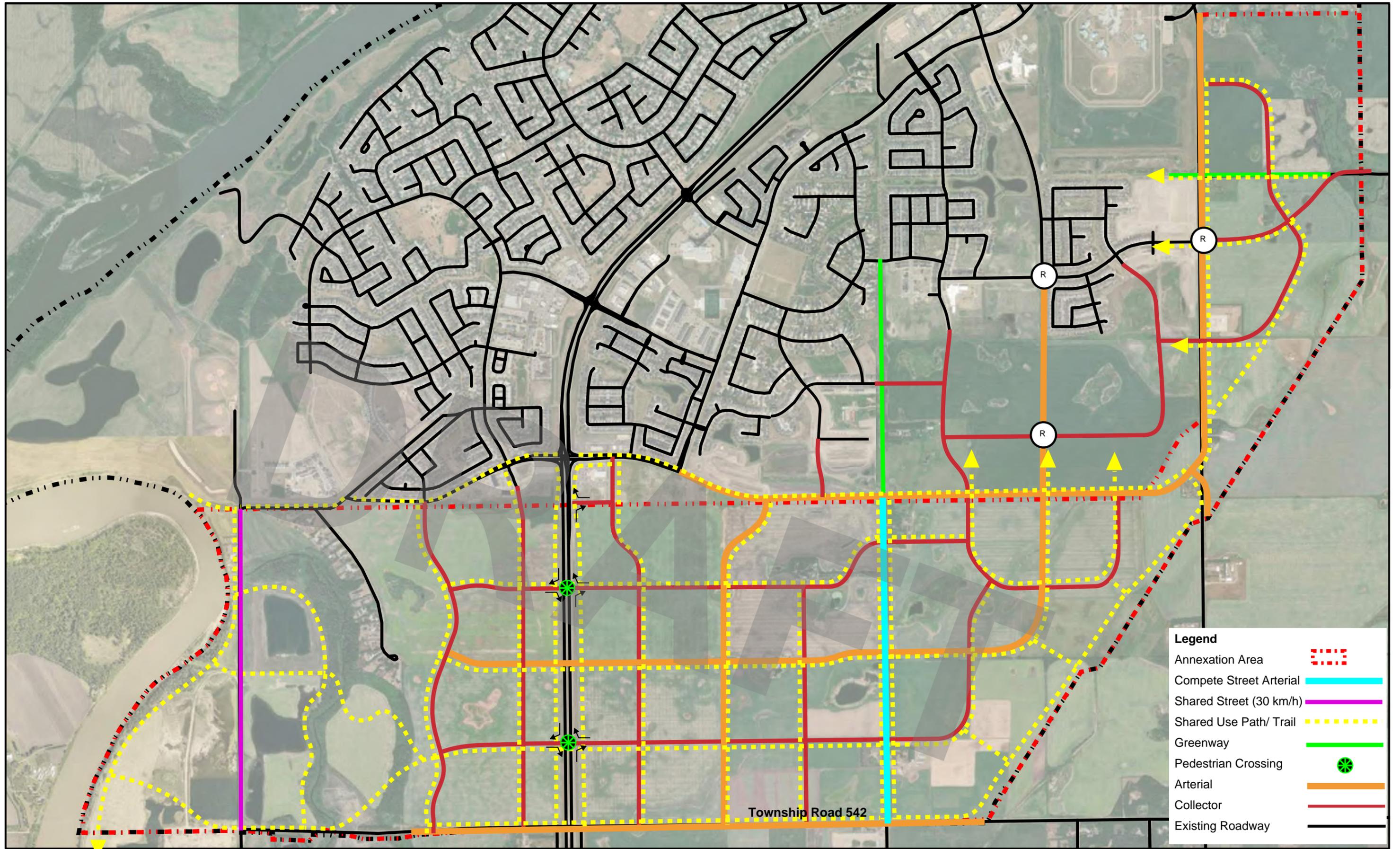
**FORT SASKATCHEWAN ANNEXATION
SERVICING DESIGN BRIEF**
PROPOSED ANNEXATION AREA ROADWAY NETWORK

FIGURE 4.2

1:17,000

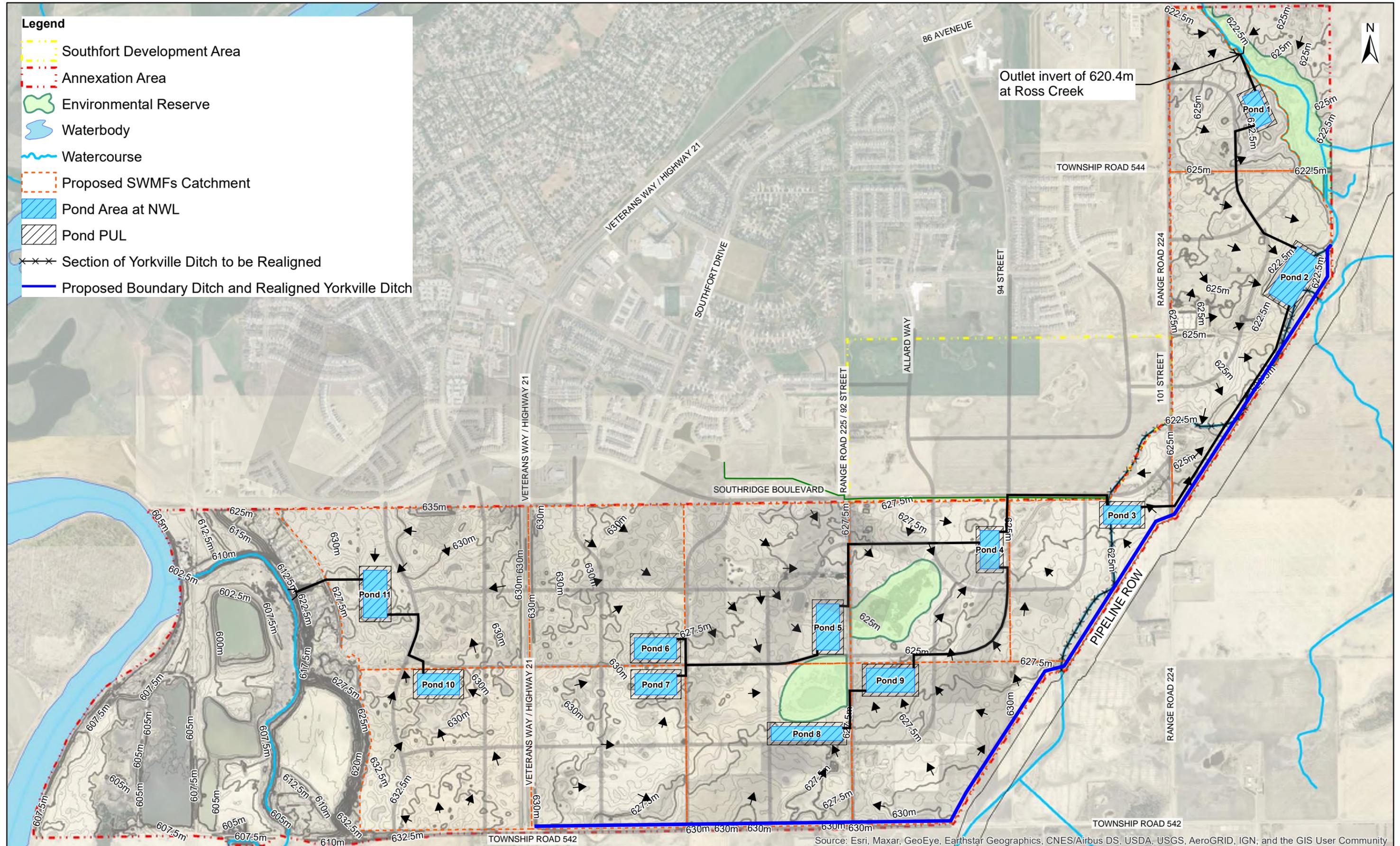


Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS



**FORT SASKATCHEWAN ANNEXATION
SERVICING DESIGN BRIEF**
PROPOSED ANNEXATION AREA ACTIVE MODES NETWORK

FIGURE 4.15

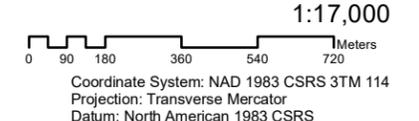


- Legend**
- Southfort Development Area
 - Annexation Area
 - Environmental Reserve
 - Waterbody
 - Watercourse
 - Proposed SWMFs Catchment
 - Pond Area at NWL
 - Pond PUL
 - Section of Yorkville Ditch to be Realigned
 - Proposed Boundary Ditch and Realigned Yorkville Ditch

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Proposed Stormwater Servicing Concept

FIGURE 5.5
1:17,000

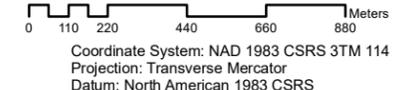


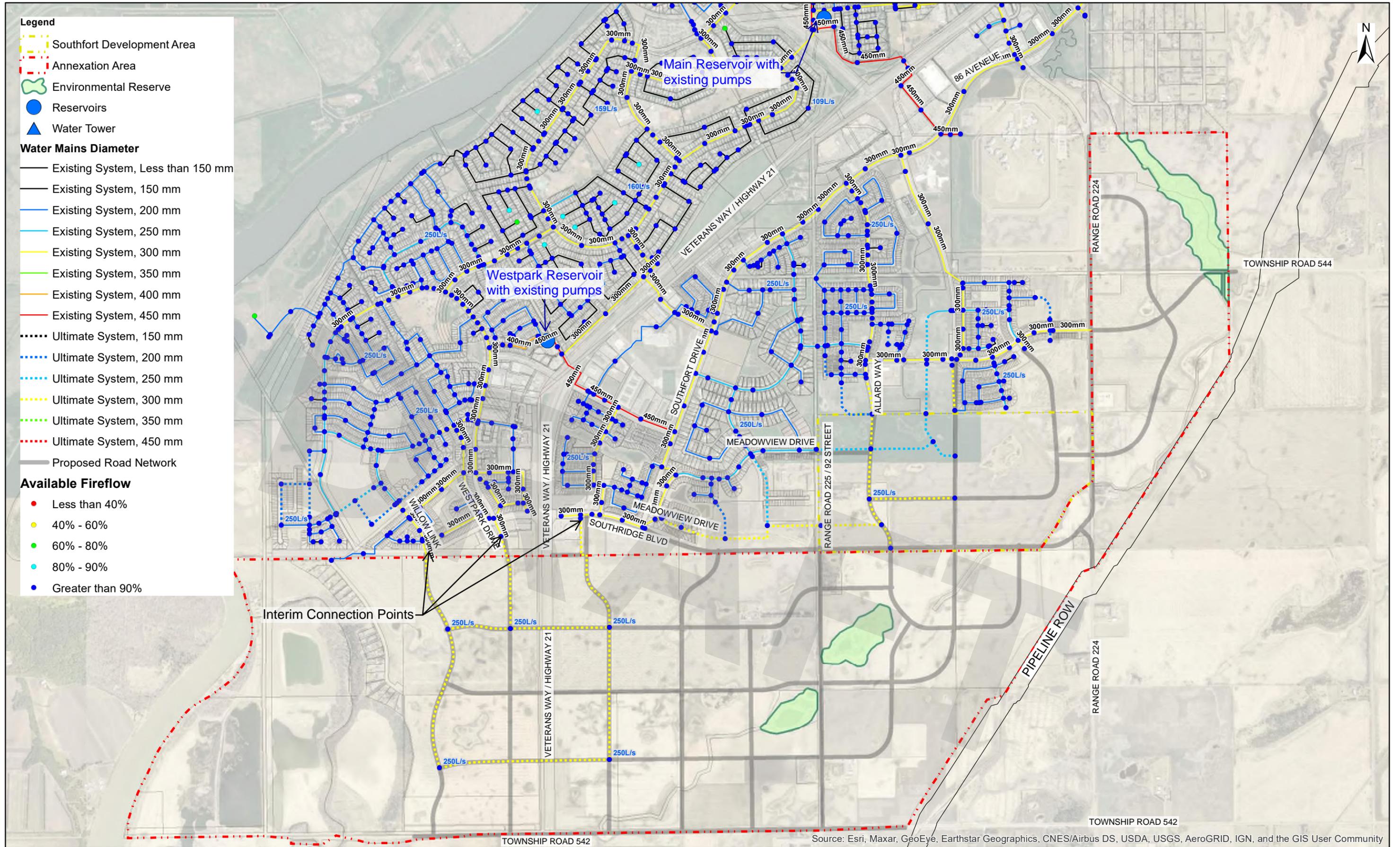


**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**
Option 2 - New Annexation Area Reservoir with Upsized Grid

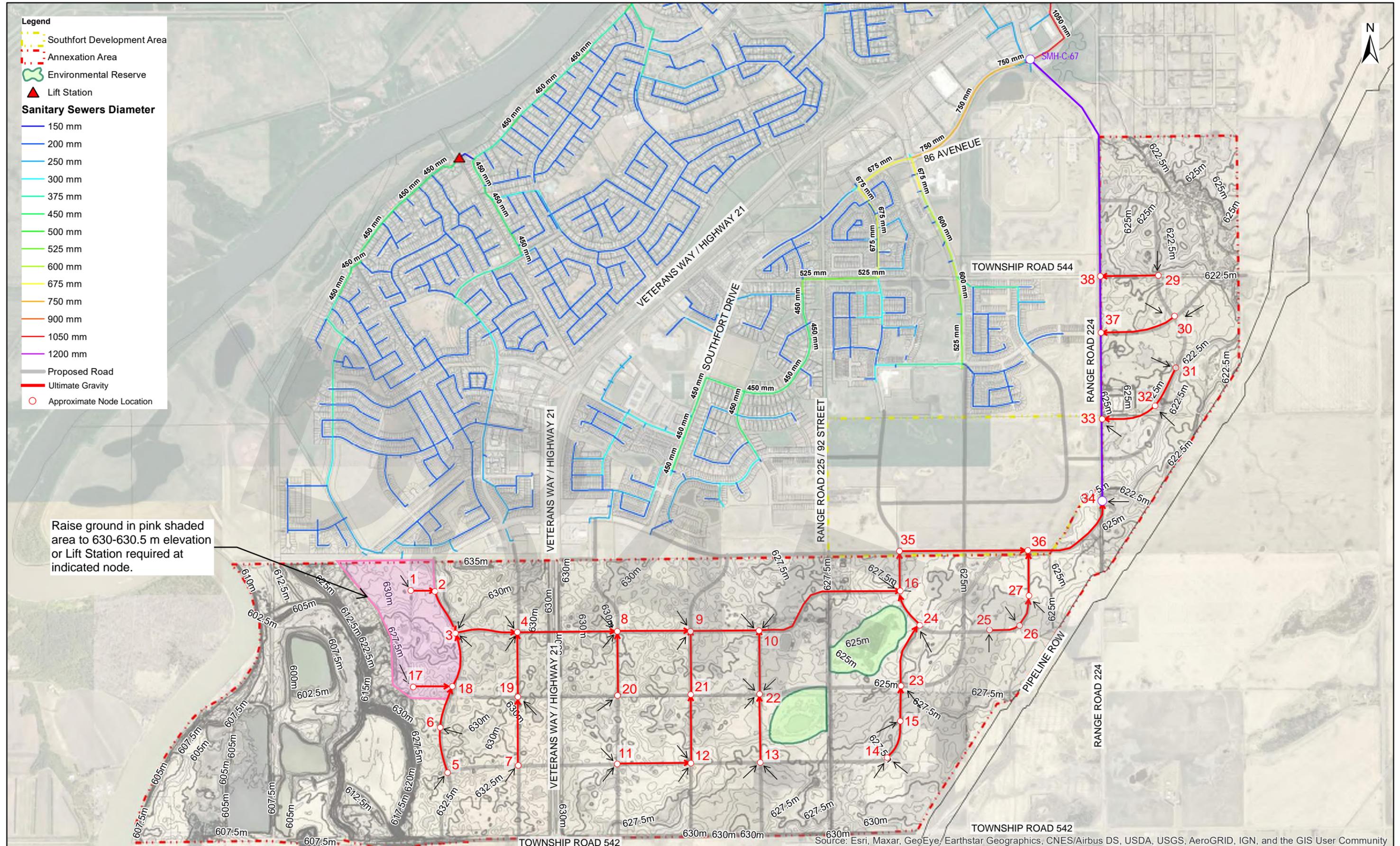
FIGURE 6.4

1:20,000





- Legend**
- Southfort Development Area
 - Annexation Area
 - Environmental Reserve
 - Reservoirs
 - ▲ Water Tower
- Water Mains Diameter**
- Existing System, Less than 150 mm
 - Existing System, 150 mm
 - Existing System, 200 mm
 - Existing System, 250 mm
 - Existing System, 300 mm
 - Existing System, 350 mm
 - Existing System, 400 mm
 - Existing System, 450 mm
 - Ultimate System, 150 mm
 - Ultimate System, 200 mm
 - Ultimate System, 250 mm
 - Ultimate System, 300 mm
 - Ultimate System, 350 mm
 - Ultimate System, 450 mm
 - Proposed Road Network
- Available Fireflow**
- Less than 40%
 - 40% - 60%
 - 60% - 80%
 - 80% - 90%
 - Greater than 90%



**FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF**

Ultimate On-Site Wastewater Servicing Concept Option 1b – Gravity Servicing to the Northeast

FIGURE 7.5

1:20,000



Coordinate System: NAD 1983 CSRS 3TM 114
Projection: Transverse Mercator
Datum: North American 1983 CSRS



APPENDIX
Crown Claimability Assessment

D

From: AEP Water-Boundaries <Water.Boundaries@gov.ab.ca>
Sent: January 12, 2023 12:23 PM
To: Robyn Gamber <RGamber@islengineering.com>
Cc: Daniel Zeggelaar <DZeggelaar@islengineering.com>
Subject: RE: Crown Claimability Assessment for 2 Wetlands; NW 17-54-22 W4M and SE 18-54-22 W4M (Fort Saskatchewan)

Good morning Robyn,

Thank you for your enquiry. We have a large number of enquiries in our queue, so I apologize for the long delay and appreciate your patience.

You enquired about Wetland 1, located in NW 17-54-22-W4M, and Wetland 2, located in SE 18-54-22-W4M (shown on the attached image you previously sent). Based on a review of 22 historical aerial photos of the area from 1950-2021, Wetland 1 contains a naturally occurring body of water that is reasonably permanent. As such, under Section 3 of the *Public Lands Act*, the title to the bed and shore of the water body within Wetland 1 is vested in the Crown in right of Alberta.

The right-of-way for the Galloway Yorkville drainage ditch includes the basin of Wetland 2, and the ditch was built around 1989. Prior to this ditch being built, Wetland 2 did not contain any permanent and naturally occurring body of water that meets the criteria for a Crown ownership claim to its bed and shore under Section 3 of the *Public Lands Act*. Therefore, the Crown in right of Alberta does not have any interest in any portion of Wetland 2.

Please let me know if you have any further questions.

Kind regards,
Erin

Erin Doxsey-Whitfield, M.Sc.

Water Boundary Analyst
Water Boundaries Unit
Grants and Program Delivery Section
Lands Policy and Programs Branch
Lands Division
2nd Floor, South Petroleum Plaza
9915 – 108 Street, Edmonton, AB T5K 2G8
Email: erin.doxsey-whitfield@gov.ab.ca



Environment and Protected Areas

Please consider your environmental responsibility before printing this e-mail

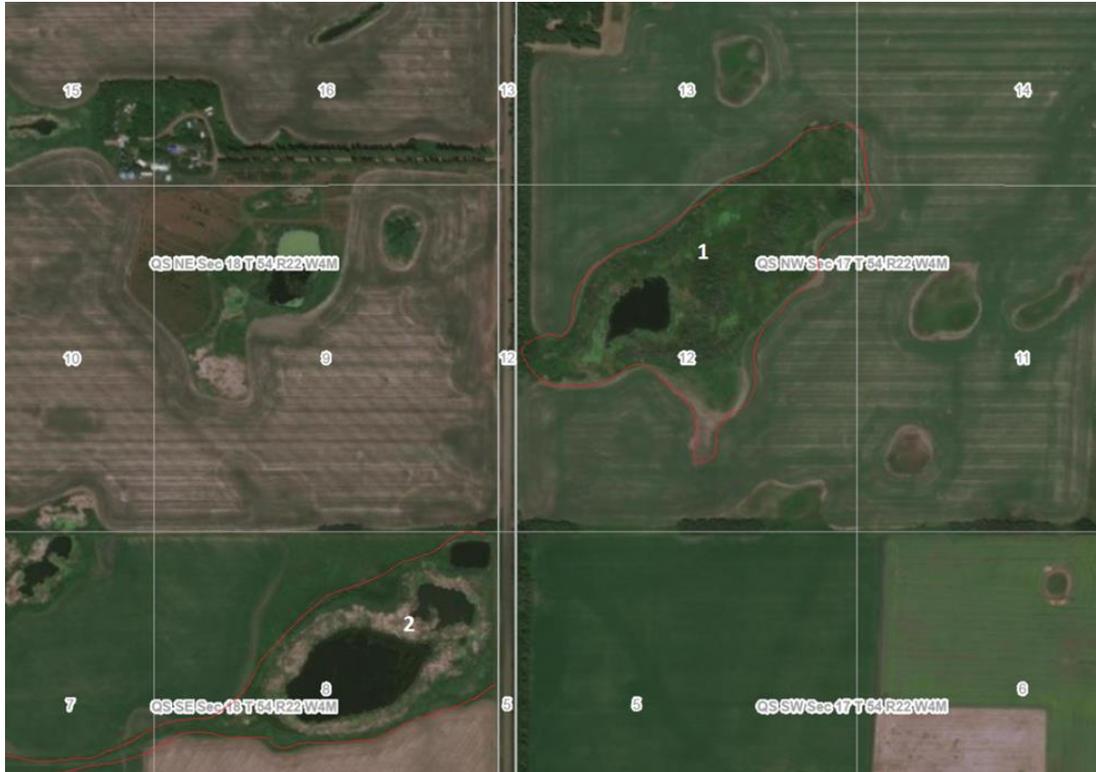
Classification: Protected A

From: Robyn Gamber <RGamber@islengineering.com>
Sent: Tuesday, May 10, 2022 10:31 AM
To: AEP Water-Boundaries <Water.Boundaries@gov.ab.ca>
Cc: Daniel Zeggelaar <DZeggelaar@islengineering.com>
Subject: Crown Claimability Assessment for 2 Wetlands; NW 17-54-22 W4M and SE 18-54-22 W4M (Fort Saskatchewan)

CAUTION: This email has been sent from an external source. Treat hyperlinks and attachments in this email with care.

Hello,

I'd like to submit the two wetlands outlined in red below for an assessment of Crown Claimability.



Thankyou,

Robyn Gamber (she/her), B.Sc., B.GIS., P.Biol., R.P. Bio. | Environmental Scientist
ISL Engineering and Land Services Ltd.
4015 - 7 Street SE
Calgary, AB T2G 2Y9
T: 403.254.0544 F: 403.254.9186 C: 403.612.7028
RGamber@islengineering.com islengineering.com

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Appendix D Wetland Crown Claimability Assessment

D.1 Introduction

From the Class IV wetlands identified in the 2015 Fort Saskatchewan Growth Study, there were seven wetlands with particularly high environmental values that were initially considered for environmental reserve designation for the purpose of this study. A formal request for Crown claimability assessment was submitted to Alberta Environment and Protected Areas (AEP) at the beginning of this study for the two largest wetlands, but no response was received until the report was being finalized.

The Fort Saskatchewan Annexation Area Servicing Study was done assuming two largest Class IV wetlands located within the annexation boundary would be claimed. On January 12, 2023, AEP indicated that the wetland in Quarter Section R (SE18-54-22-4) does not meet the criteria for a Crown ownership claim. See the attached email chain and **Figure D.1** for reference.

D.2 Impacts of Wetland Development

Based on the January 12, 2023, email from AEP, the landowner / developer will be free to develop the wetland in Quarter Section R (SE18-54-22-4) if they choose. The impact of development in this wetland was briefly assessed to determine potential impacts on off-site levy infrastructure requirements. These are presented below.

Transportation

The modelling results indicate the proposed annexation area roadway network has enough spare capacity to accommodate the additional trips that may be generated if the wetland is developed. As such, this new information is expected to have little to no impact on transportation servicing.

Stormwater

The study uses a conservative method in designing the SWMF and the downstream system to include the wetland area. Therefore, if the wetland is developed, there is little to no impact on the SWMF and downstream system. However, as the report indicated, the developer is responsible for the refinement of the SWMF and downstream system as the report is solely a guideline for the servicing potential.

Development of the wetland would result in a slight increase in the off-site levy contributing area, which would result in a marginal reduction in off-site levy rates.

Water

If the developer chooses to develop this area, the increase in developable area, dwelling units, population and average day demand (ADD) is summarized in **Table D.1**.

Table D.1 Increase in developable area, dwelling units, population and ADD within Quarter Section R

Increase in Development within Quarter Section R			
Area (ha)	Dwelling Units	Population (c)	ADD (L/s)
8.7	350	910	2.6

Notes:

1. Lot density: 40 du/ha.
2. Population density: 2.6 c/du.
3. Water consumption rate: 250 L/c/d.

The increase in the developable area will result in increases in the maximum day demand and peak hour demand by approximately 3%. As the fire flow demands are unchanged, the net impact of the MDD+FF demand is less than 2%, and thus will have negligible impact on the pipe sizes within the annexation area.

The water storage requirements will increase by approximately 3% or about 500 m³. This would result in a net increase in the storage reservoir costs of about \$0.6 million including engineering and contingency.

It is noted that the off-site levy contributing area would also increase by about 2%, resulting in negligible impacts on the water off-site levy rates.

Wastewater

Based on a similar assumption as water, the total design (peak wet weather) flow increase would be 8.9 L/s at Quarter Section R.

The wastewater design flow spreadsheet for the recommended servicing option (gravity connection to 1050 mm trunk) was reviewed to determine the impact on downstream trunk sewers if the wetland was developed. The greatest impact occurs immediately downstream of Quarter Section R with a 14% increase in the design flow. Further downstream the increase in design flows drops to 4%.

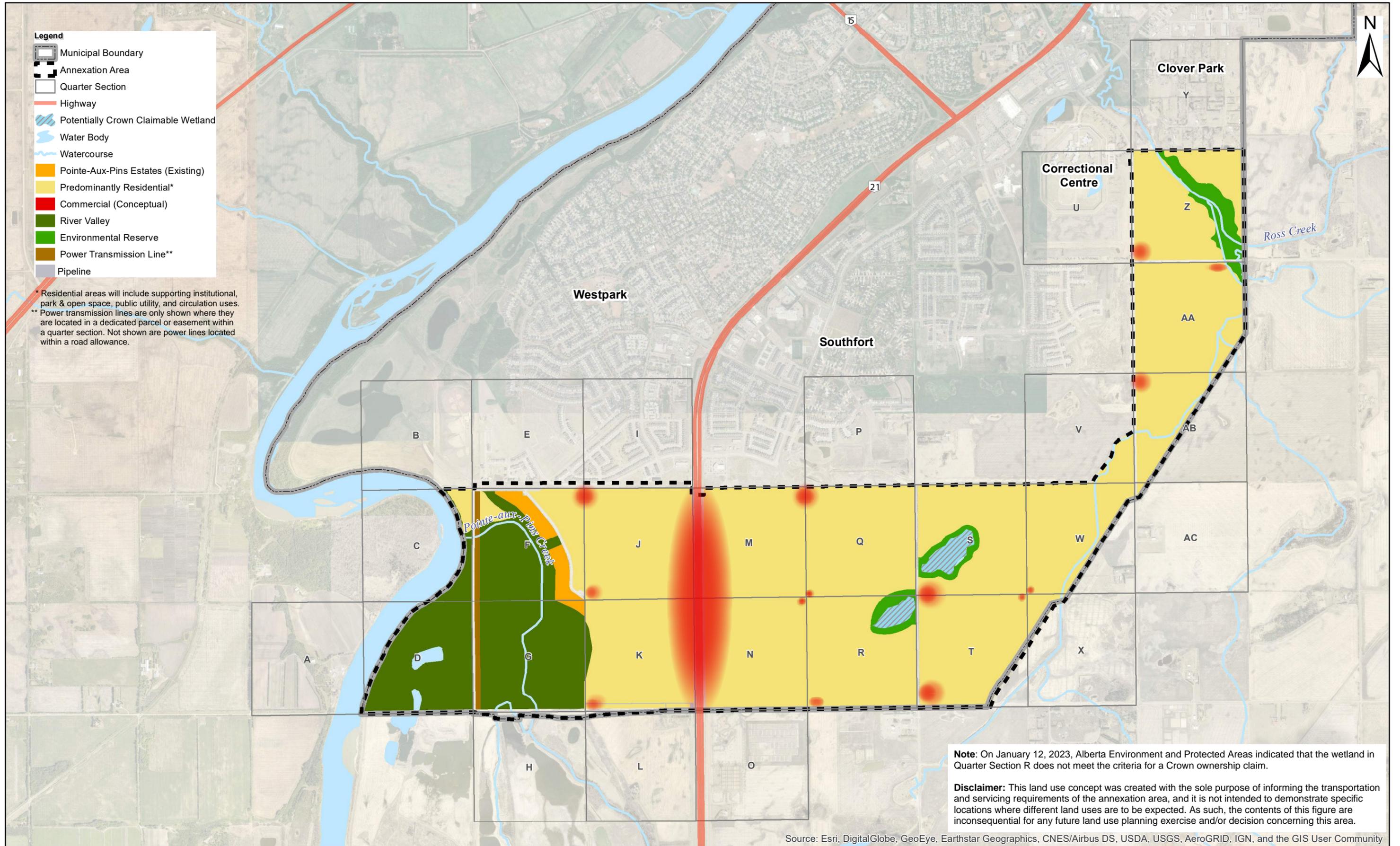
The increase in wastewater flows would require two sections of trunk to be upsized. The branch receiving the increased flow will be upsized from 375 mm to 450 mm but any pipe below 525 mm is at the expense of the local developer so it will not impact the off-site levy calculations.

The main trunk section with a length of 940 m further downstream will increase by one pipe size from 600 mm to 675 mm. The increase in pipe size will result in an overall cost increase of approximately \$160,000. The percent increase in total off-site levy costs is approximately 0.2%, which is much less than the increase in total developable area at about 2%. Thus, the off-site levy rates would decrease slightly if the wetland was developed.

D.3 Closure

The landowner / developer of Quarter Section R (SE18-54-22-4) will be free to develop the wetland (with compensation) if they choose. This will have minor to no impact to each service area as outlined above.

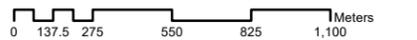
A decision on the development of this wetland should be made when the area structure plan is prepared. The City should then make any necessary changes to the off-site levies at that time.



FORT SASKATCHEWAN ANNEXATION AREA
SERVICING DESIGN BRIEF
 Underlying Land Use Assumptions

FIGURE D.1

1:25,000



Coordinate System: NAD 1983 CSRS 3TM 114
 Projection: Transverse Mercator
 Datum: North American 1983 CSRS



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