Lacombe Intermunicipal Development Plan - 2017 Servicing Study

Final Report

Prepared for:
Lacombe County and
City of Lacombe

Prepared by:
Stantec Consulting Ltd.

September 29, 2017

Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by the City of Lacombe (City) and Lacombe County (County) to update the Intermunicipal Development Plan (IDP), which is under separate cover. In conjunction with the IDP report, this study was completed to provide guidance on the water, wastewater, and stormwater servicing for Lacombe County's proposed development areas surrounding Lacombe. Further, high-level opinions of probable costs were developed for the major infrastructure components for each of the areas. There are seven separate areas included in this report, as illustrated on Figure 1-0. Each of the areas have their own unique engineering requirements and as such, this report is structured with the following Sections:

- Section 3 – Joint Economic Area and West Area Servicing
- Section 4 – West Barnett
- Section 5 – Rosedale Valley
- Section 6 – Iron Rail Business Park
- Section 7 – QEII North of Lacombe
- Section 8 – Milton Area
- Section 9 – North Lacombe Storm Water Management

The criteria used for the assumed land uses and the water, wastewater, and stormwater modeling are described in Section 2. In general, the water and wastewater modeling criteria were based off the City of Lacombe's water and wastewater models, respectively. The main exception was the water consumption for commercial and industrial land uses, where a rate of 0.05 l/s/ha was applied under the basis described in the sensitivity analysis, which was based in part on historical data. All stormwater management analysis was completed in accordance with the Master Drainage Plan for the Wolf Creek and Whelp Brook Watersheds. The land uses were based upon the most recent area structure planning documents. Desktop level wetland mapping was completed to provide a basis for areas that will likely be considered as environmental reserve.

The Joint Economic Area (JEA) encompasses a very large area west of the Queen Elizabeth II Highway and has been identified as a short term priority for development within Lacombe County's jurisdiction. The servicing of the JEA can be established in two phases. The medium term phase will include 353 ha within the JEA in addition to the 92 Ha of residential and commercial development within the City. The medium term phase will tie directly into the City's water and wastewater systems. The long term phase, which will include approximately 290 Ha of additional development, will require the construction of a water reservoir and pump station as well as modifications to the proposed lift station to bypass the City's wastewater trunks and tie in with the regional system at the City's lagoons because of the capacity limits in the Woodland Drive trunk. Stormwater will be managed by a series of stormwater management facilities and trunks prior to discharging into Whelp Brook in accordance with the requirements outlined in the Whelp Brook report.

The West Barnett Area, which is bounded by the Queen Elizabeth II Highway, Barnett Lake, and the City limits, can be serviced by the City's water and wastewater networks. The water distribution

network is consistent with what is proposed in the City's water model. The wastewater will be collected at a central lift station located in the low area, where Whelp Brook crosses the Queen Elizabeth II Highway, and pumped to the trunk in Woodland Drive. In general, the stormwater from the proposed development area will be accommodated by stormwater management facilities prior to being discharged into Whelp Brook in accordance with the requirements outlined in the Whelp Brook report.

Rosedale Valley is an existing rural residential subdivision that consists of approximately 40 lots that are approximately one acre in size. Currently, the dwellings are serviced by wells and septic systems. The subdivision can be serviced by the City's water and wastewater system. Preliminary design drawings were prepared for two development scenarios. The first scenario includes upgrading the area to the City's current standards, which would be relatively challenging given the topography and existing conditions. The second scenario includes basic water servicing and a low pressure force main system.

The Iron Rail Business Park is an existing industrial subdivision located east of Lacombe. It can be serviced by the City's water and wastewater systems with pipes running parallel to Highway 12. Water servicing can be provided either through the City's system or the North Red Deer Regional Water Line. To supply water to the industrial park, a booster pump would be required in either scenario. The wastewater sewer can be designed as a gravity system along Highway 12 to tie into the City's system.

The QE II North and Milton Subdivisions are located north of the existing City limits. These areas can both be serviced by the regional water line and would require water reservoir storage. Depending on how development builds out, they can be serviced by having reservoirs in each of them or alternatively, having a single large, shared reservoir in Milton. Similarly, they both would require lift stations to tie into the Regional Lift station at the City's lagoons. It is possible that there can be gained efficiencies by having Milton pump into the wastewater collection and lift station system in the QE II North area.

As described in Section 9, an effective outlet for Henner's Pond is required for the North area within Lacombe's city limits. A storm trunk is proposed to drain from Henner's Pond to Williams Slough, and then Williams Slough will be made to drain to Wolf Creek though an open channel. The North Storm Trunk within city limits is proposed to have a catchment area of approximately 177 ha, and at 2 L/s/ha this equates to a design flow rate of approximately 354 L/s. A preliminary design and an opinion of probable cost were prepared for this area.

Combined, the above-mentioned areas proposed for developments are very large relative to the current buildout of Lacombe and the existing Lacombe County developments. It is important to note that these areas have been assessed on an individual area-by-area basis. As the City of Lacombe and surrounding areas grow, it is critical that the water, wastewater, and stormwater models be updated and reviewed on a regular basis. Further, careful consideration is required for the regional water and wastewater transmission line capacities, which were not assessed as part of this study.

Sign-off Sheet

This document entitled Lacombe Intermunicipal Development Plan - 2017 Servicing Study was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Lacombe County and the City of Lacombe (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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The Association of Professional Engineers and Geoscientists of Alberta

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1 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by the City of Lacombe (City) and Lacombe County (County) to update the Intermunicipal Development Plan (IDP). The purpose of the IDP is to ensure that land use decisions within the plan area are thoughtfully considered. The IDP identifies future growth areas within the City of Lacombe and the surrounding area.

As demonstrated by the completion of numerous Area Structure Plans (ASP's), there is very strong growth potential for commercial, industrial, and various types of residential communities within Lacombe and the surrounding area. The City and the County share a vision and a goal that the areas described in this report will grow in a mutual and sustainable manner that will benefit the Lacombe region as a whole.

There is considerable potential to extend the City's water distribution and wastewater collection systems into the nearby existing and future County development areas. In conjunction with the IDP report, this servicing study has been prepared to provide general engineering guidance on the water, wastewater, and storm water servicing for the various growth areas in the IDP area. Although the Milton area and Iron Rail Business Park are located outside of the IDP area, they have been included in this Study to evaluate their financial viabilities of connecting to the City's water and wastewater infrastructure systems because they are relatively close to the City.

1.1 STUDY AREAS

As shown on Figure 1-0 at the end of this section, there are eight separate areas included in this report. Each of the areas have their own unique engineering requirements and as such, this report is structured with the following Sections:

- Section 3 – Joint Economic Area and West Area Servicing
- Section 4 – West Barnett
- Section 5 – Rosedale Valley
- Section 6 – Iron Rail Business Park
- Section 7 – QEII North of Lacombe
- Section 8 – Milton Area
- Section 9 – North Lacombe Storm Water Management
- Section 10 – Conclusion

1.2 STUDY OBJECTIVES

As mentioned above, each of the areas have their own unique requirements. The general objectives of this study are to:

- Estimate the future water and wastewater demands of the various study areas;

- Model the existing and proposed future water infrastructure to identify water trunk routes and sizes, new reservoir and pump house locations, and connections to the existing City of Lacombe water distribution network;
- Model the existing and proposed future wastewater infrastructure to identify gravity sewer sizes and locations, lift stations sizes and locations, force main sizes and locations, and connections to the existing City of Lacombe sanitary sewer system;
- Identify storm trunk sizes and routes, potential regional storm pond locations and sizes, and connections with the existing storm sewer system in the west and north areas of the IDP;
- Complete a Traffic Impact Analysis for the Joint Economic Area (separate report); and
- Prepare opinions of probable costs for the water, wastewater, and stormwater infrastructure.

1.3 REFERENCES

There are numerous plans, studies, and regulatory guidelines that form the basis of this study. The intent of this report is to compile the information from the relevant resources into a single document to be referenced as part of all future City and County planning processes.

Land Use Planning Documents

The following planning documents have been used in the preparation of this Study:

- Lacombe Intermunicipal Development Plan (Stantec, 2017);
- Highway 2 West Area Structure Plan (January, 2012);
- Milton-Morningside Area Structure Plan (July 10, 2008);
- (*Iron Rail Business Park*) Parkview Industrial Park Site Development Guidelines (UMA Engineering, Revised September, 2016);
- QEII North of Lacombe Area Structure Plan (Lacombe County, April, 2013);
- Milton Area Servicing Revised Water and Wastewater Servicing Strategy; and
- City of Lacombe's Municipal Development Plan: Growing Lacombe (2015 - 2036) Bylaw 405.

Technical Resources

The following technical documents have been used in the preparation of this Study:

- City of Lacombe Design Guidelines;
- Lacombe County Standards Manual - Edition 3, May 2017;
- City of Lacombe 2013 Water Model Update (Stantec, 2013);
- City of Lacombe Wastewater Model (Stantec, 2016);
- Master Drainage Plan for the Wolf Creek and Whelp Brook Watersheds, prepared for Lacombe County, Ponoka County, City of Lacombe, and Town of Blackfalds, by MPE Engineering Ltd., August 31, 2014;
- Stormwater Management Guidelines for the Province of Alberta, Alberta Environmental Protection, January 1999;
- Municipal Policies and Procedures Manual, Alberta Environmental Protection, April 2001;
- Computational Hydraulics International; Users' Guide to SWMM5; 2010; and

- The City of Calgary - Wastewater and Drainage – Stormwater Management and Design Manual, December 2000.
- AltaLIS Ltd. 2014. BF_HYDRO_POLYGON [shapefile]. Spatial Data Warehouse Ltd. Calgary, AB.
- Alberta Environment and Parks (AEP). 2016. Access FWMIS Data September 15, 2016. http://esrd.alberta.ca/fish-wildlife/fwmis/access-fwmis-data.aspx.
- Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System. Water Policy Branch, Policy and Planning Division, Edmonton, AB.
- *Fisheries Act.* RSA 2000, c F-16
- *Public Lands Act*. RSA 2000, c. 40
- Stantec Consulting Ltd. 2002. Natural Space Management Plan. Edmonton, AB.
- *Water Act*. RSA 2000, c W-3

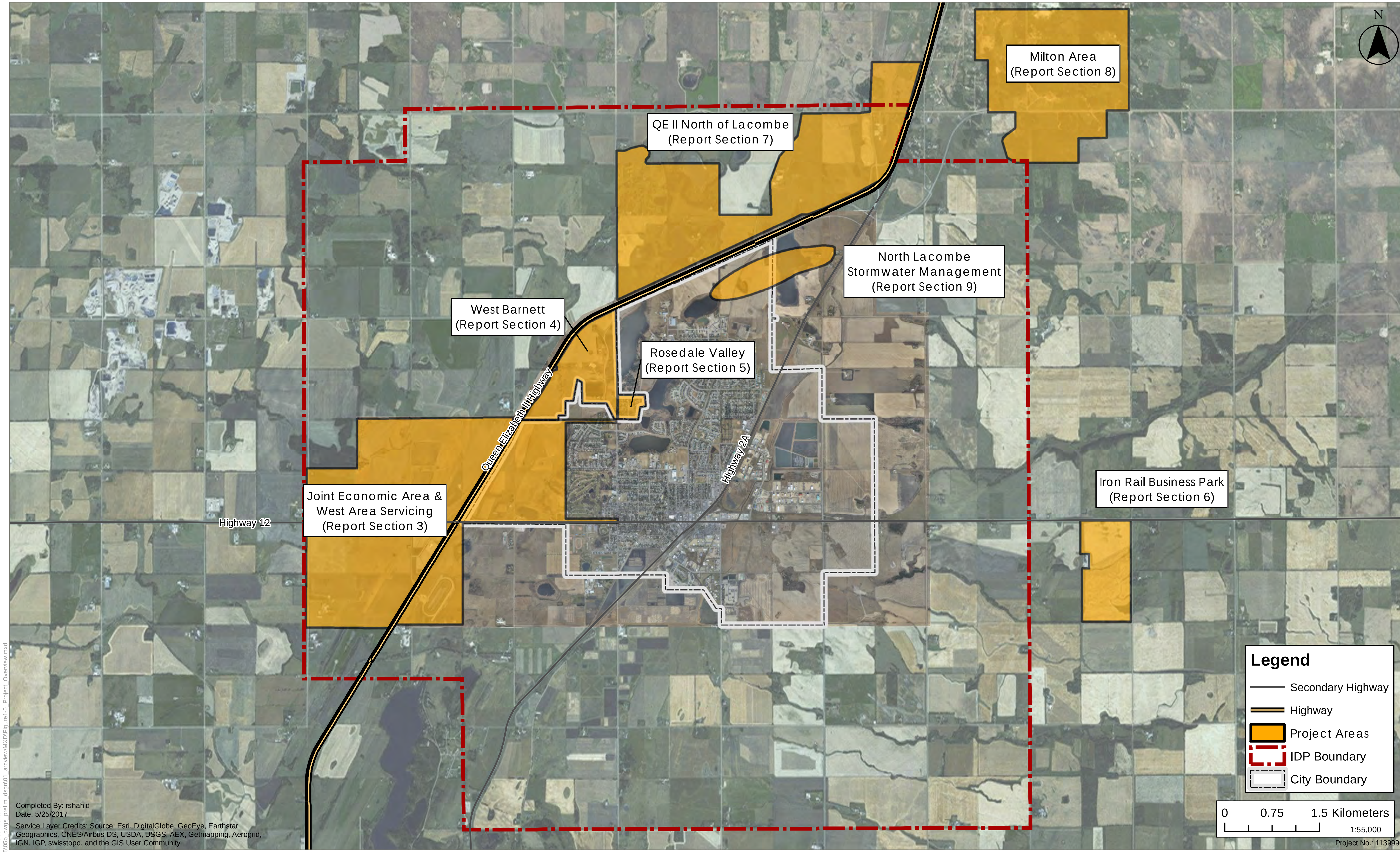


Figure 1-0: Project Overview

City of Lacombe

Lacombe County

Intermunicipal Development Plan

2 STUDY CRITERIA

In order to determine the servicing requirements for the IDP areas included in this report, it is first necessary to establish the servicing parameters. As described in the subsections below, the criteria include identification and layout of various land uses, measurement of developable area, and projection of future water servicing demands based on populations and land use types.

The various areas have been assessed individually; however, the water and wastewater infrastructure networks are required to be engineered as one system as a whole. Therefore, the modeling of each of the areas is essentially a continuation of the City's water and wastewater models. The capacities of the City's key water and wastewater trunks, reservoirs, etc. have been reviewed as part of this report to ensure that the City's long term growth and servicing requirements will be protected.

2.1 LAND USE AND SERVICING CONCEPTS OVERVIEW

The general land uses in Sections 3 through 8 are based on the most recent relevant planning documents (ASP's, etc.) and existing community buildouts. Most of the past planning documents were not established to the level of detail that outlines routes for roadways and other infrastructure, but rather, they only provide general and high-level vision for the servicing requirements.

For the purpose of projecting the alignments, sizing, and general locations of critical water, wastewater, and stormwater infrastructure, Stantec prepared concepts that illustrate a hypothetical land uses and roadways typical of industrial, commercial, and urban and residential subdivisions. These concepts may be revisited in the future by developers and their planners, but this report sets forth the "big picture" servicing requirements for the Lacombe IDP area as a whole.

The land use concept plans have been supplemented with detailed topographic LiDAR contour data. Detailed topographic surveys are recommended in the future.

2.2 WETLAND AREA CONSIDERATIONS

For the purpose of estimating areas that are considered developable and undevelopable, desktop mapping was completed within five of the study areas (Joint Economic Area, West Barnett, Milton, QE II North of Lacombe, and Rosedale Valley). The desktop mapping was completed to build upon the data from the Alberta Merged Wetland Inventory and provide refined wetland boundaries and classifications for wetlands and waterbodies within the five areas. This information will be used to identify potential constraints to development, including wetlands that may need to be considered for retention, and future studies or regulatory approvals related to wetlands and waterbodies.

The wetland mapping, complete with the assessed classifications is illustrated in Figure 2-0.

Wetlands and waterbodies were mapped in each of the five areas using aerial photographs from 2008 and 2012. Wetland mapping was completed at a scale of 1:10,000 with a minimum polygon size of 0.5 hectares. Once the mapping was completed, wetlands and waterbodies were then classified as marshes, waterbodies, watercourses, drainages, and swamps as described in Table 2-1 below. In some cases, mapping units were a combined class (e.g., "watercourse/marsh") where the feature included a combination of more than one of the above-mentioned classifications. Field assessments of soils and vegetation will be required to further refine these classifications. However, this level of assessment will provide an indication of wetland and waterbody permanence.

Table 2-1 Summary and Descriptions of Classifications Used for Desktop Mapping

Classification	Description
Marsh	• A marsh is defined as "a mineral wetland with water levels near, at, or above the ground surface for variable periods during the year, and which supports graminoid vegetation in the deepest portion of the wetland in the majority of years"[1] • This mapping unit generally includes temporary marshes, seasonal marshes and semi-permanent marshes • Includes features listed as "recurring" in the AltaLIS Ltd. waterbodies layer but the boundary of the wetland was drawn based on visual wetland indicators
Waterbody	• Waterbodies are features that contain permanent open water. • Includes lakes (i.e., water depths greater than 2 m), permanent marsh wetlands and may include some semi-permanent marsh wetlands • Includes features listed as "permanent" in the AltaLIS Ltd. waterbodies layer • Waterbody boundaries were mapped based on the visual wetland indicators.
Watercourse	• Watercourses are features with a defined shoreline that convey water either seasonally or permanently • Watercourses mapped included their associated riparian area • These features may have been anthropogenically altered in the past (e.g., ditching).
Drainage	• Drainages are features that convey water either seasonally or permanently but have been constructed or are heavily modified by anthropogenic influences. • Drainages may include constructed, linear ditches used for drainage or water conveyance
Swamp	• A swamp is defined as "a mineral wetland with water levels near, at or above the ground surface for variable periods during the year which contains either more than 25% tree cover of a variety of species or more than 25% shrub cover"[1]. • Areas classified as swamps contained a dominant component of woody vegetation when compared to those classified as marsh.
NOTES: 1. ESRD 2015	

In this study, Stantec has assumed that waterbodies, watercourses, drainage channels, and swamps are considered undevelopable, and as such, they have been excluded from the calculations for water and wastewater demands. Marshes, however, have typically been assumed to be demolished and developed over in the future with the exception of some very large marshes in the Joint Economic Area. The results of the desktop mapping and considerations for each of the study areas are described in the relevant report sections.

Following the desktop mapping, historical aerial photographs from 1949, 1950, 1969, 1980, 1998, 2007, and 2008 were reviewed to assist with confirming the permanence of water within wetlands and waterbodies and to identify historical changes or disturbances (e.g., ditching). The historical aerial photographs were reviewed for the presence of standing water, and areas lacking standing water but with evidence of past standing water (i.e., bare ground, presence of salt or carbonates, patchy vegetation).

2.3 RESIDENTIAL POPULATION DENSITIES

The planned population density for the study area is defined in two documents:

- City of Lacombe's Municipal Development Plan: Growing Lacombe (2015 - 2036) Bylaw 405 (MDP); and
- City of Lacombe/Lacombe County Intermunicipal Development Plan

The MDP notes that future urban development will need to meet or exceed 15 dwellings per hectare within the urban zone. Assuming a population density of 2.3 persons/dwelling unit, this provides a population density of approximately 35 persons per hectare for the net developable area. The population projections used for the urban areas within the IDP are also based on 15 dwellings per hectare and 35 persons/hectare for the net developable area.

There are two zones within the study area that will be developed as rural residential lands. These are the Milton Area and portions of the Queen Elizabeth II North of Lacombe area. The rural residential density for these areas are adopted from the Milton Area Water and Waster Servicing Strategy completed by Stantec in 2008. Two types of rural residential lots in 2.5 acre and 1.0 acre were used as the basis to develop water servicing in the report. The population density of 2.54 people per hectare for 1.0 acre rural residential lots is used in this study in a slightly conservative manner. It is important to note that if future population densities vary from the 2.54 people per hectare for rural residences, the servicing strategy developed in this study should be re-evaluated to ensure the feasibility.

The total study area is a mix of residential, commercial, and industrial lands. The net residential areas were used as the basis for population calculation, listed in **Table 2-1** below. Note that the scope of this study for North Lacombe only includes stormwater management in **Section 9**, which is not shown in **Table 2-1**.

Table 2-1 Development Areas and Population Projections

Study Area	Residential Area (Ha)	Industrial/ Commercial Area (Ha)	Total Developable Area (Ha)	Projected Population at Buildout
Joint Economic Area	31.9	565.4	597.3	1,117
West Barnett Area	78.4	1.6	80	2,744
Rosedale Valley	16	0	16	560
Iron Rail Business Park	0	112.6	112.6	0
QEII North of Lacombe	75.4	251.4	326.8	192
Milton Area	464	0	464	1,179
In Total	**665.7**	**944.7**	**1610.4**	**5,791**

2.4 WATER AND WASTETER UNIT FLOW RATES

2.4.1 Residential Area Water Consumption Rate

The water consumption rates applied in the hydraulic model for residential areas were adopted from the *City of Lacombe 2013 Water Model Update* (Stantec, 2013) in **Table 2-2**.

Table 2-2 Water Consumption Rate

Land Use	Average Day Demand (ADD)	Maximum Day Demand (MDD)	Peak Hour Day Demand (PHD)
Residential	320 LPCD	640 LPCD	1280 LPCD
Industrial / Commercial	0.05 L/s/ha	0.1 L/s/ha	0.2 L/s/ha

2.4.2 Residential Wastewater Generation Rate

The wastewater generation rate is set at 270 LPCD to align with the criteria in the wastewater master plan. (Stantec, 2016).

2.4.3 Industrial/Commercial Area Water and Wastewater Rate

In the City of Lacombe 2013 Water Model Update report, a water consumption rate of 0.10 L/s/ha was used to project demands in industrial/commercial areas. The 0.15 L/s/ha rate is the City of Red Deer's design standard for industrial and commercial development. As part of this project, actual water demand data provided for Lacombe County's Aspelund industrial park near Blackfalds and the City's Wolf Creek industrial subdivision was reviewed. Both reviews concluded that the County and the City industrial areas experience average water demands of less than 0.02 L/s/ha. In reviewing the medium term developable area for the Joint Economic Area, a sensitivity analysis was completed to determine the amount of serviceable area within the Joint Economic Area without having to connect to the Regional Wastewater line and construct the future water reservoir. Through that sensitivity analysis, 0.05 L/s/Ha was established as a reasonable rate that satisfies water demands as well as the required amount of viable, serviceable land within the JEA for Lacombe County,

Therefore, water and wastewater consumption rate of 0.05 L/s/ha are applied in this servicing report.

2.5 WATER SERVICING

2.5.1 Water Supply

Both the City of Lacombe and Lacombe County are members of the North Red Deer Regional Water Services Commission (NRDRWSC). Potable water, treated at the City of Red Deer's Water Treatment Plant, is delivered to participating communities north of Red Deer through the NRDRWSC transmission line. It is assumed that the water treatment capacity and the conveying capacity of the NRDRWSC regional supply line will grow to meet the demands/growths in the participating communities, including the City of Lacombe and Lacombe County.

2.5.2 City of Lacombe Water Distribution and Storage System

The following sections describes the existing and future water distribution network and facilities in the City of Lacombe denoted in the "2013 Water Model Update" by Stantec, 2014.

2.5.2.1 Water Distribution System

The City of Lacombe's water distribution system is comprised of approximately 84 km of water distribution mains ranging from 50 mm to 350 mm in diameter. Through the NRDRWSC regional line, potable water is transferred and stored in three existing reservoirs (Reservoir A, B, and C).

In the 2013 Water Model Update (Stantec, 2014), the future growth analysis was completed for four future horizon years, which were 2018, 2023, 2033 and 2038. The future land use planning was adopted from "City of Lacombe – 2013 Transportation Master Plan" (Stantec, 2013). **Table 2-3** summarizes the 2013 water demands (i.e. near-existing) and future projected demands utilized for growth analysis in the hydraulic water model for Average Daily Demand (ADD), Maximum Daily Demand (MDD) and PHD scenarios in the 2013 Water Model Update (Stantec, 2014).

Table 2-3 Existing and Future City Water Demands

	2013	2018	2023	2033	2038
Average Daily Demand (ADD), L/s	39.2	50.6	63.6	95.2	114.1
Maximum Daily Demand (MDD), L/s	78.4	101.2	126.6	190.4	228.2
Peak Hourly Demand (PHD), L/s	156.8	202.4	253.2	380.8	456.4

2.5.2.2 Reservoir and Pumping Facilities

The City of Lacombe's water distribution system is separated into two pressure zones: the 903 m Low Pressure Zone and the 910 m High Pressure Zone. Pump Station C maintains pressure in the High Pressure Zone while pump stations A and B operate the Low Pressure Zone. Pump station C also supplies water to the low pressure zone via a pressure reducing valve (PRV). The storage volume for three existing reservoirs are summarized in Table 2-4.

Table 2-4 Existing Storage Capacity

Reservoir	Storage Capacity (m^3)
Reservoir A	4,545
Reservoir B	2,275
Reservoir C	7,120

In the "City of Lacombe 2013 Water Model Update" report, it was concluded that the available total storage of **13,940 m^3** in the City of Lacombe met the requirements for fire flow, equalization, emergency, and additional storage for supply interruptions for the existing City, as required by Alberta Environmental and Parks (AEP).

This past study noted that Reservoir and Pump Station B was approaching the end of its design life. The decommissioning of this reservoir and pump station and incorporation of necessary pumping and storage capacities into a new facility would be necessary in a long-term run. Based on the future growth horizon analyzed in this study, two future reservoirs and pump stations were proposed and identified as necessary to provide future water service. One reservoir and pump station (R-F2) was proposed at the Lacombe Golf and Country Club area to supply required storage and pumping capacity for future developments east of Highway 2 and northwest of the City. The second reservoir and pump station (R-F1) is proposed to provide storage and pumping capacity to future developments at the southeast corner of the City. The future system storage requirements were adopted and shown in **Table 2-5**.

Table 2-5 Future System Storage Analysis (2013 Water Model Update, Stantec)

Storage Type	Method	2018 Storage Volume (m3)	2023 Storage Volume (m3)	2033 Storage Volume (m3)	2038 Storage Volume (m3)
A = Fire Storage	Fire Storage (233 L/s for 3 hours) 2,516 m3 in each Zone	5,033	5,033	5,033	5,033
B = Equalization Storage	0.25MDD (0.5ADD)	2,186	2,735	4,113	4,929
C = Emergency Storage	0.15ADD	656	820	1,234	1,479

Storage Type	Method	2018 Storage Volume (m3)	2023 Storage Volume (m3)	2033 Storage Volume (m3)	2038 Storage Volume (m3)
D = Additional Storage	1.25ADD	5,465	6,836	10,282	12,323
TOTAL STORAGE REQUIRED	S=A+B+C+D	13,339	15,424	20,661	23,764
Existing Reservoir Capacity (A&B&C)		13,940	-	-	-
Existing Reservoir Capacity (A&C)		-	11,665	11,665	11,665
Surplus (Deficit)		601	(3,759)	(8,996)	(12,099)

2.5.2.3 Storage Requirement Sensitivity Analysis

The 2038 population projection developed in 2013 Water Model Update report by Stantec was based on a 5% population growth rate, which was also used in the "City of Lacombe – 2013 Transportation Mater Plan" (Stantec, 2013). Historical trends indicate that the actual growth is substantially lower than what was anticipated in 2013. As such, the timing for future storage upgrades is projected to be later. A sensitivity analysis on the City's required storage volume was conducted using population growth rates of 0.8%, 2%, and 5%. The 0.8% growth rate represents the City's actual growth in recent years.

The rate of the City's growth may affect the timing of the next expansion as well as the recommended volume of the expansion. Alberta Environment and Parks Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Section 2.5.2, states:

> *"Treated water storage requirements should be calculated using a first phase projected demand of no more than 10 years (refer to Section 2.1.2). Present worth cost analysis may show that longer design periods are more economical, however the failure to properly phase the storage requirements can result in operational problems due to oversized pumping facilities and/or problems with maintaining the required chlorine residual if the available storage is excessive".*

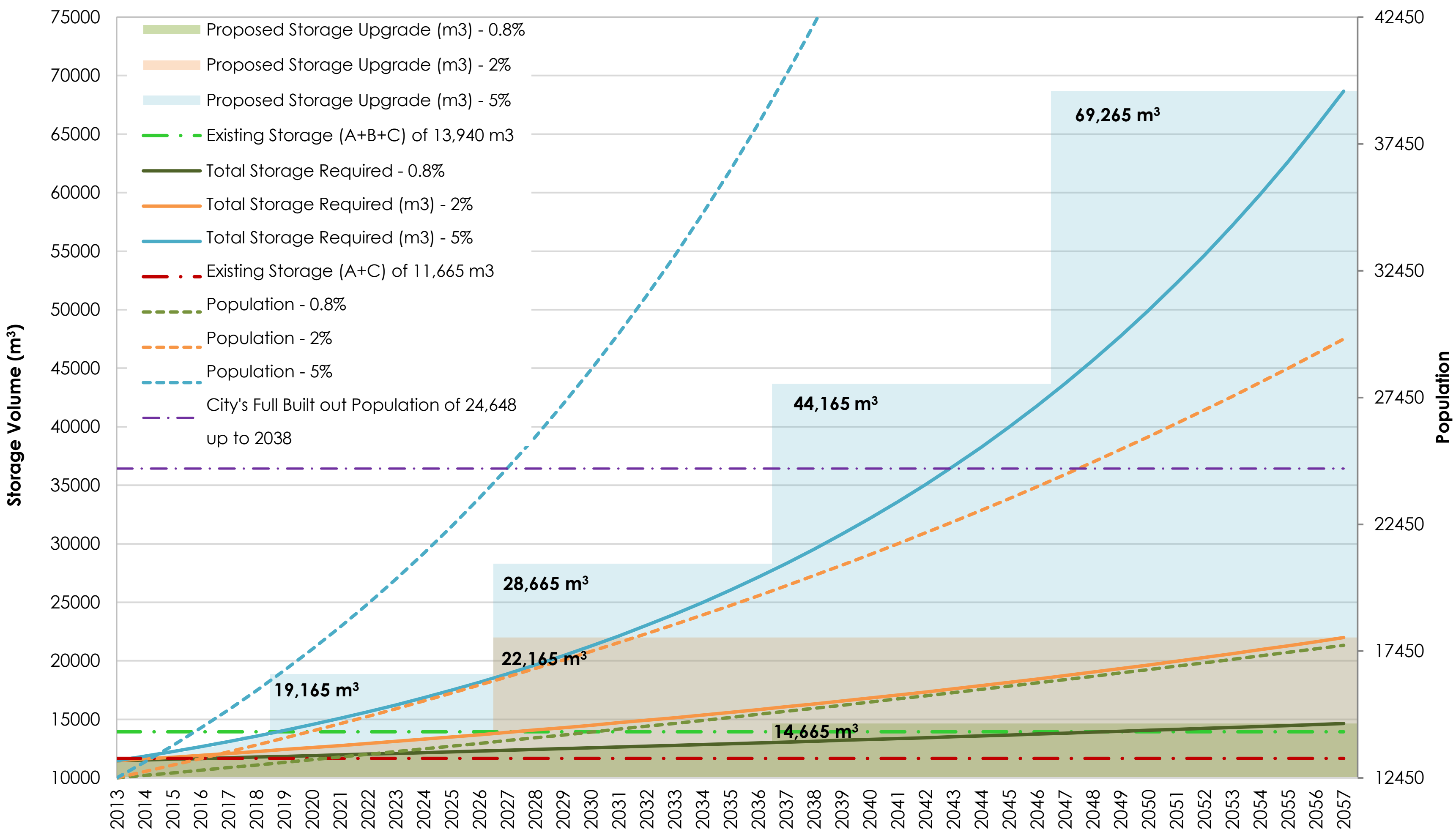
Table 2-7 and Figure 2-1 below show the projected storage upgrades requirements using three population growth rates of 0.8%, 2% and 5% for a 10 year horizon. Due to economic viability considerations, municipalities often plan and design their reservoirs beyond the 10-year horizon appropriately. The table **in Appendix C** provides more detailed information on the projected timeline of future reservoirs using 0.8%, 2% and 5% population growth rates up to the year of 2057.

Table 2-7 Summary of Future Storage Requirement

Year	Existing Storage Volume (m³)	[2]Future Storage Requirement (m³)	Total Storage Volume (m³)
Population Growth Rate: 0.8%			
[1]2037	11,665	3,000	14,665
Population Growth Rate: 2%			
[1]2027	11,665	10,500	22,165
Population Growth Rate: 5%			
[1]2019	11,665	7,500	19,165
2027	11,665	9,500	28,665
2037	11,665	15,500	44,165
2047	11,665	25,100	69,265

As described in the "2003 Water Distribution Study", Reservoir and Pump Station B is approaching the end of its design life. Thus, Reservoir B is recommended to demolished in conjunction with the construction of future reservoirs.

Figure 2-1 Sensitivity Analysis of Proposed Storage Upgrade



2.6 HYDRAULIC WATER MODELING

The hydraulic water model developed and updated in the "City of Lacombe 2013 Water Model Update" report (Stantec, 2014) was used as the basis for completing the water modeling analysis as part of this servicing study. The WaterCAD Version V8i software is used to perform the steady state analysis.

The total modeled water demands for the 2038 future scenarios for a population of approximately 24,648 was used as the basis in developing water servicing strategies for all study areas in this servicing report.

2.6.1 Modeling criteria

2.6.1.1 Supply Criteria

As the remaining capacities of NRDRWSC transmission line is uncertain at the time of this study, it is therefore assumed that the water treatment capacity and the conveying capacity of the NRDRWSC regional supply line will grow to meet the demands/growths in the participating communities, including the City of Lacombe and Lacombe County.

2.6.1.2 Level of Service Criteria

The level of service criteria utilized in the study were developed based on the typical industrial standard in association with the *City of Lacombe Water Design Standards*, as shown in **Table 2-8.**

Table 2-8 Level of Service Criteria

Indicator	Level of Service (LOS) Criteria
Operation Pressure Range	250 kPa (36.3 psi) to 630 kPa (91 psi)
Maximum Velocity allowed at PHD	1.5 m/s
Fire Flow – Rural Residential	33 L/s
Fire Flow – Residential (Single Family)	75 L/s
Fire Flow - Residential (multi-family)	135 L/s
Fire Flow - Industrial/Commercial/Institutional	233 L/s
Fire Flow – Maximum Allowable Velocity During Fire Flow[1]	2.5 m/s
Maximum allowable Headloss Gradient	5 m/km
Pumping Capacity [2]	PHD based on Firm Pumping Capacity

1. In this servicing study, the 2.5 m/s velocity constraint under MDD plus fire flow condition per City of Lacombe Water Design Standards is not considered as a limiting factor for interim servicing for JEA area. But this velocity constraint was applied as a limiting factor for all future pipes in the model for ultimate servicing scenario.

2. The Firm Pumping Capacity refers to the pumping capacity of a pump station when one of the biggest pump is taken off-line.

2.6.2 Storage Requirements

The City of Lacombe receives its water supply through the NRDRWSC regional transmission line. Thus, it is of importance that the City have sufficient available storage capacity. Alberta Environment and Parks (AEP) stipulates that the required water storage is as follows:

S = A+B+C+D, where

- Fire Storage (A): As fire storage water is permanently required, it effectively reduces the usable reservoir volume. The required Fire Storage Capacity in each zone should equal 233 L/s for 3 hours, as per the Fire Underwriters Survey, equivalent to 2,516 m^3 that must be stored in each pressure zone for a total of **5,033m^3** for the two current zones in the City.

  For rural residential lands, required fire storage capacity in each zone should equal 33 L/s for 1 hour, as per the Fire Underwriters Survey, equivalent to **119** m^3.

- Equalization Storage (B): When demand fluctuates above the supply of water being input to the system, equalization or peaking storage is used to meet the temporary shortfall. The typical volume of water required for peaking or equalization storage is to be 25% of the MDD condition (**0.25 MDD**).

- Emergency Storage (C): Emergency storage is usually required for potable water to the system in case of a supply line failure or maintenance shut down. An emergency storage of 15% of ADD is required (**0.15 ADD**).

- Emergency Storage for Supply interruption (D): As the NRDRWSC is a long regional water supply line that currently extends from the City of Red Deer to the Town of Ponoka, a contingency for water supply, should also be allowed to account for unlikely supply interruptions. A common criterion for this additional required storage is **1.25 ADD**.

Given the criteria above, the total storage is as follows:

S = A + B + C + D
= Fire Storage [2,516 m^3 per zone or 119 m^3 per zone for rural residential area]
+ Equalization Storage [0.25 MDD]
+ Emergency Storage [0.15 ADD]
+ Additional Storage [1.25 ADD]

2.7 WASTEWATER SERVICING

For the wastewater servicing, it is acknowledged that the current treatment and storage capacity of the City's wastewater lagoons cannot accommodate additional flow from Lacombe IDP area unless major upgrades are completed. The North Red Deer Regional Wastewater Services Commission (NRDRWWSC) line is scheduled to be in operation by 2019 to convey the wastewater, collected in the City and County, including the Lacombe IDP area, to the City of Red Deer Wastewater Treatment Plant (CRD WWTP) for treatment and final disposal.

The Lacombe IDP development plan will include the planning and construction of the local wastewater sewer systems and the downstream infrastructures for sanitary wastewater conveyance. Depending on the development conditions, the local wastewater sewer systems will have an appropriate type (e.g. a gravity sanitary system or a low pressure sanitary system), to service the planned developments. The treatment and final disposal of the sanitary wastewater generated in the Lacombe IDP areas will rely on the NRDRWWSC system, which will transmit the wastewater to the CRD WWTP. The Lacombe regional lift station is currently under construction. Once constructed, it will convey all the wastewater flows from the Lacombe IDP area and the City of Lacombe to the CRD WWTP.

With the City of Lacombe in the vicinity, connecting the local wastewater servicing areas or subdivisions defined the Lacombe IDP to the City's wastewater system is the preferred solution. However, the City's wastewater system has limited residual capacity to accommodate the projected flows from the Lacombe IDP areas. The hydraulic model developed in the Lacombe Wastewater Master Plan was utilized to determine whether and where the flows from the Lacombe IDP can be introduced into the City's sanitary sewer system.

The development conditions, assumptions, and standards for the wastewater servicing of the Lacombe IDP areas are listed as the following:

- The proposed development and wastewater system within the City of Lacombe is completed. i.e. the proposed sanitary sewer system in the Lacombe Wastewater Master Plan is fully built out.
- The planning of the local sanitary system is based on the current ground elevation only. If significant grading is required in the detailed design stage, the service concept proposed in this study may need to be changed accordingly.
- The population density is 35 people per ha in the urban residential areas and 2.54 people per ha in the rural residential area.
- The sanitary generation rate is 275 liters per capita per day (Lcpd) for the residential area.
- The sanitary generation rate is 0.05 liter per second per ha (l/s/ha) for the Industrial, and commercial areas.
- The calibrated diurnal pattern derived from sanitary monitoring program in the Lacombe Wastewater Master Plan is used to project the peak flows. The maximum peaking factoring factor in the diurnal pattern is 2.5.

- The Inflow and Infiltration (I&I) flows, is based on the 'unit hydrograph' method and parameters used in the Lacombe Wastewater Master Plan model. The design storm is the 1 in 25 year Huff distribution event. The instantaneous peak I&I is approximately 0.1 l/s/ha.
- The pumping velocities in lift station force mains shall range from 0.6 to 3 m/s.

2.8 STORMWATER MANAGEMENT

This section provides storm trunk sizes and alignments, regional storm pond locations and sizes, and determines the design release rates for each area in the study area.

2.8.1 Existing Studies

2.8.1.1 Lacombe County, Ponoka County, City of Lacombe, Town of Blackfalds – Master Drainage Plan for the Wolf Creek and Whelp Brook Watersheds:

In 2013, MPE Engineering Ltd. was commissioned by Lacombe County, Ponoka County, City of Lacombe, and Town of Blackfalds to complete a Master Drainage Plan study for the Wolf Creek and Whelp Brook Watersheds. Prior to the study, several land owners located along Wolf Creek and Whelp Brook have voiced concerns about perceived conveyance capacity limitations along these water courses which may have resulted in increased frequency of overbank inundation levels; therefore, Alberta Environment and Parks (AEP) requested that the municipalities undertake the study. A final report for the Master Drainage Plan for the Wolf Creek and Whelp Brook Watersheds, was submitted by MPE Engineering Ltd. on August 31, 2014. Water Act Approval No. 00358426-00-00 was subsequently granted to the municipalities on August 24, 2015.

2.8.2 Study Objectives

This study will provide a conceptual design for the various Lacombe IDP areas. The study will provide preliminary storage volumes, discharge rates, land requirements, and design elevations of proposed regional stormwater management facilities. It will also provide preliminary alignments, dimensions, design elevations, and design flow rates of the proposed storm trunks within the study areas.

The primary objective of this study is to provide a storm system design and framework which will ultimately provide an adequate outlet for each of the areas within the study area, and subsequently facilitate regulatory approvals and further development in the area. The conceptual/preliminary designs provide a valuable blueprint to be followed during subsequent planning and development activities and will facilitate the development of funding mechanisms.

2.8.3 Pre-Development Discharge Rates

The project areas fall within the study area of the Master Drainage Plan for the Wolf Creek and Whelp Brook Watersheds (final report MPE, August 2014), and as such must meet the pre-development release rate of 2.0 L/s/ha, as outlined in the previously named study. Water Act Approval No. 00358426-00-00 was subsequently granted to the municipalities on August 24, 2015 for the Master Drainage Plan (MDP).

2.8.4 Computer modeling

The PCSWMM computer model (Version 5.1.010) was used in this study to perform a single event analysis. PCSWMM has a proprietary graphical user interface developed by Computational Hydraulics, Inc. (CHI) in Guelph, Ontario, but is based on the EPA SWMM5 computational engine.

PCSWMM can utilize steady state, kinematic wave or full dynamic wave routing methods, which can take into account various hydrologic processes such as precipitation, evaporation, snow accumulation, and melting. By providing input data on rainfall and land use, the PCSWMM model can be used to generate runoff for specific catchments. Algorithms in PCSWMM can then be used to model the conveyance of runoff through pipes or in open channels. Reservoir routing can also be completed to represent the attenuating effects of storage found in trap-lows or stormwater management facilities.

2.8.5 Design Storm

The most common method of analysis used for stormwater management is based on a single storm event; either a real historic storm or a theoretical design storm. A one-in-one hundred (1:100) year return period design storm was used with the Chicago distribution. This distribution does not necessarily reflect the shape that such a rare storm event would exhibit in Lacombe, but it represents two important characteristics for design purposes:

- The total precipitation of the Chicago storm, for any duration, is the same as the total precipitation defined statistically for the 1:100-year event.

The peak intensity of the Chicago Storm, for any time increment, is the same as the peak intensity defined statistically for the 1:100-year event.

The storm duration was 24 hour and the rainfall time increment was 5 minutes.

Rainfall intensities for the Chicago distribution are determined from an *intensity-duration-frequency* (IDF) relationship that is described as

$$i = \frac{a}{(t+b)^c} \qquad [1]$$

where i is intensity (mm/hr), a, b and c are IDF parameters and t is the time duration (minutes). The time to storm peak is determined by

$$\frac{t_p}{t_d} = r \quad \text{or} \quad t_p = r(t_d) \qquad [2]$$

where t_p is the time to peak and r is the ratio of time to peak versus storm duration, t_d.

The following parameters were used to generate the Chicago design storm, and these parameters were developed from the Environment Canada IDF data for the Red Deer Airport (3025480), with data from 1959 – 2012. Please refer to **Appendix A** for a graphical representation of the Chicago design storm utilized.

a = 644.6 b = 1.41 c = 0.689 r = 0.3 (24 hour duration)

2.8.6 Hydrology

Table 2-7 below shows the hydrologic parameters used for and resulting from the single event PCSWMM computer modeling, which was used to estimate the required pond storage volume for the 24 hour, 1:100-year design storm, and for preliminary design of the storm trunks. The PCSWMM modeling data files can be provided upon request.

The PCSWMM computer modeling estimated the infiltration over pervious surfaces based on Horton's Method. Horton's equation and the study area parameters are defined below:

$$f = f_c + (f_o - f_c)\, e^{-k(t)}$$

Where,

f = infiltration rate at time t (mm/hr)
f_c = final infiltration rate (mm/hr)
f_o = initial infiltration rate at the start of the storm (mm/hr)
k = decay rate (t^{-1})
t = time since initial infiltration rate

Table 2-7 Hydrologic Parameters

Parameter	Unit	Value
Infiltration		
Initial Rate	mm/hr	75
Final Rate	mm/hr	2.5
Decay Factor	(1/hr)	4.14
Depression Storage		

Parameter	Unit	Value
Pervious Area	mm	3.2
Impervious Area	mm	1.6
Manning's Coefficient		
Pervious Area	n/a	0.25
Impervious Area	n/a	0.015

The sub-catchment area and impervious surface ratio parameters have the greatest impact upon the stormwater runoff rate and volume from developed areas. Proposed land use data was used to develop the impervious surface ratio for each sub-catchment located within the Lacombe IDP study area. These parameters are shown in the following sections for each of the analyzed areas.

Other sub-catchment characteristics that are specified in PCSWMM include the width (based on the travel length) and slope. The width of sub-catchment was computed by dividing the sub-catchment area by the travel length. Increasing the travel length decreases the sub-catchment width which creates a more attenuated response to precipitation events (CHI 2011).

Given that this is a relatively high level study covering a significant area, relatively conservative percolation/infiltration rates must be assumed at this stage. At the time of development in the future, with geotechnical information at hand, the developer/consultant may be able to justify utilizing parameters that result in higher rates of infiltration over pervious surfaces found within a sub-catchment area.

2.8.7 Regional Storm Ponds

This study provides conceptual configurations for the required stormwater management facilities required for development within the study areas. The subsequent report sections will provide figures that outline the location of the proposed regional storm ponds for each of the development areas.

The proposed stormwater facilities were universally assumed to have active depths of either 1.5 metre or 2.0 metre and 7:1 side slopes above the normal water level (NWL). For estimating the facility footprint, they were also assumed to have a 15 m buffer beyond the high water level (HWL) which includes freeboard area, berming and backsloping, and perimeter landscaping.

This is a relatively high level study; therefore, the configurations provided should not be considered as final. During the ultimate development process, the developer's consultants could conceivably develop alternate drainage plans that work equally as well. Regardless, the provided stormwater management plan provides a useful guide as to the facilitys' required active storage volumes and approximate footprint areas associated with given development areas.

2.8.8 Water Quality

In terms of water quality improvement, wet stormwater management facilities are considered superior to dry facilities. Wet stormwater management facilities generally take the form of either wet ponds or constructed wetlands. Constructed wetlands are generally considered as providing better treatment than wet ponds, due to their larger surface area for biological and chemical processes to occur on; thus, providing better treatment of nutrients and dissolved contaminants. However, typical wet ponds are still considered to provide sufficient treatment, and the decision between providing a constructed wetland or wet pond is generally contingent upon geotechnical conditions and earth balance requirements, and must be determined on a site by site basis.

Where dry facilities are desired by the developer, or are required due to site constraints, other Best Management Practices (BMPs) must also be considered and implemented to make up for the water quality performance limitations of dry facilities. Dry facilities may also be fine on their own if a wet facility is located downstream. The following BMPs should be considered for use in combination with dry stormwater facilities:

- Bio-retention areas – These are relatively small vegetated depressions that intercept and dispose of runoff on a local scale. They are ideally suited to being in parking islands in commercial and industrial areas.

- Vegetated swales – These can be used to convey runoff through lower density developments instead of the more typical curb and gutter and storm sewers. They are effective at filtering and biologically treating runoff as it is conveyed.

- Storm facility wet cells – Effective water quality improvement can be provided by providing a much smaller wet cell (forebay) within an overall dry pond facility.

- Oil and grit separators (OGS) – These are below grade vaulted structures that are designed to provide enhanced sedimentation in a relatively smaller footprint. OGS units in Alberta have typically relied on sedimentation which due to the smaller footprint typically do not provide as high of performance as a full out wet stormwater management facility. However, OGS units can also be made to provide very high levels of treatment by utilizing filtration methods. These units typically have very high operating costs and have essentially not been widely utilized in Alberta.

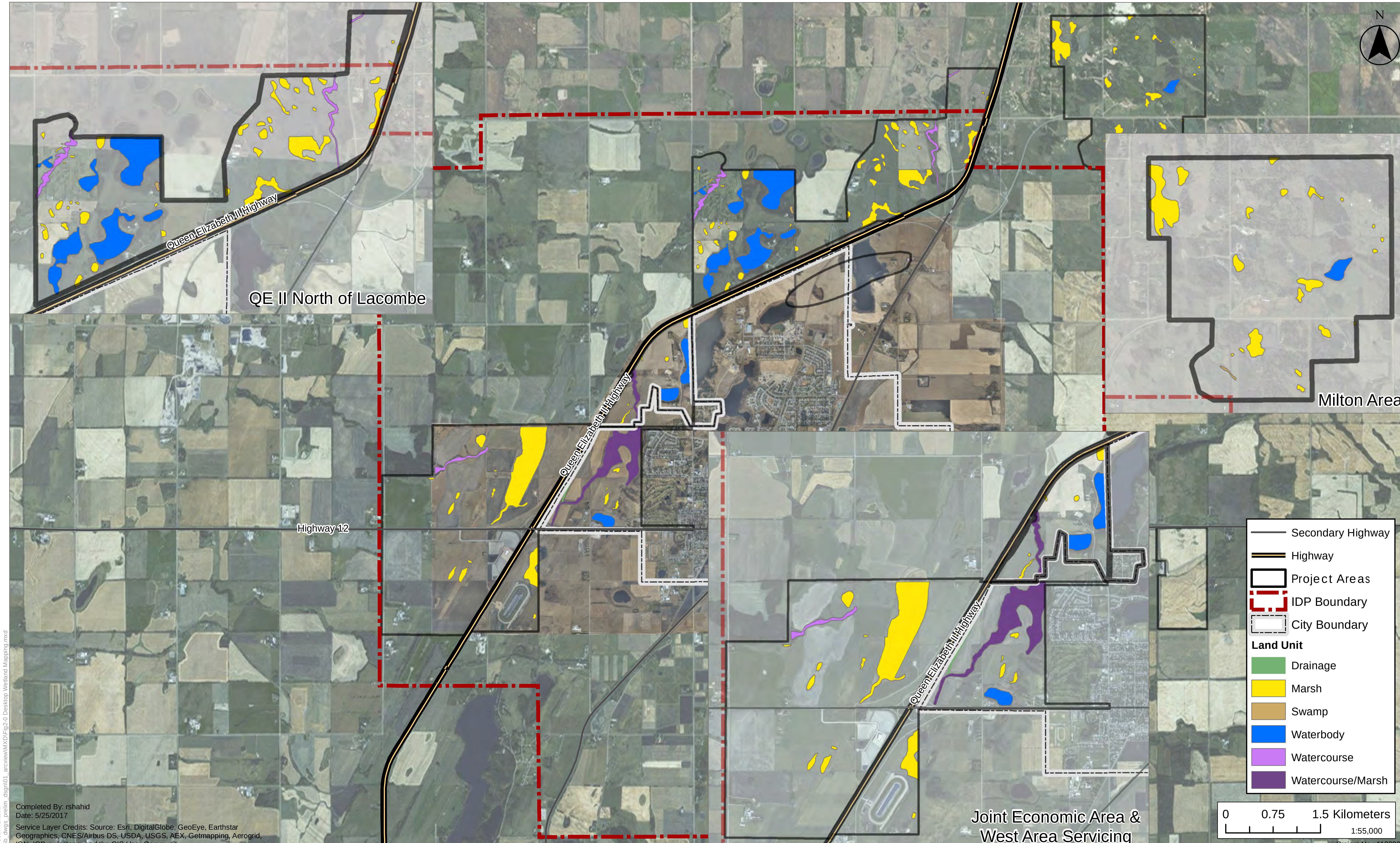
As previously mentioned, the project area falls within the study area of the Master Drainage Plan for the Wolf Creek and Whelp Brook Watersheds (Final report MPE, August 2014), and as such must meet the pre-development release rate of 2.0 L/s/ha. The adopted pre-development release rate at 2.0 L/s/ha will result in significant water quality improvement through relatively long stormwater management facility detention times. Stantec is also confident that the adopted pre-development release rate is sufficiently low such that downstream drainage courses will not experience erosion and/or environmental degradation because of development in the study area.

If the water quality improvement recommendations outlined in this report are followed, Stantec is confident that the West Barnett areas will handily provide the necessary water quality improvement to meet the Alberta Environment and Parks (AEP) criteria for removing 85% of Total Suspended Solids (TSS), for sediment particles 75 microns and larger.

2.8.9 Low-Impact Development (LID)

There are also numerous Low-impact development (LID) strategies that can be implemented to help reduce runoff volume and increase the water quality. The following list are LID's that could be implemented in the IDP study area where appropriate:

- A minimum topsoil depth of 300 mm will be replaced on future landscaped areas within residential lots, private lots, and public open space areas. This will increase stormwater soil retention and provide opportunities for enhanced landscaping.
- Drainage from single family roofs and driveways will be first directed to landscaped areas before it can drain overland onto City streets, sidewalks, or lanes. This will contribute to infiltration of water into the soils.
- Rear lot drainage will be directed as sheet flow across landscaped areas to the ER areas.
- Rainwater harvesting on private sites may be used whereby the roof drainage is retained in underground cisterns and used for irrigation of landscaped areas or alternative reuse opportunities.
- Educational material can be provided to home builders and homeowners to inform them of the Drainage Bylaw requirement and encourage additional measures that can be implemented on-site, such as enhanced landscaped (garden) areas, rainwater harvesting and rain barrels.



Stantec LACOMBE COUNTY CITY OF LACOMBE

Figure 2-0 Desktop Wetland Mapping

City of Lacombe
Lacombe County
Lacombe Intermunicipal Development Plan - 2017 Servicing Study

3 JOINT ECONOMIC AREA (JEA) & WEST AREA SERVICING

3.1 PLANNING CONCEPT

As shown in **Figure 3-1** at the end of this section, the Joint Economic Area (JEA) and the City's west area servicing is located in vicinity of the Queen Elizabeth II Highway and Highway 12 interchange. As shown in the Area Structure Plan, the JEA will consist entirely of highway commercial and industrial development. Within the City's jurisdiction, there will be a mix of commercial development (Midway Outline Plan) and future residential adjacent to 76th Street, which is designated as an important future arterial roadway. The proposed City and County developments are being assessed together in this area because they are proposed to share critical water, wastewater, and storm water infrastructure.

As described in the subsections below, the JEA has been planned with two key horizons (medium term and the long term) for serviceability considerations. The medium-term horizon buildout is based on the serviceable area within the JEA that can be accommodated by the City's existing Woodland Drive sanitary sewer and the City's existing water distribution system (without a new reservoir and pump station). Development beyond the medium term buildout will trigger the requirement for a water reservoir and booster station as well as redirecting the majority of the wastewater away from Midway and Woodland Drive to the NRDRWWSC transmission line or lift station.

3.2 WETLAND CONSIDERATIONS

The JEA and West Lacombe servicing area is primarily made up of cultivated lands with small pockets of commercial and residential development and several wetlands and waterbodies including Whelp Brook. The area is bisected by the Queen Elizabeth II Highway and includes the interchange at Highway 12.

Desktop mapping identified 20 wet features including 16 marshes, one waterbody (i.e., Crescent Lake, located adjacent to the Lacombe Golf and Country Club), one watercourse/marsh (i.e. Whelp Brook), one drainage and one unnamed watercourse.

The marshes in this area are generally small features, with the exception of the large marsh located northwest of the Queen Elizabeth II Highway and Highway 12 interchange. The marshes appear to have been regularly cultivated throughout the historical aerial photograph reviewed and a ditch was constructed in the center of the large marsh before 1950. The large marsh appears to be part of drainage system that collects water from the unnamed watercourse to the west, ephemeral drainage features located on the south side of Highway 12, and ultimately connects to Whelp Brook north of the JEA. This large marsh has been assumed to be undevelopable. However, developers may wish to further evaluate its developability in the future.

The waterbody (i.e., Crescent Lake) is situated in the west of the Lacombe Golf and Country Club. Crescent Lake is bisected by a road, which has been present on the landscape since before 1950. The City of Lacombe Natural Spaces Management Plan (Stantec 2002) describes Crescent Lake as a moderately healthy permanent waterbody with a wide diversity of aquatic and emergent vegetation surrounded by a narrow mixedwood forest.

The feature classified as a watercourse/marsh (i.e., Whelp Brook) appears unchanged since 1969. In the 1969 historical aerial photograph, it appears that portions of Whelp Brook were modified and realigned as part of the construction of the Queen Elizabeth II Highway. Whelp Brook was further modified when an oval-shaped facility was constructed in 2007. It appears that Whelp Brook runs through this oval-shaped facility, creating an area of standing water in the center. The City of Lacombe Natural Spaces Management Plan (Stantec 2002) described the portion of Whelp Brook within the Joint Economic area as a unique example of a riparian corridor and wet meadow node surrounded by undeveloped and agricultural land.

The feature classified as drainage is a linear area located on the east side of the Queen Elizabeth II Highway. The drainage appears to by hydrologically linked to Whelp Brook. The drainage is visible as a series of wetlands in the 1950 historical aerial photograph and appears to have been modified into the current form as part of the Queen Elizabeth II Highway construction between 1950 and 1969.

The unnamed watercourse has a fringe of woody vegetation and appears to feed into the large marsh located northwest of the Highway 12 interchange through an ephemeral channel or ditch. The historical aerial photographs identified several changes to the unnamed watercourse including vegetation clearing between 1950 and 1969 and realignment/ditching of the portion adjacent to the large marsh between 1983 and 1993.

The presence of marshes, watercourses, drainage and a waterbody in the area may affect development in this area and/or trigger the need for additional studies and regulatory approvals. Based on the information available, considerations and next steps related to wetlands and waterbodies are listed below:

- All watercourses, marshes and waterbodies are regulated under the *Water Act* and will require an approval prior to modification or removal. A wetland assessment, including field classification and delineation, will be required to support the *Water Act* application and the proponent will need to show use of the wetland mitigation hierarchy (i.e., avoidance, minimization and replacement). It is likely that the field assessment will identify more wetlands than what was identified as part of this desktop mapping exercise due to the scale of mapping and minimum polygon size.
- The areas classified as waterbody (i.e., Crescent Lake) and watercourse/marsh (i.e., Whelp Brook) and watercourse appear to be permanent features with potential to be claimed as Crown land under Section 3 of the *Public Lands Act*. These features will likely need to be retained within future development or approvals under the *Public Lands Act* will be required for development or modification. It is possible that wetlands in addition to those classified as waterbody, watercourse and watercourse/marsh could be claimed as

Crown land. Therefore, a water boundaries review should be submitted to AEP for all marshes, watercourses, and waterbodies to confirm if the features are deemed Crown land under Section 3 of the Public Lands Act prior to development.

- If wetlands or waterbodies are retained in the development, site specific buffers and setbacks should be determined and implemented for pollution prevention and flood protection of adjacent lands. Additional studies should be completed to determine the pre-development volume and frequency of surface water inputs into retained wetlands and waterbodies so that this can be matched post-development and reduce potential effects on retained waterbodies from changing the hydrology (e.g., flooding, erosion, cutting off water inputs, etc.).
- The FWMIS database indicates that Whelp Brook is a fish bearing waterbody. Development or modifications to Whelp Brook or a fish bearing waterbody (e.g., realignment, culvert/bridge construction, etc.) will require regulatory approvals under the *Water Act, Public Lands Act* and potentially the *Fisheries Act.* Applications for this type of development will likely require a supporting fish and fish habitat field survey and report.
- Although the FWMIS database does not contain records of fish for the other watercourses and waterbodies in the area, this may be due to a lack of sampling effort. The potential for fish and fish habitat should be confirmed prior to development or modification to the watercourses and waterbodies. If fish are present, there may be additional regulatory approvals required as listed above.
- The AEP flood hazard mapping database did not identify records of floodplain mapping for Whelp Brook. The flood hazard area should be determined prior to development so that appropriate mitigation measures can be implemented (e.g., setbacks).

3.3 INTERIM WATER AND WASTEWATER SERVICING STRATEGY

In conjunction with the IDP servicing work for Lacombe County and the City of Lacombe, Stantec was requested to develop an interim servicing strategy to support the forthcoming developments in the Lacombe Joint Economic Area west of the Queen Elizabeth II Highway. A technical memorandum "Lacombe IDP – Joint Economic Area Interim Water and Wastewater Servicing Strategy" was completed on November 7, 2016. The purpose of the interim analysis is to provide the amount of area can be serviced only relying on the current water/wastewater infrastructure system with no upgrade on the existing facilities. A preliminary estimate of the size of serviceable area west of the Queen Elizabeth II Highway was identified using 0.10 l/s/ha for both water ADD and wastewater generation rates. The servicing capacities of the infrastructure system was conducted by including the services to the proposed Midway commercial development. As further requested, another two technical memorandums for a high level sensitivity analysis were conducted using reduced consumption rate from 0.03 l/s/ha to 0.10 l/s/ha. The details of water and wastewater servicing strategies can be found in **Appendix D**.

It was concluded that using an average daily design flow of 0.10 L/s/ha, the serviceable area west of the Queen Elizabeth II Highway could reach up to approximately 207 ha for water servicing and 253 ha for wastewater servicing. An additional 116 ha and 100 ha of lands could be serviced by existing water and wastewater infrastructure, respectively, when assuming a consumption rate of 0.05 L/s/ha. As future development occurs, it is recommended that the water consumption rates be regularly metered and the wastewater flow be regularly monitored downstream to review the overall impact to the City's residual capacities.

Through meetings held between the City and the County, it was agreed that the 0.05 L/s/ha average water demand be used as the basis for developing water and wastewater servicing strategies in the JEA. Should actual water and wastewater consumption rates exceed this value, the servicing capacities should be re-assessed to ensure the existing infrastructure can accommodate future development.

3.4 LONG TERM WATER SERVICING

Based on the contours shown in **Figure 3-2**, the proposed Midway commercial development was planned to operate in 903 m Zone in the 2013 Water Model Update Report (Stantec). The JEA land west of the Queen Elizabeth II Highway is generally sloping from northwest 885 m to southeast 859 m. Thus, this area shall be maintained in the 910 m Pressure Zone to meet the LOS pressure criteria. Three pressure reducing vaults are required to separate the 910 m zone from 903 m zone as denoted in **Figure 3-2**.

A breakdown of demand projected for ADD, MDD and PHD scenarios for this area is summarized in **Table 3-1**.

Table 3-1 Future Demand Projection – Joint Economic Area

Design Parameters	Projection
ADD	32.4 L/s
MDD	64.8 L/s
PHD	129.6 L/s

To align with the proposed roadway network, the proposed water servicing network consists of watermains ranging from 200 mm to 350 mm in diameter, which loop around the planned roadway alignments. The main purpose for the looping is to supply sufficient fire flow, as shown in **Figure 3-2**. Looping also aids in reducing the total area that needs to be serviced during the event of a water main break. The existing 150 mm watermain along Fairway Drive from Westview Drive to 58th Street will need to be upgraded to a 300 mm diameter trunk main to service the JEA and west Lacombe areas. Proposed 350 mm diameter pipes are recommended to be installed along Highway 12 and up to Woodland Drive, respectively, to provide additional water looping.

In the 2013 Water Model Update report (Stantec, 2014), a future southwest reservoir and pump station (R-F2) was proposed at the Lacombe Golf and Country Club area to supply required storage and pumping capacity for future City developments.

It is proposed to have a long term future reservoir and pump station at the northwest area of the JEA (R-F3) to provide sufficient storage and pumping capacities to JEA areas. The conceptual location of future reservoir is presented in **Figure 3-2**. The proposed Midway commercial development was previously included in the scope of the 2013 Water Model Update Report. The Midway area will be supplied by the proposed future southwest reservoir and pump station (R-F2). The total required storage for the JEA future reservoir does not include any area east of the Queen Elizabeth II Highway. The required storage of this proposed long term future reservoir is 4,120 m^3.

A summary of the modeling results for the system pressure under PHD condition and available fire flow under MDD condition are presented in **Figure 3-2** and **Figure 3-3**. According to modeling results, all LOS criteria will be satisfied.

3.5 LONG TERM WASTEWATER SERVICING

The possibility of conveying the wastewater collected in the JEA and West areas through the existing wastewater system in the City has been studied. It was found that the existing sanitary sewer in the City cannot accommodate all the projected high peak flow, which are approximately 160 l/s from the JEA and West areas. Therefore, prior to the Woodland Drive pipe reaching its capacity from the JEA, West Area, and the West Barnett Area, the wastewater from the JEA will be required to divert around the City's infrastructure to the Regional Water Line or lift station.

For discussion purposes, the JEA and West area can be divided into four quadrants by the two highways, the Queen Elizabeth II Highway and Highway 12. The proposed wastewater servicing system is presented in **Figure 3-4**. The majority of the two quadrants west of the Queen Elizabeth II Highway can be serviced by a gravity sanitary sewer system and a major lift station in the south quadrant. The wastewater flows from the north to the south, west to the east in the two quadrants. The gravity sewer system in North portion will connect to the south portion with a sewer section crossing under Highway 12. The wastewater collected in the two west quadrants will be conveyed by the lift station crossing the Queen Elizabeth II Highway to the future Lacombe Regional Lift Station in the current Lacombe WWTF. The 350 mm diameter force main (internal diameter) of the major lift station servicing these two quadrants is estimated to be10 km long. The northeast portion of the JEA can be serviced by the 300 mm diameter gravity trunk crossing under the Queen Elizabeth II Highway. The 300 mm diameter gravity trunk will convey the wastewater to the Midway lift station.

In the small area located southeast of the Highway 12 and Queen Elizabeth II Highway interchange, which is currently a race track, a small lift station with approximately 9 L/s of capacity is proposed to transmit the wastewater collection westward via a 100mm diameter force main to tie into the major lift station across the Queen Elizabeth II Highway.

As for the northeast quadrant of the JEA and West area, a local gravity sewer is proposed to collect the wastewater generated in the residential and commercial developments. A lift station is proposed at the northeast site of this area. The lift station, with a design capacity of 47 l/s, will convey the wastewater collected in the east portion of JEA and West area, the east commercial strip of north west quadrant and the midway development area in the City, to the Woodland Drive sanitary sewer.

3.6 STORMWATER MANAGEMENT

3.6.1 Sub-catchment Delineation

The proposed sub-catchments for the Joint Economic Area were delineated based upon the DEM topographical data that was collected in 2016, and as shown in **Figure 3.6 – Joint Economic Area Storm System**, located at the end of this report section. The drainage paths and sub-catchment boundaries are essentially the same for both pre-development and post-development conditions; therefore, **Figure 3.6** can be used to reference both conditions.

The Joint Economic Area consists of approximately 990 ha of land found within the County and City limits. Within the study area there is one large natural low-lying wetland area with a significant drainage course draining to it from the west. On the east side of the Queen Elizabeth II Highway, Whelp Brook drains through this area from south to north and will be the discharge point for the entire West Area. As will be discussed in latter report sections, numerous storm trunks are proposed to drain the east side of the JEA locations to Whelp Brook.

The hydrologic analysis methods where previously discussed in Section 2.5.6, and **Table 3-2** below provides the hydrologic parameters used for and resulting from the single event PCSWMM computer modeling of the Joint Economic Area. These modeling results were further used to estimate the required pond storage volume for the 24 hour, 1:100-year design storm, and for preliminary design of the Joint Economic Area Storm Trunks. The PCSWMM modeling data files can be provided upon request.

Table 3-2 Sub-catchment Hydrologic Characteristics

Catchment Area	Catchment Area Description	Design Rainfall Event Return Period and Duration	Rainfall Amount (mm)	Catchment Area (ha)	% Imperv.	Runoff Depth (mm)
SC_6	Commercial	1:100 yr, 24 hr	103.1	29.7	78	90.0
SC_7	Residential/Commercial	1:100 yr, 24 hr	103.1	69.2	64	81.7
SC_8	Light Commercial/Rec.	1:100 yr, 24 hr	103.1	87.5	47	70.6
SC_9	Commercial	1:100 yr, 24 hr	103.1	40.2	81	91.5
SC_10	Commercial	1:100 yr, 24 hr	103.1	54.1	76	88.5
SC_11	Industrial	1:100 yr, 24 hr	103.1	55.9	74	87.3
SC_12	Industrial	1:100 yr, 24 hr	103.1	38.6	85	93.8
SC_13	Industrial	1:100 yr, 24 hr	103.1	65.8	86	94.4

Catchment Area	Catchment Area Description	Design Rainfall Event Return Period and Duration	Rainfall Amount (mm)	Catchment Area (ha)	% Imperv.	Runoff Depth (mm)
SC_14	Industrial	1:100 yr, 24 hr	103.1	66.2	86	94.4
SC_15	Industrial	1:100 yr, 24 hr	103.1	65.1	86	94.4
SC-16	Industrial	1:100 yr, 24 hr	103.1	65.1	86	94.4
SC_17	Industrial	1:100 yr, 24 hr	103.1	65.1	86	94.4
SC_18	Industrial	1:100 yr, 24 hr	103.1	56.0	81	91.5
SC_19A	Existing Commercial	1:100 yr, 24 hr	103.1	19.8	85	93.8
SC_19B	Existing Commercial	1:100 yr, 24 hr	103.1	13.4	85	93.8
SC_21	Highway Commercial	1:100 yr, 24 hr	103.1	20.4	82	92.4
SC_22	Highway Commercial	1:100 yr, 24 hr	103.1	17.8	82	92.4
Wetland	Body of Water/ER	1:100 yr, 24 hr	103.1	12.9	90	97.6

3.6.2 Regional Storm Ponds

As previously described in section 2.5.7 and further detailed in this report section, conceptual designs for the stormwater management facilities required for future development within the Joint Economic Area are explored. **Figure 3-6 Joint Economic Area Storm System**, located at the end of this report section, provides the conceptual location of the proposed stormwater management facilities.

Table 3-3 below summarizes the sub-catchment area, permissible release rate, proposed active storage volume, approximate facility footprint, and preliminary design elevations, for each of the stormwater facilities that were modeled for the Joint Economic Area.

Table 3-3 Proposed Regional Storm Pond Characteristics

Pond #	Serviced Area (ha)	Permissible Discharge Rate (l/s)	Active Storage Volume (m³)	Approximate Facility Foot Print (ha)	Preliminary NWL Elevation (m)	Preliminary HWL Elevation (m)	Opinion of Probable Pond Cost[1] ($)
6	29.70	59.40	23,500	2.39	852.0	854.0	$740,250
7	69.20	138.40	49,000	4.11	852.0	854.0	$1,543,500
8	87.50	175.00	52,500	4.34	854.0	856.0	$1,653,750
9	40.20	80.40	32,000	2.99	862.0	964.0	$1,008,000
10	54.10	108.20	41,500	3.61	862.5	864.5	$1,307,250
11	55.90	111.80	42,000	3.66	862.0	864.0	$1,323,000
12	38.60	77.20	31,500	2.94	862.0	864.0	$992,250
13	65.80	131.60	54,500	4.46	877.0	879.0	$1,716,750
14	66.20	132.40	55,000	4.49	864.5	866.5	$1,732,500
15	65.10	130.20	53,500	4.40	867.0	869.0	$1,685,250

Pond #	Serviced Area (ha)	Permissible Discharge Rate (l/s)	Active Storage Volume (m^3)	Approximate Facility Foot Print (ha)	Preliminary NWL Elevation (m)	Preliminary HWL Elevation (m)	Opinion of Probable Pond Cost[1] ($)
16	65.10	130.20	53,500	4.40	861.0	863.0	$1,685,250
17	65.10	130.20	53,500	4.40	865.5	867.5	$1,685,250
18	56.00	112.00	44,500	3.83	860.5	862.5	$1,401,750
19A	19.84	39.68	14,000	1.68	858.5	860.5	$441,000
19B	12.96	25.92	4,500	0.87	857.0	859.0	$141,750
21	20.40	40.80	16,500	1.87	852.0	854.0	$519,750
22	17.80	35.60	14,000	1.70	852.0	854.0	$441,000

1. Opinion of probable pond costs includes construction costs, maintenance period costs, 20% contingency, and 15% for engineering and construction management.

3.6.3 Discharges to Whelp Brook

All five of the proposed catchment areas on the east side of the Queen Elizabeth II Highway can discharge directly into Whelp Brook. The other 13 located on the west side of Queen Elizabeth II Highway will be integrated together through various storm systems which will then drain to Whelp Brook.

As previously mentioned, numerous storm trunks are proposed to drain the area west Queen Elizabeth II Highway to Whelp Brook. This study assumes that the large wetland located in the north of this study area can be used for flow-through discharge from future development located around the wetland area and is not proposed to provide stormwater management for surrounding developments. Since this wetland is proposed to be part of the overall conveyance system the elevations will rise slightly during significant rainfall events, and then draw down to the normal water level after the event passes.

The results of the 1:100-year design storm event modeling for this wetland area is provided in Tables 3-5 below. The results suggest that the water surface elevation will rise approximately 0.14 m for the 1:100-year event, and this is believed to be a reasonable level of fluctuation.

Table 3-4 Wetland Characteristics

Description	Elevation (m)	Active Ponding Depth (m)	Surface Area (m^2)
NWL	851.00	0.00	468,000
Elevated Stage	851.50	0.50	497,000
Modeled 1:100 Year Results	851.14	0.14	

Based on the layout of the land, there will be three separate portions of storm trunks on the west side of the Queen Elizabeth II Highway. The north portion will include the offsite drainage area, the large wetland, and three storm trunks. The south portion will include four storm trunks and an open ditch/pipe portion. The existing catchment areas of SC 19A and SC 19B will function as they do now and will not be changed.

North of Highway 12, an offsite area of approximately 536 ha is estimated to be draining through the natural drainage course that flows from the west into the Large wetland. This drainage course is going to be maintained. Sub-catchment areas and their associated stormwater management facilities will discharge into this wetland area and flow through to the south into the Highway 12 ditch. Three other sub-catchment areas and their associated stormwater management facilities will discharge to this same location. From this point, the flows will drain through a 1,200mm diameter pipe under the Queen Elizabeth II Highway and discharge into Whelp Brook on the east side of the Queen Elizabeth II Highway and north side of Highway 12 as shown on **Figure 3-6 Joint Economic Area Storm System**.

The area south of Highway 12 will have four sub-catchment areas and their associated stormwater management facilities draining through various storm trunks to a point in the Queen Elizabeth II Highway ditch, and then will drain south approximately 500 m to Whelp Brook prior to flowing under the Queen Elizabeth II Highway, as shown on **Figure 3-6 Joint Economic Area Storm System**.

3.7 TRAFFIC IMPACT ASSESSMENT FOR JOINT ECONOMIC AREA

The Joint Economic Area encompasses approximately 11 quarter sections. The growth will have a significant impact on Highway 12 and the interchange at the Queen Elizabeth II Highway. The traffic impact assessment was being completed under separate cover at the time of the report.

3.8 OPINIONS OF PROBABLE COSTS AND OFF-SITE LEVIES

Opinions of probable costs were generated for the infrastructure that development benefits from as a whole (e.g. major water, wastewater, and storm trunks; lift stations; and reservoirs). For the purpose of determining an off-site levy rate and recovery plan from the trunk infrastructure, the Joint Economic Area was broken down into future development areas on quarter section basis. They were also developed for the medium term and long term development horizons, individually. The costs for the upgrades to Highway 12 are also being reviewed as part of the Traffic Impact Assessment

The figures in **Appendix B** illustrate the infrastructure that is included and excluded in the opinions of probable costs. It is assumed that the developers will cover the costs for non-trunk lines, lot services, storm ponds

Table 3-5 Medium Term JEA Infrastructure Costs

Medium Term Infrastructure Costs	
Water Trunks	$5,120,000

Medium Term Infrastructure Costs	
Wastewater Trunks	$2,355,650
Stormwater Trunks	$3,375,000
Lift Station Phase 1	$3,669,000
30% Contingency and Professional Services	$4,355,895
City of Lacombe Infrastructure (July 22, 2016 Memo)	$5,834,400
Total Medium Term JEA and West Area Servicing	**$24,709,945**
Net Developable Area (Ha)	**258**
Cost per Developable Area (Ha)	**$95,775**

Table 3-6 Long Term JEA Infrastructure Costs

Long Term Infrastructure Costs	
Water Trunks	$1,894,500
Wastewater Trunks	$621,480
Stormwater Trunks	$690,920
Lift Station Phase 2 (Connection to Regional)	$3,340,000
Reservoir and Pump Station	$9,000,000
30% Contingency and Professional Services	$4,664,070
Total Medium Term JEA and West Area Servicing	**$20,210,970**
Net Developable Area (Ha)	**212**
Cost per Developable Area (Ha)	**$95,335**

For details, please refer to **Appendix B - Opinions of Probable Costs**.

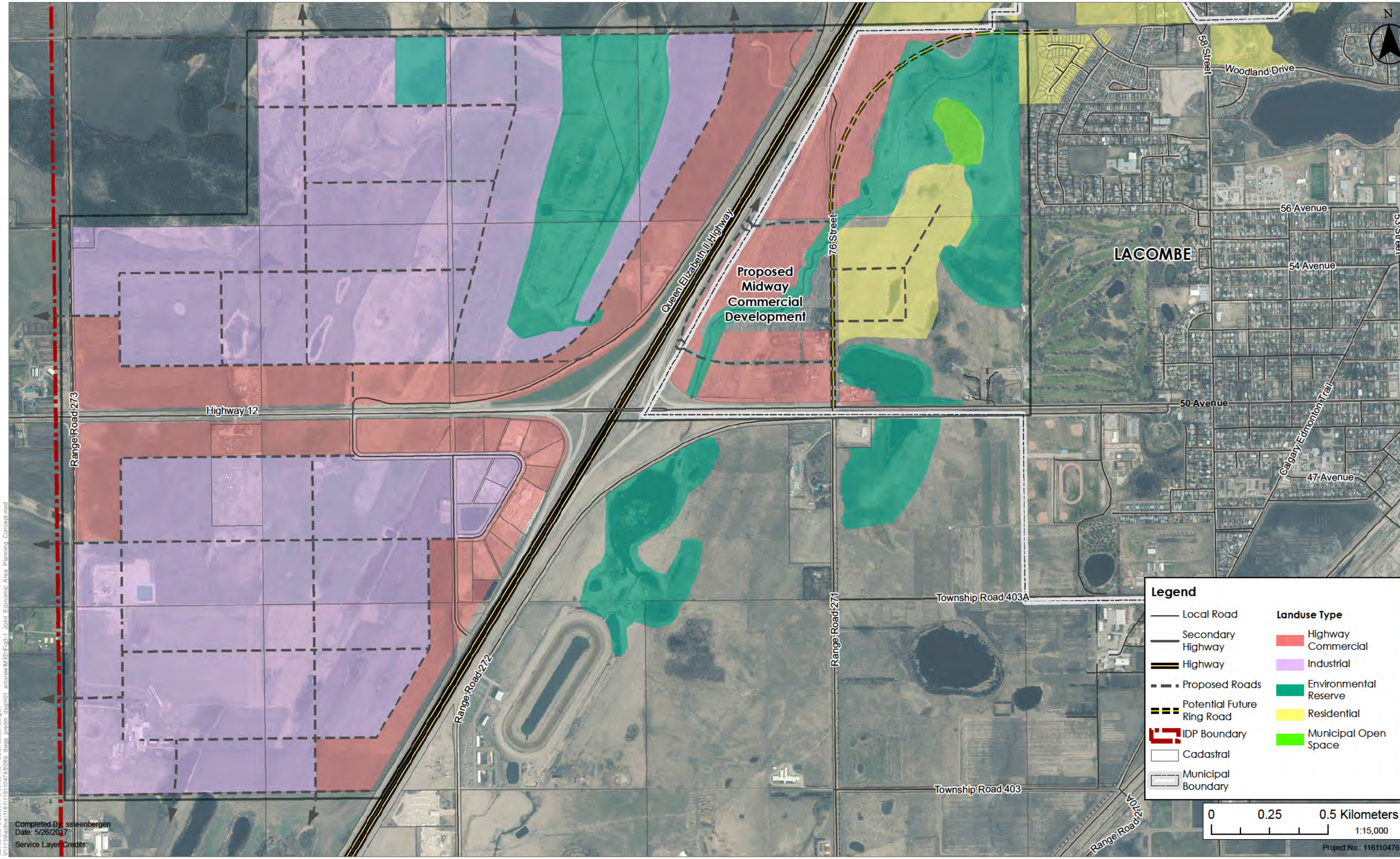


Figure 3-1 Joint Economic Area & West Area Servicing Planning Concept

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2017 Servicing Study

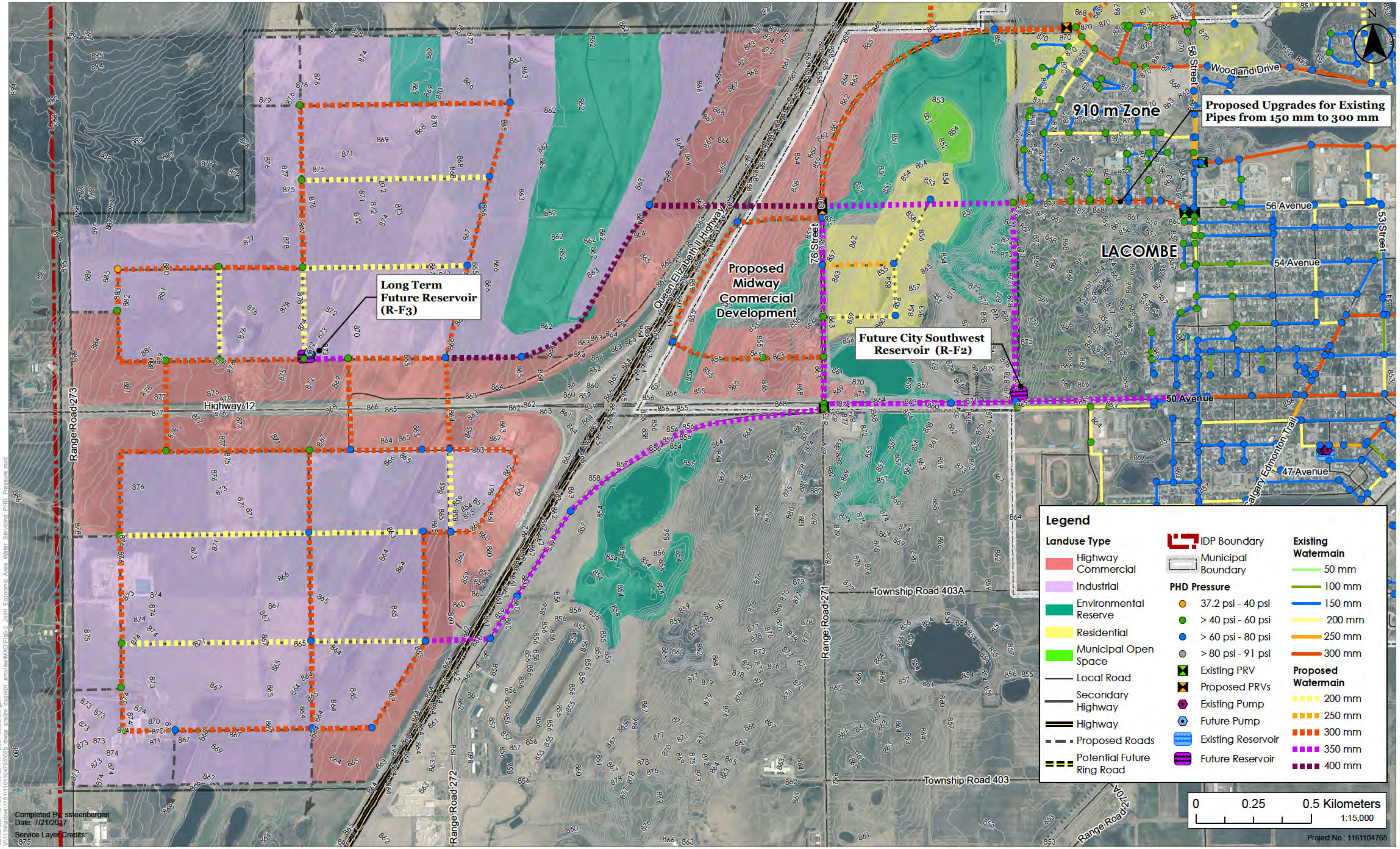

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Figure 3-2 Joint Economic Area Water Servicing PHD Pressure

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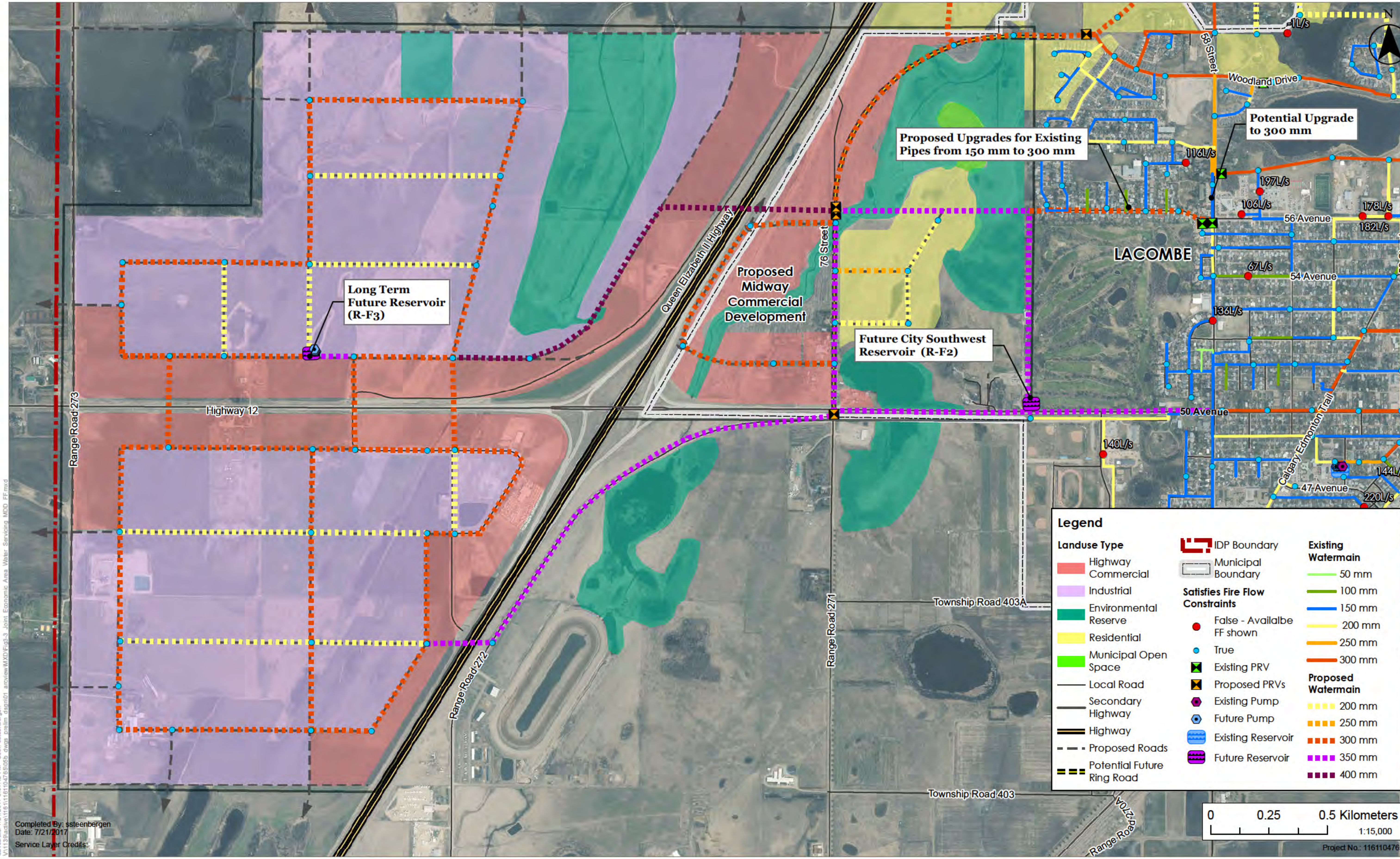

Figure 3-3 Joint Economic Area Water Servicing MDD plus Fireflow

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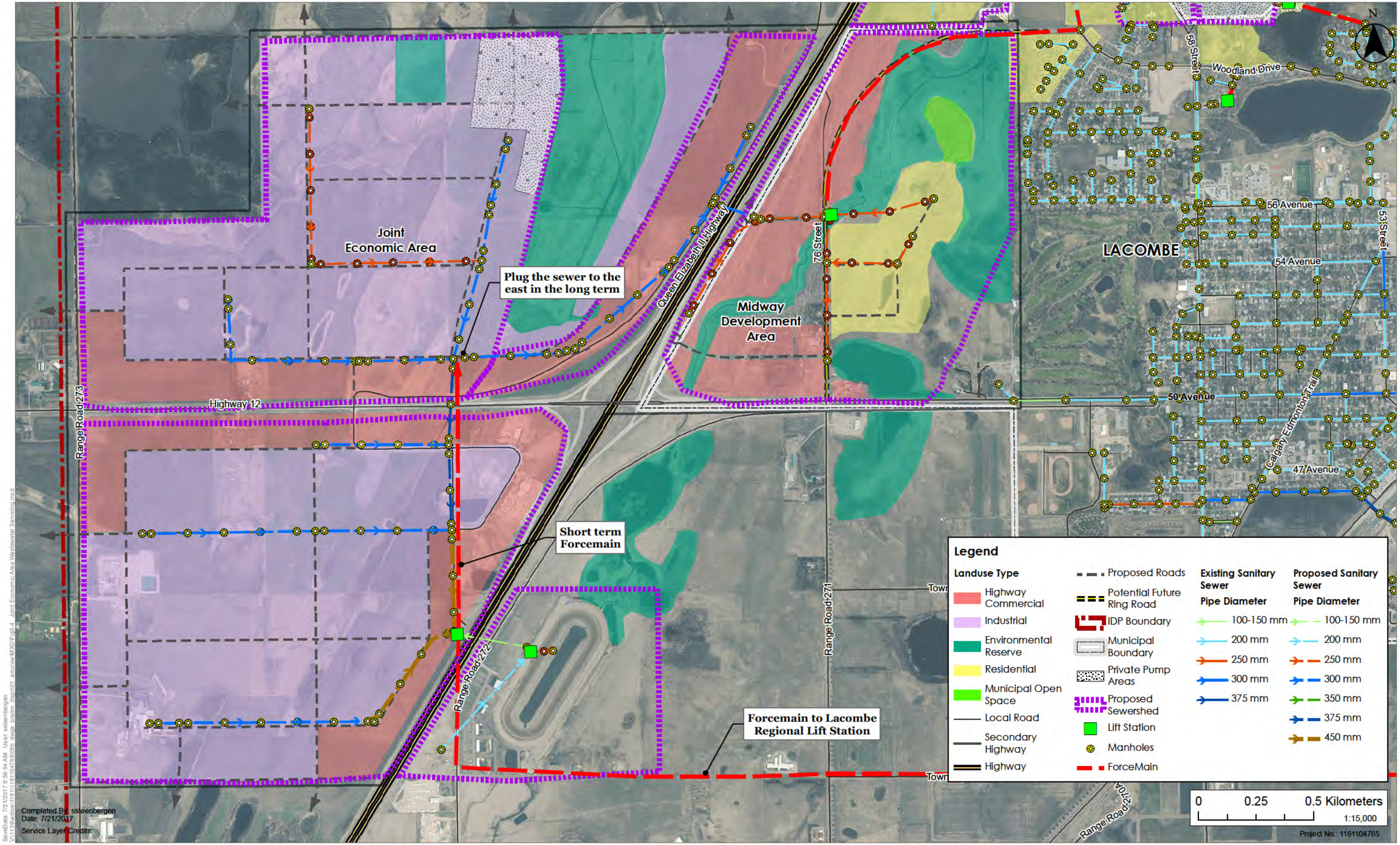

Figure 3-4 Joint Economic Area Wastewater Servicing

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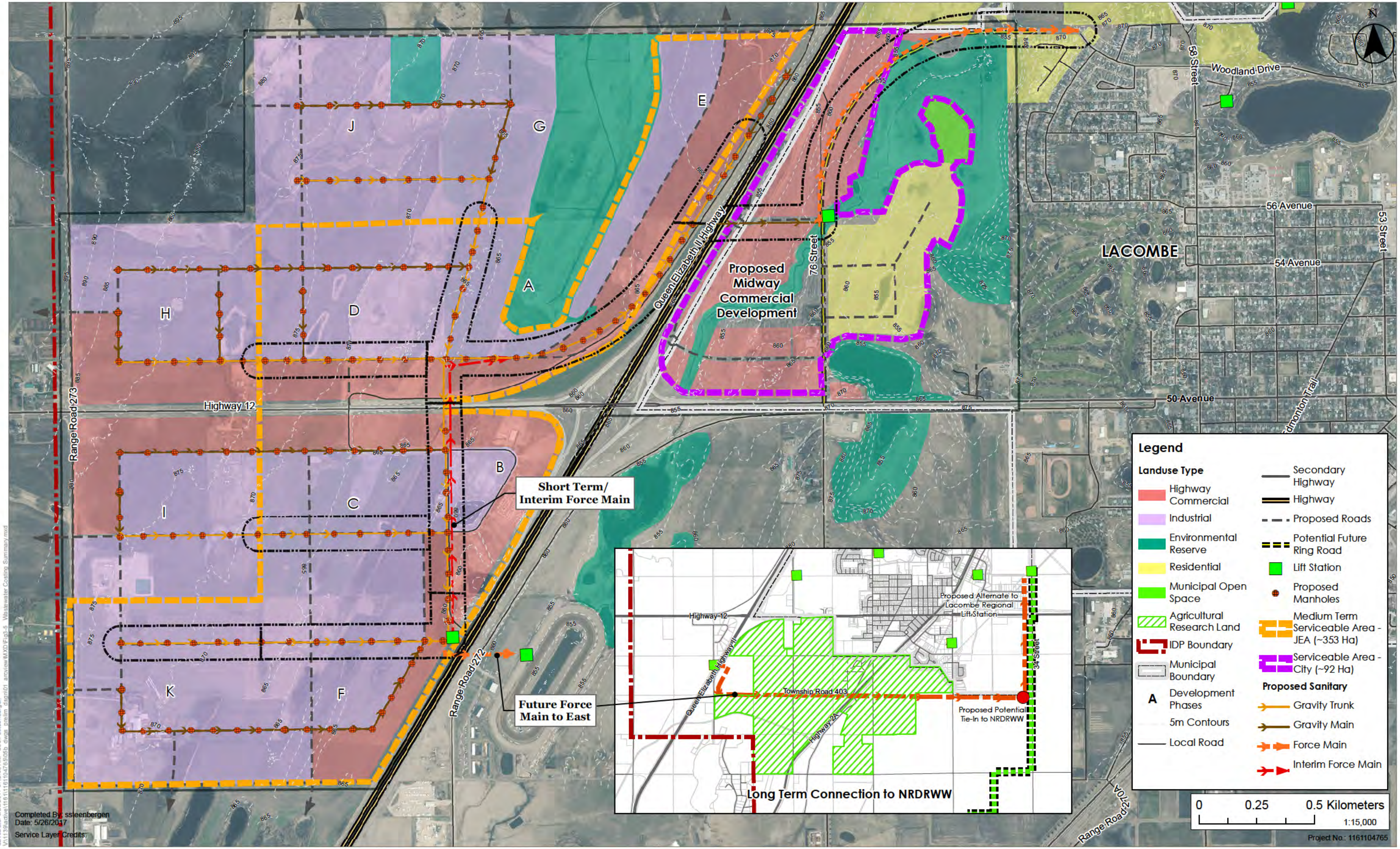

Figure 3-5 Wastewater Construction Costing Summary

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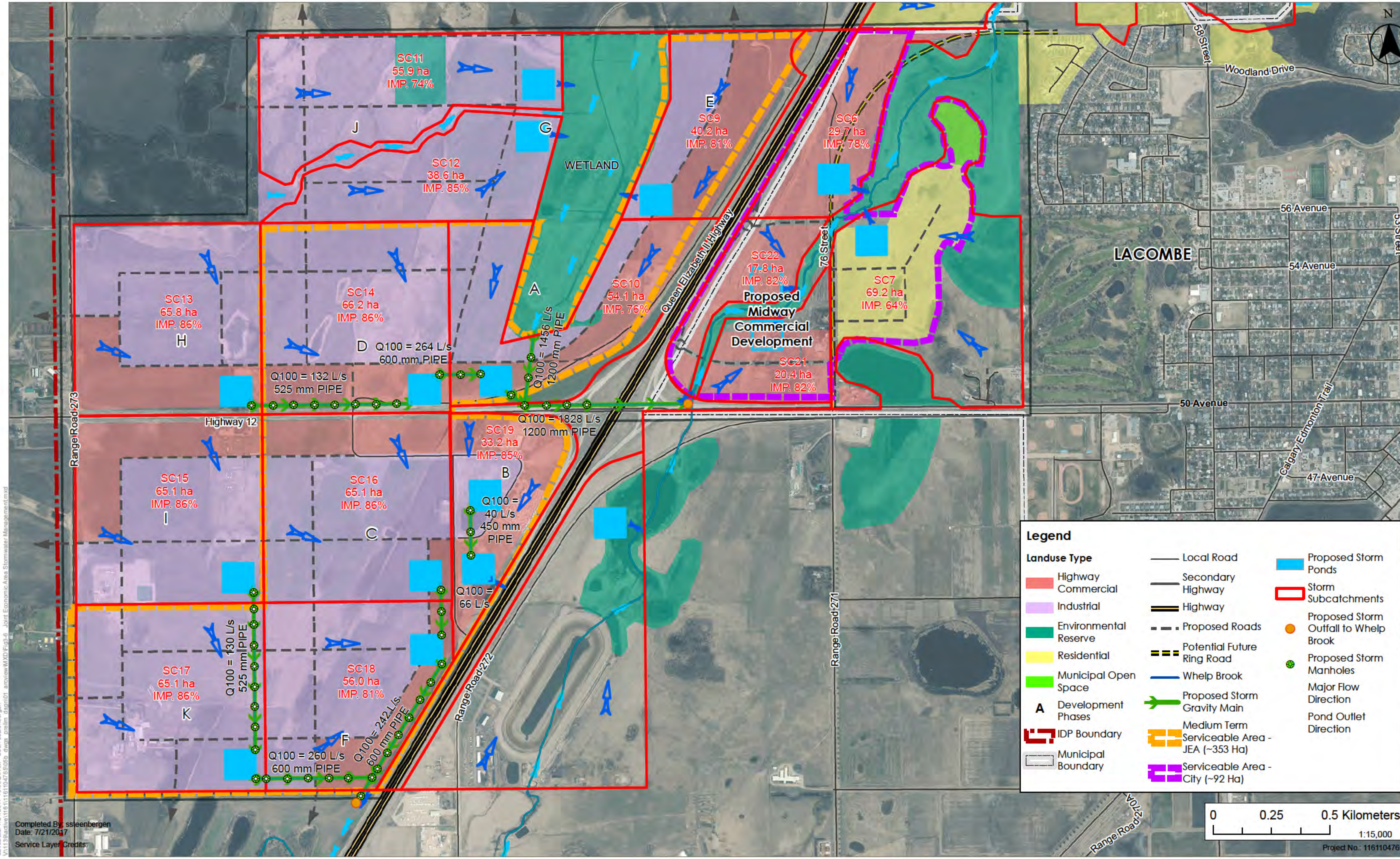

Figure 3-6 Joint Economic Area Stormwater Management

Lacombe Intermunicipal Development Plan
2017 Servicing Study

4 WEST BARNETT AREA

4.1 PLANNING CONCEPT

This future development area is bound by the Queen Elizabeth II on the west and north side, Barnett Lake and Rosedale Valley on the east side, and the existing City boundary to the south. The land within the West Barnett Area is currently used for agricultural purposes. Whelp Brook drains through this study area, flowing from the south to the north. Barnett Lake extends into the east portion of the area and a smaller, unnamed pond is located within the southeastern portion of the area. The future development areas are currently used for farming operations that include hay, pasture, and small grain agriculture. There are a few residences throughout this area. Like the rest of the Lacombe IDP, the West Barnett Area is characterized by knob and kettle topography that either drains to the existing two water bodies, or to Whelp Brook.

As described in the IDP report, the development concept for the West Barnett Growth Area (**Figure 4-1** at the end of this section) denotes a generalized development strategy that establishes the area for primarily urban residential development. Neighbourhood commercial will be considered at the general locations identified. There is an existing landfill located within the City limits, adjacent to the south limit of the West Barnett perimeter. Any development within the 300 metre landfill setback will need to comply with the requirements of Section 13 of the Subdivision and Development Regulations of the Municipal Government Act which prohibits food service or overnight accommodation uses within the setback (unless a setback relaxation is granted by the Province). For the purpose of this study, it is assumed that the open area within the 300 metre setback is considered developable.

The scope of work for the West Barnett Area included preparing water and sanitary servicing plans and stormwater management plans for urban residential development. It is not anticipated that any arterial roadways will be extended into the West Barnett Area with the areas being served by collector and local roads only.

4.2 WETLAND AREA CONSIDERATIONS

The West Barnett area contains a mixture of several wetlands, waterbodies and small pockets of upland vegetation. The desktop wetland mapping identified nine wet features in the Barnett lands area, which consisted of six marshes, two waterbodies (i.e., Barnett Lake and an unnamed waterbody) and one watercourse/marsh (i.e., a portion of Whelp Brook).

The marshes identified within the Barnett Lands area are generally small features. The marshes appear to have been cultivated periodically throughout the historical aerial photographs reviewed. For the purpose of the servicing study, it is assumed that the marshes will be demolished and developed over.

The two waterbodies are unchanged on the landscape over time and contain open water in the historical aerial photographs reviewed. The two waterbodies were described in the City of Lacombe Natural Spaces Management Plan (Stantec 2002) as a diverse ecosystem with established riparian vegetation surrounded by a fringe of mixed wood forest. The waterbodies were noted to contain high wildlife diversity, specifically for waterfowl. In addition, fish species (i.e., brook stickleback) were observed in Barnett Lake.

The watercourse/marsh (i.e., Whelp Brook) is unchanged on the landscape through the historical aerial photographs reviewed with the exception of the construction of Highway 2 between 1950 and 1969. Following the construction of the Queen Elizabeth II Highway, a culvert was installed and a portion of Whelp Brook adjacent to the highway was channelized. The City of Lacombe Natural Spaces Management Plan describes the portion of Whelp Brook within the Barnett Lands area as having moderate vegetation diversity with a mixture of native and weedy plant species and evidence of disturbance from livestock. However, the report notes that Whelp Brook is an important dispersal corridor for wildlife. Although no records or fish were present for the portion of Whelp Brook in the Barnett Lands area, the FWMIS database states that other reaches of Whelp Brook contains fish species such as brook stickleback, fathead minnow, northern pike and white sucker (FWMIS 2016).

The presence of wetlands, waterbodies and watercourses in the Barnett Lands may affect development in this area and/or trigger the need for additional studies and regulatory approvals. Based on the information available, considerations and next steps related to wetlands and waterbodies are listed below:

- All marshes, waterbodies and watercourse are regulated under the Water Act and will require an approval prior to modification or removal. A wetland assessment, including field classification and delineation, will be required to support the Water Act application and the proponent will need to show use of the wetland mitigation hierarchy (i.e., avoidance, minimization and replacement). It is likely that the field assessment will identify more wetlands than what was identified as part of this desktop mapping exercise due to the scale of mapping and minimum polygon size.

- The areas classified as waterbodies and watercourse/marsh appear to be permanent features with potential to be claimed as Crown land under Section 3 of the Public Lands Act. These features will likely need to be retained within future development or approvals under the Public Lands Act will be required for development or modifications. It is possible that wetlands in addition to those classified as waterbodies and watercourse/marsh could be claimed as Crown land. Therefore, a water boundaries review should be completed for all marshes, watercourses and waterbodies and submitted to AEP to confirm if they are deemed Crown land under Section 3 of the Public Lands Act prior to development.

- If wetlands or waterbodies are retained in the development, site specific buffers and setbacks should be determined and implemented for pollution prevention and flood protection of adjacent lands. Additional studies should be completed to determine the pre-development volume and frequency of surface water inputs into retained wetlands and waterbodies so that this can be matched post-development and reduce potential effects on retained waterbodies from changing the hydrology (e.g., flooding, erosion, cutting off water inputs, etc.).

- The FWMIS database indicates that Whelp Brook is a fish bearing waterbody. Development or modifications to Whelp Brook (e.g., realignment, culvert/bridge construction, etc.) will require regulatory approvals under the *Water Act, Public Lands Act* and potentially the *Fisheries Act*. Applications for this type of development will likely require a supporting fish and fish habitat field survey and report.

- The AEP flood hazard mapping database did not identify records of floodplain mapping for Whelp Brook. The flood hazard area should be determined prior to development so that appropriate mitigation measures can be implemented (e.g., setbacks).

4.3 WATER SERVICING

Based on the contours shown in **Figure 4-2**, West Barnett will operate in the 903 m Pressure Zone to meet the LOS pressure criteria. Three pressure reducing vaults are required to separate the 910 m pressure zone from the 903 m pressure zone along 58th Street and Woodland Drive.

A breakdown of demands projection for ADD, MDD and PHD conditions and required storage to service this area is summarized in **Table 4-1**.

Table 4-1 Future Demand Projection – West Barnett Area

Design Basis	Demand Projection
ADD	10.2 L/s
MDD	20.5 L/s
PHD	41.0 L/s
Required Storage	1,681 m^3

Based on the proposed roadway alignments, the West Barnett area will be serviced by extending the existing 300 mm watermains at Rosedale Avenue and Woodland Drive. The proposed water distribution system consists of 300 mm diameter watermains looped around the proposed roadway alignments. The main purpose for the looping is to supply sufficient fire flow, as shown in **Figure 4-2.** Looping also aids in reducing the total area that needs to be taken out of service during the event of a water main break.

As discussed in Section 2.5.2.2, the required storage for this study area can be incorporated into the future southwest reservoir and pump station (R-F2) proposed in the 2013 Water Model Update report (Stantec, 2014). Depending on the timeline of development, the opportunity to use remaining storage volume to supply water to this area would be viable.

A summary of the modeling results for the system pressure under PHD condition and available fire flow under MDD condition are presented in **Figure 4-2** and **Figure 4-3**. All LOS criteria are satisfied based on the modeling results.

4.4 WASTEWATER SERVICING

The total estimated developable area of 66.5 ha (residential only) in the West Barnett area can be serviced by a local gravity sewer system as shown on **Figure 4-4**. The gravity sewer trunks will convey the collected sanitary water into a local lift station that is proposed to be located in the vicinity of where Whelp Brook approaches the Queen Elizabeth II Highway.

To the south, the construction of the local gravity sewer system may be challenging due to the possible high ground water level and the presence of the creek within the West Barnett area. The creeks might have relatively low bottoms that may require the wastewater trunk to be installed relatively deep. To potential mitigations include constructing the sanitary trunk under a future roadway that is elevated over the creek or so that some gravity sewer sections will be inverted syphons under the creek, which is difficult to operate, especially in the initial development years when sanitary flow is low.

The West Barnett lift station can be constructed in the middle of the West Barnett area as shown in the attached **Figure 4-4**. The proposed lift station has an approximate ground elevation of 852 m. The lift station force main will connect and discharge into the last sanitary sewer man hole at the west end of the Woodland Drive. The peak wet weather flow from the West Barnet Subdivision is approximately 38 l/s.

4.5 STORMWATER MANAGEMENT

4.5.1 Sub-catchment Delineation

The proposed sub-catchments for the West Barnett Area were delineated based upon the DEM topographical data that was collected in 2016, and as shown in **Figure 4-5**, located at the end of this report section. The drainage paths and sub-catchment boundaries are essentially the same for both pre and post development conditions; therefore, Figure 8-6 can be used to reference both conditions.

The West Barnett Area consists of approximately 160 ha of land. Within the study area there are two bodies of water, (Barnett Lake and Lake 'C'). Whelp Brook drains through this area from south to north and will be the discharge point for the entire West Barnett Area. As will be discussed in latter report sections, a storm trunk is proposed to drain west from Barnett Lake to Whelp Brook.

The hydrologic analysis methods where previously discussed in Section 2.7, and **Table 4-2** below provides the hydrologic parameters used for and resulting from the single event PCSWMM computer modeling of the West Barnett Area. These modeling results were further used to estimate the required pond storage volume for the 24 hour, 1:100-year design storm, and for preliminary design of the West Barnett Area Storm Trunk.

Table 4-2 Sub-catchment Hydrologic Characteristics

Catchment Area	Catchment Area Description	Design Rainfall Event Return Period and Duration	Rainfall Amount (mm)	Catchment Area (ha)	% Imperv.	Runoff Depth (mm)
SC_1	Residential	1:100 yr, 24 hr	103.1	17.6	62	80.7
SC_2	Residential	1:100 yr, 24 hr	103.1	33.6	61	79.9
SC_3	Residential	1:100 yr, 24 hr	103.1	33.9	61	79.7
SC_4	Residential	1:100 yr, 24 hr	103.1	25.1	59	79.0
SC_5	Light Commercial	1:100 yr, 24 hr	103.1	3.9	85	94.1
Barnet Lake	Body of Water/ER	1:100 yr, 24 hr	103.1	58.2	89	93.8
Lake 'C'	Body of Water/ER	1:100 yr, 24 hr	103.1	12.9	90	85.0

4.5.2 Regional Storm Ponds

As previously described in Section 2 and further detailed in this report section, conceptual designs for the stormwater management facilities required for future development within the West Barnett Area is explored. **Figure 4-5** provides the conceptual location of the proposed stormwater management facilities.

Table 4-3 below summarizes the sub-catchment area, permissible release rate, proposed active storage volume, approximate facility footprint, and preliminary design elevations, for each of the stormwater facilities that were modeled for the West Barnett Area.

Table 4-3 Proposed Regional Storm Pond Characteristics

Pond #	Serviced Area (ha)	Permissible Discharge Rate (l/s)	Active Storage Volume (m^3)	Approximate Facility Foot Print (ha)	Preliminary NWL Elevation (m)	Preliminary HWL Elevation (m)	Opinion of Probable Pond Cost[1] ($)
1	17.60	35.4	12,000	1.52	851.00	853.00	$378,000
2	33.60	67.2	22,900	2.34	851.00	853.00	$721,350
3	33.90	67.8	22,900	2.34	851.00	853.00	$721,350
4	25.10	50.2	17,200	1.93	852.00	854.00	$541,800
5	3.90	7.8	2,700	0.64	852.00	853.00	$85,050

1. Opinion of probable pond costs includes construction costs, maintenance period costs, 20% contingency, and 15% for engineering and construction management.

4.5.3 Discharges to Whelp Brook

Three of the proposed catchment areas can discharge directly into Whelp Brook. The other two cannot drain by gravity to Whelp Brook without using Barnett Lake as a discharge point.

As previously mentioned, a storm trunk is proposed to drain Barnett Lake to Whelp Brook routed through Lake 'C'. This study assumes that Barnett Lake and Lake 'C' can be used for flow-through discharge from future development located around Barnett Lake and are not proposed to provide stormwater management for surrounding developments. Since they are proposed to be part of the overall conveyance system their elevations will rise slightly during significant rainfall events, and then draw down to their normal water levels after the event passes.

The results of the 1:100-year design storm event modeling for Barnett Lake and Lake 'C' are provided in Tables 8-4 and 8-5 below. The results suggest that Barnett Lake's surface elevation will rise approximately 0.12 m and Lake 'C's surface elevation will rise approximately 0.11 m for the 1:100-year event, and this is believed to be a reasonable level of fluctuation.

Table 4-4 Barnett Lake Characteristics

Description	Elevation (m)	Active Ponding Depth (m)	Surface Area (m^2)
NWL	851.00	0.00	468,000
Elevated Stage	851.50	0.50	497,000
Modeled 1:100 Year Results	851.12	0.12	

Table 4-5 Lake 'C' Characteristics

Description	Elevation (m)	Active Ponding Depth (m)	Surface Area (m^2)
NWL	851.00	0.00	87,000
Elevated Stage	851.50	0.50	99,000
Modeled 1:100 Year Results	851.11	0.11	

The West Barnett Storm trunk will consist of two portions. Due to the proximity of Barnett Lake and Lake 'C', a submerged equalizer pipe is proposed to control these two bodies of water. An 80 m long pipe with a diameter of 450 mm will equalize these two water bodies. A control structure is proposed to be installed on the west side of lake 'C' with approximately 180 m of 450 mm diameter pipe that will discharge to Whelp Brook. The control structure will provide a consistent normal water level elevation.

4.6 OPINION OF PROBABLE COSTS

The water mains going through the West Barnett area are all 300mm in diameter and therefore, are not typically considered as water trunks covered by off-site levies. There are no significant storm trunks that will be shared by multiple developments and as such, there are no costs associated with those. For information purposes, opinions of probable costs for the storm ponds are included in Section 4.5.2 above.

The lift station, which will collect wastewater from multiple developments and pump it to the trunk along Woodland Drive, is typically covered under off-site levies. As outlined in Appendix A, the lift station and force main will cost approximately $3,100,000, including contingency and professional services.

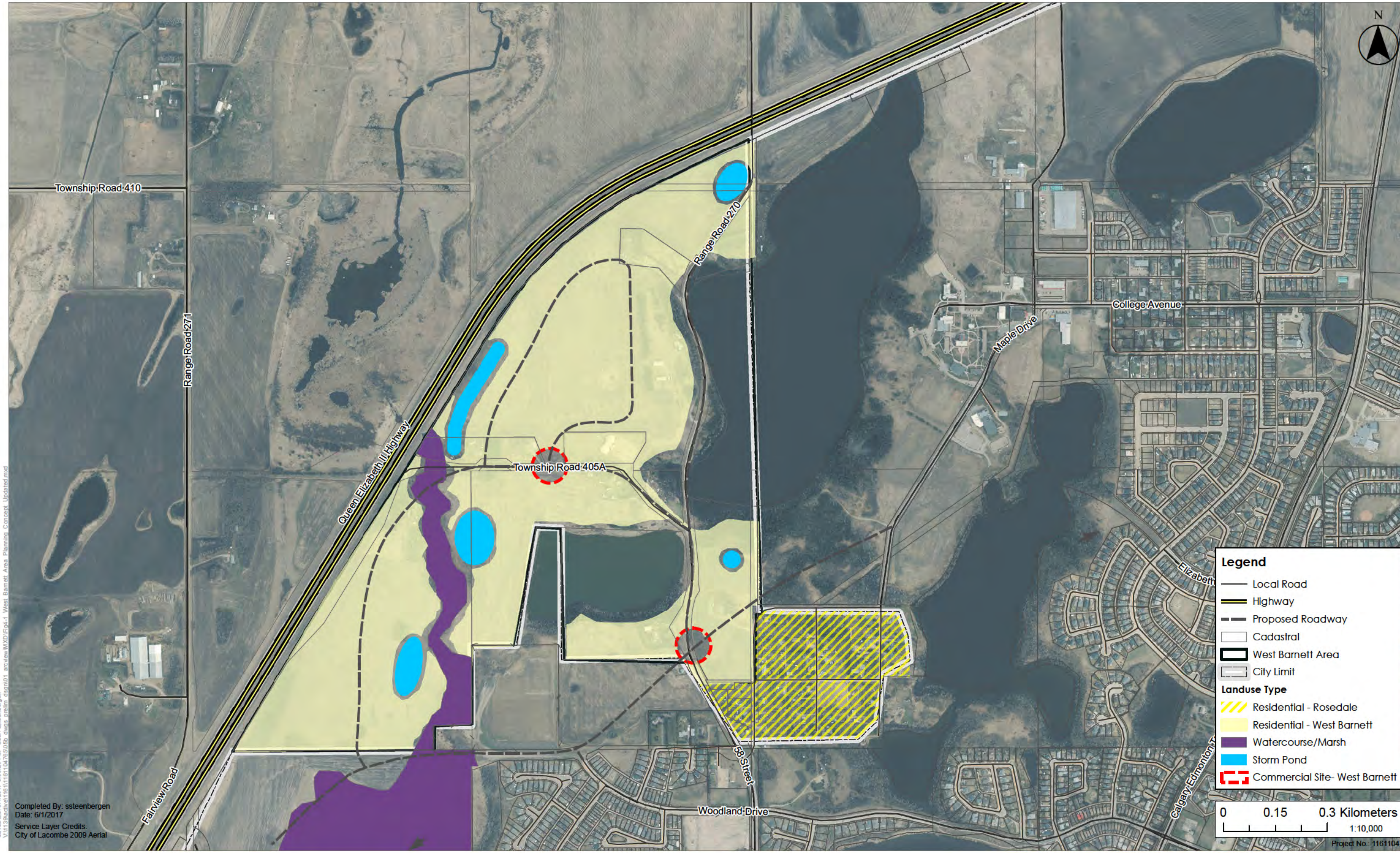

Figure 4-1 West Barnett Planning Concept

Lacombe Intermunicipal Development Plan

2017 Servicing Study

Stantec

Lacombe County

City of Lacombe

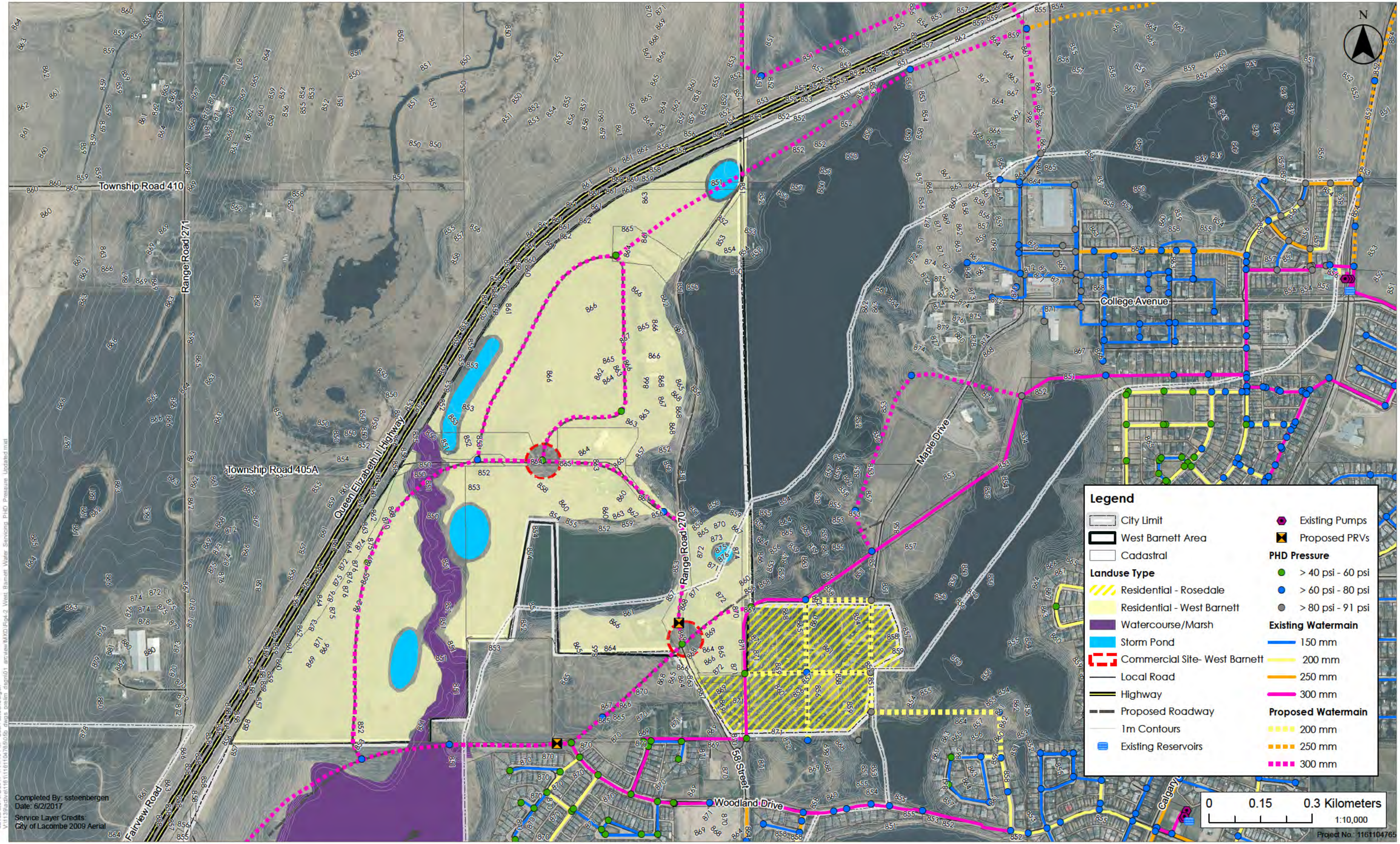

Figure 4-2 West Barnett Water Servicing PHD Pressure

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City of Lacombe

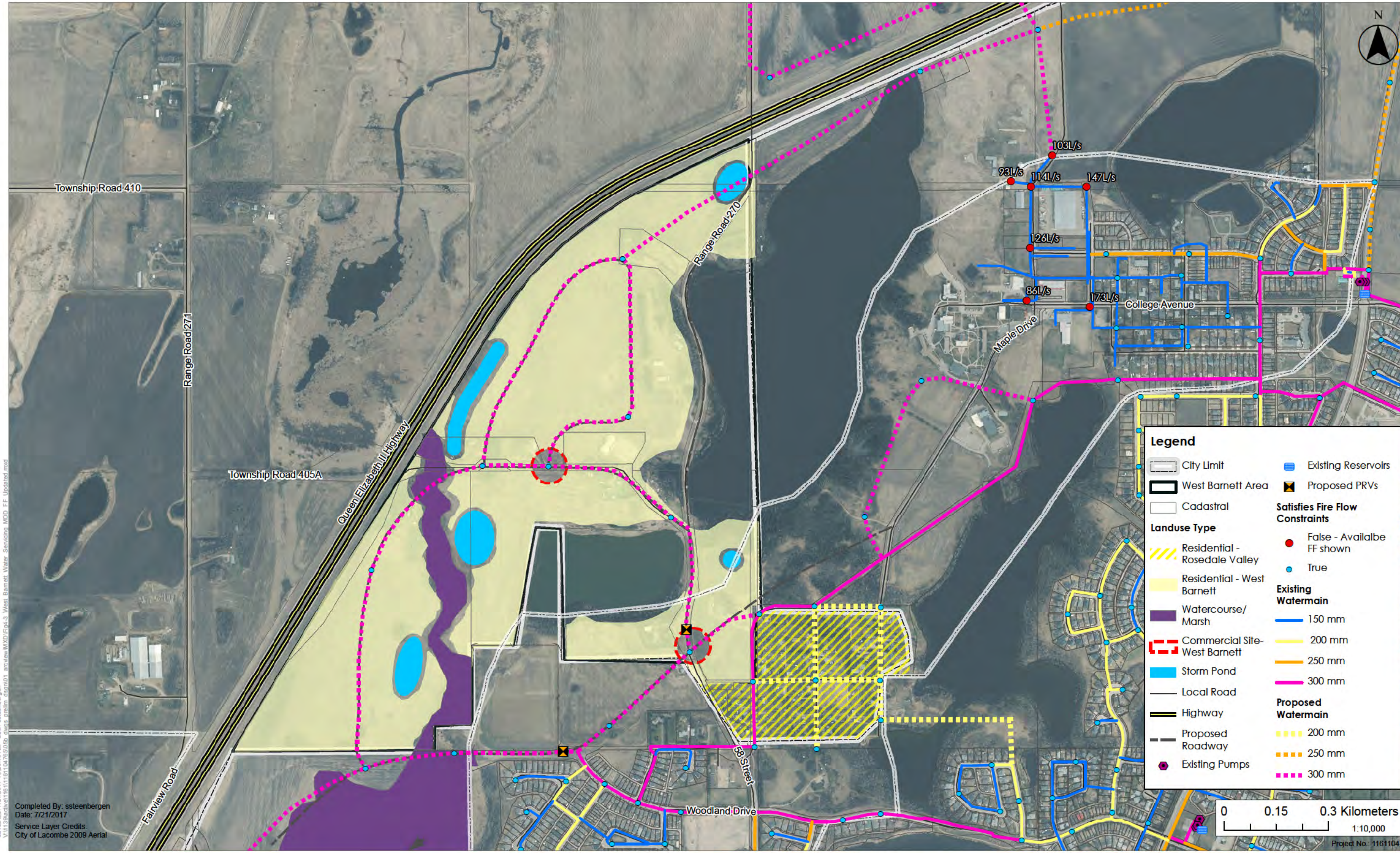

Figure 4-3 West Barnett Water Servicing MDD plus Fire Flow

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City of Lacombe

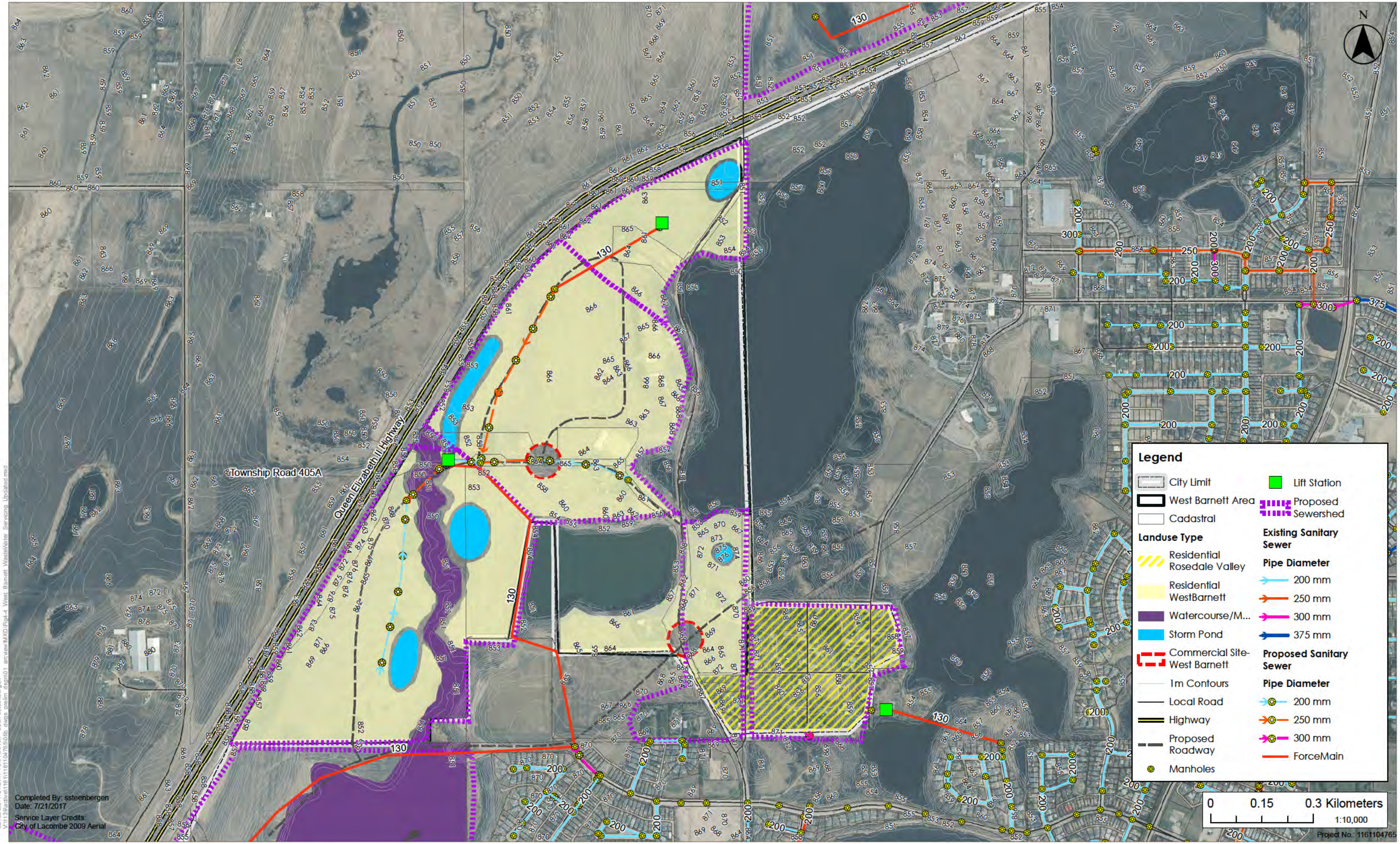

Figure 4-4 West Barnett Wastewater Servicing

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2017 Servicing Study

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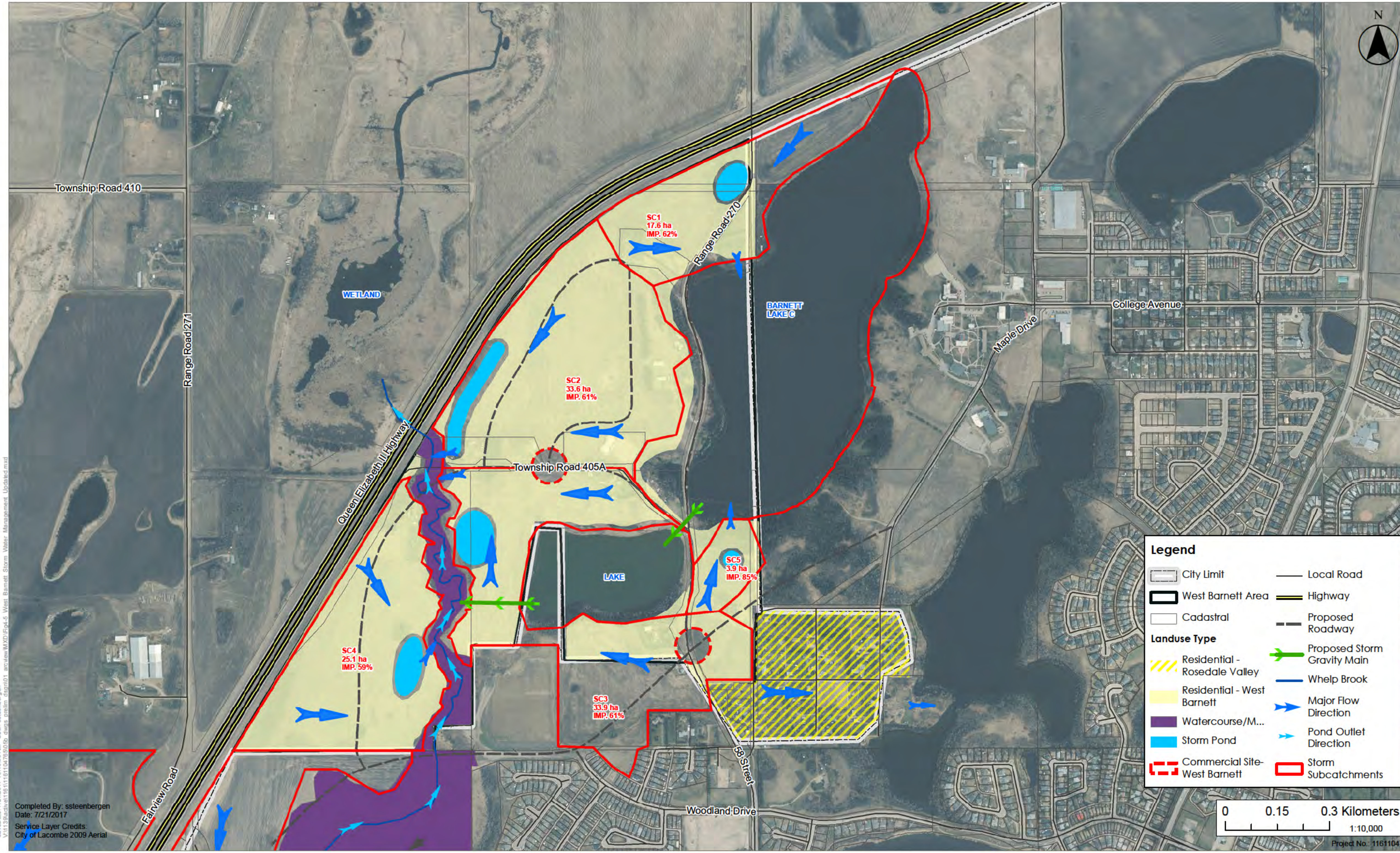

Figure 4-5 West Barnett Stormwater Management
Lacombe Intermunicipal Development Plan
2017 Servicing Study

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5 ROSEDALE VALLEY

5.1 SERVICING STRATEGY OVERVIEW

Rosedale Valley is an existing subdivision located to the southeast of the West Barnett area. It was developed as a rural residential community and was constructed with rural roadways and roadside ditch drainage. Rosedale Valley is bounded to the east by Elizabeth Lake, to the north and west by the West Barnett Area, and to the south by Woodland Drive. The existing overland drainage flows east into Elizabeth Lake. The residences in Rosedale Valley are currently serviced by wells and septic tanks.

The purpose of this section is to evaluate the potential to integrate the Rosedale Valley subdivision into the City's utility and roadway infrastructure systems. When upgrading rural subdivisions, there is a range of strategies from basic water and lower pressure forcemain systems (basic end of the spectrum) to full urban City of Lacombe standards, complete with gravity sewers, sidewalks, etc. (premium end of the spectrum). To identify the range of servicing options, two preliminary design alternatives have been developed. A brief description of these alternatives is described below followed by more detailed descriptions of the servicing for each alternative in the subsections below.

These preliminary design concepts were completed at a desktop level only. The information shown in the drawings is based on air photos, legal cadastral, LiDAR topographic data, and familiarity with the site. At the time of detailed design, it is recommended that topographic survey and franchise utility locates be completed to refine the design.

Alternative 1 – Upgrade to Urban City Standard

This alternative would include a full road rebuild to an urban standard with curb and gutter, sidewalks, and boulevards. The horizontal geometry of the road network would remain the same, with moderate modifications to the intersections road profile, where the centerline would be lowered to accommodate the newly urbanized cross section and drainage from the fronts of lots to the top of roadway. All existing private water wells and septic tanks would be decommissioned and/or removed. All overhead powerlines and power poles would be removed and all power would be relocated below ground. In terms of aesthetics, the implementation of this alternative would dramatically change the look of the Rosedale Valley subdivision. This alternative would include the installation of new sanitary, water, and stormwater infrastructure which is described in detail in Section 5.2. Refer to Figures 5.2A to 5.2G at the end of this section for a detailed illustration of this alternative.

Alternative 2 – Basic Water and Low Pressure Wastewater Servicing

This alternative maintains the existing rural roadway cross section and would cause much less surface disturbance in comparison to the upgrade to the urban city standard. The watermains could be constructed within the ditches to prevent the requirement to remove and replace the majority of the road surface. The low pressure forcemain systems can be directional drilled almost in entirety. A description of the sanitary and water servicing is provided in detail in Section 5.3. Refer to drawings. Refer Figures 5.3A to 5.3H for a detailed illustration of this alternative.

5.2 ALTERNATIVE 1 – UPGRADE TO FULL CITY STANDARD

5.2.1 WATER SERVICING

As this alternative would include converting to an urban cross section, water would be constructed underneath the road and service the existing lots from the front. As shown in Figure 5.2A, the proposed waterline would then extend east of the Rosedale Valley subdivision tie in with the proposed Rosemont subdivision to provide additional looping.

Based on the existing topography, Rosedale Valley will be operated in the 910 m Zone to meet the LOS pressure criteria. A pressure reducing valve is required to separate the 910 m Zone from 903 m Zone along Cranna Lake Drive.

A breakdown of demand projections for ADD, MDD and PHD conditions is summarized in **Table 5-1** below.

Table 5-1 Future Demand Projection – Rosedale Subdivision

Design Parameters	Projection
ADD	2.1 L/s
MDD	4.1 L/s
PHD	8.3 L/s
Required Storage	340 m^3

5.2.2 WASTEWATER SERVICING

As discussed previously, Rosedale Valley is currently a rural subdivision. Similar to the water servicing described above, the proposed sanitary alignment for this alternative would be located under the urbanized roadway and would service existing lots from the front. The Rosedale Valley subdivision's existing topography allows for local gravity sewer to be constructed due to a significant elevation difference across the community. The sanitary sewer sizing would be 200 mm in diameter. Wastewater would eventually be conveyed to a future lift station to the east, within the proposed Rosemont subdivision. This lift station would have a capacity of at least 6 l/s and would pump the wastewater via force main easterly to tie in with the City's existing gravity system in Cranna Lake Drive.

5.2.3 STORMWATER MANAGEMENT

As shown in Figure 5-2B, the Rosedale Valley subdivision is split into 8 drainage basins which drain into the existing ditch system. Upgrading this road to an urban standard would require implementing a storm sewer network. All stormwater runoff would be collected on the road where it would be conveyed to the new storm sewer system. The proposed storm alignment, including sizing and manhole locations, is shown in Figures 5.2C through 5.2G. The storm sewer sizing required for this subdivision varies between 300 mm and 900 mm in diameter.

Ultimately, all stormwater from the Rosedale Valley subdivision would collect at the proposed storm pond facility located immediately to the east. Stantec has provided storm pond sizing options which may need to be modified based on the municipality's and Alberta Environment and Parks' requirements at the time of detailed design. Regardless of the chosen option, the stormwater would eventually outfall to Elizabeth Lake. A description of each storm pond option is briefly described below:

<u>Option 1: Storm Pond w/ Strict Release Rate</u>

This storm pond would require a much larger footprint (approximately 1ha) than the second option. This is based on a much more stringent release rate requirement of 2.0 l/s/ha as per the Wolf Creek & Whelp Brook Watersheds MDP, MPE 2014 where increased storage would be required to slow down the rate at which stormwater outfalls to Elizabeth Lake. Currently, there is no available space for a 1 ha pond. Alternatively, numerous smaller ponds could be spread throughout the Rosedale Valley subdivision for future redevelopment.

<u>Option 2: Storm Pond w/ Relaxed Release Rate</u>

This option is more favorable in terms of the storm pond footprint that would be required. This is based on a more relaxed release rate in which minimum storage would be needed. The main function of this pond would be to allow enough time for sediment to settle prior to being discharged to Elizabeth Lake.

Elizabeth Lake currently does not have an adequate outlet, but rather, its water level naturally fluctuates through infiltration, exfiltration, and evaporation. Technical memorandums have addressed this issue at a high level. In October, 2015, Stantec completed a study for the City to address two options to create an adequate outlet from Elizabeth Lake to Cranna Lake, which has an adequate outlet. A gravity option and a lift station option were presented with pros and cons. Once Elizabeth Lake is stabilized with an outlet, Rosedale Valley could just have a forebay as presented in Option 2 above and discharge at higher release rate as Elizabeth Lake can handle the volume. As part of the Elizabeth Lake stabilization, there may need to be a culvert installed that would equalize Lake Anne (south of Elizabeth Lake) and Elizabeth Lake.

5.2.3.1 Sub-Catchment Delineation

The hydrologic analysis methods were previously discussed in Section 2.7, and Table 5-2 below provides the hydrologic parameters used for and resulting from the single event PCSWMM computer modeling of the Rosedale Valley. These modeling results were further used to estimate the required pond storage volume for the 24 hour, 1:100-year design storm. The

PCSWMM modeling data files can be provided upon request. The eight drainage basins were lumped together in one to model the conceptual pond for Option 1.

Table 5-2 Sub-catchment Hydrologic Characteristics

Catchment Area	Catchment Area Description	Design Rainfall Event Return Period and Duration	Rainfall Amount (mm)	Catchment Area (ha)	% Imperv.	Runoff Depth (mm)
SC20	Residential	1:100 yr, 24 hr	103.1	17.3	55	76.4

5.2.3.2 Regional Storm Ponds

As previously described in Section 2.5.7 and further detailed in this report section, conceptual designs for the stormwater management facilities required for future development within the Rosedale Valley are explored.

Table 5-3 below summarizes the sub-catchment area, permissible release rate, proposed active storage volume, approximate facility footprint, and preliminary design elevations, for the stormwater facility that was modeled for Rosedale Valley.

Table 5-3 Proposed Regional Storm Pond Characteristics

Pond #	Serviced Area (ha)	Permissible Discharge Rate (l/s)	Active Storage Volume (m^3)	Approximate Facility Foot Print (ha)	Preliminary NWL Elevation (m)	Preliminary HWL Elevation (m)	Opinion of Probable Pond Cost[1] ($)
20	17.3	35	10,977	1.45	852.00	854.00	$345,776

1. Opinion of costs for pond includes construction costs, maintenance period costs, 20% contingency, and 15% for engineering and construction management.

There is currently little existing space within Rosedale Valley to accommodate 10,977m^3 of storage. The storage could be accommodated by one large stormwater management facility at the low end of the area or multiple smaller facilities throughout. As such, the pond is not shown on the figures.

5.3 ALTERNATIVE 2 - BASIC WATER AND LOW PRESSURE WASTEWATER SERVICING

5.3.1 WATER SERVICING

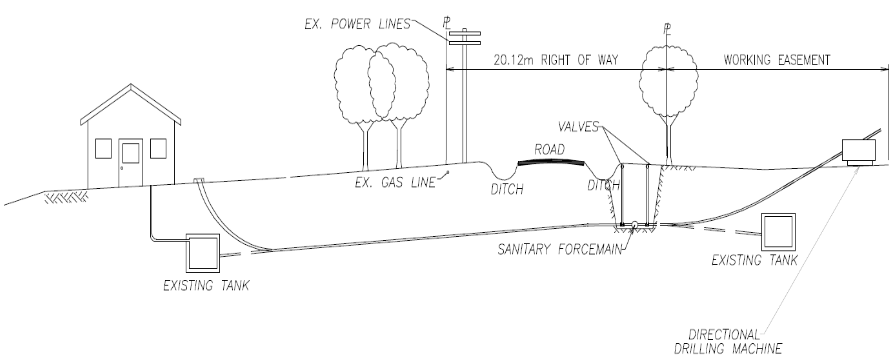
As previously mentioned, the proposed water system does not change significantly among the two alternatives, except for the alignment. To eliminate the need for reconstructing the existing road, the intent would be to install the water line underneath the existing ditch system and service the existing lots from the front.

5.3.2 WASTEWATER SERVICING – LOW PRESSURE FORCE MAINS

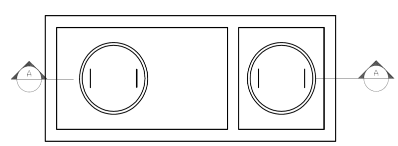
This less costly option would eliminate the need to disturb the existing roadway because they can be installed by directional drilling, almost in entirety. Small excavation pits would be required during installation to fuse joints and install service valves, air release valves, and flushouts.

In rural areas that have rolling topographies that make gravity sewer installation challenging and expensive, it is relatively common to implement low pressure forcemain systems. In low pressure force main systems, all properties are equipped with grinder pumps and backflow preventers that keep the lines under constant pressure. While under pressure, the pumps collectively transport wastewater downstream, in this case, to a proposed lift station in the Rosemont subdivision. Low pressure force main systems require detailed hydraulic engineering, which will need to be completed at the time of detailed design. It is highly recommended that all pumps be of the same make and model to ensure that all pumps can overcome the pressure in the line. In the undesirable scenario in which there are various pumps that have varying pump curves, there may be situations in which pumps with lower head capacity may not be able to overcome pressure put on the system by the higher head pumps.

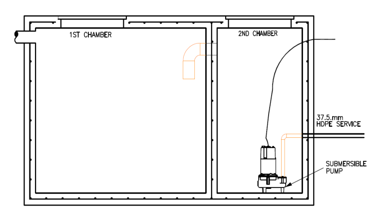
The system would include installation of grinder pumps, either within the chamber provided by the manufacturer or by retrofitting the septic tanks if they are in good condition. to a low pressure sanitary system and water wells to an underground water network.



TYPICAL DIRECTIONALLY DRILLED SERVICE CONNECTIONS



PLAN - 2 CHAMBER SEPTIC TANK



SECTION A-A - 2 CHAMBER SEPTIC TANK

Refer to Figures 5-3A to 5-3H for an illustration of the proposed system. The figures illustrate a scenario in which the low pressure forcemains are installed within an existing right-of-way at the backs of the lots. The advantage of this is that there would likely be less forcemain required overall, less conflicts with franchise utilities, and the air release valves, flushouts, and service valves wouldn't have to be in front of properties. However, there is certainly validity to installing the lines within the roadways for ease of access and less disturbance to back yards. The cost would be similar.

5.3.3 STORMWATER MANAGEMENT

As this option does not include converting the roadway to an urban cross section, the drainage patterns will not be altered. However, similar to the Full Upgrade Alternative, the water level of Elizabeth Lake will need to be monitored and may need to be addressed.

5.4 OPINION OF PROBABLE COST

The cost for the servicing of Rosedale Valley can vary depending on servicing type and the extent of road improvements. The alternatives below represent the two ends of the spectrum and include contingency and professional services, as detailed in **Appendix B**.

Table 5-4 Rosedale Valley Opinion of Probable Cost

No.	Description	Cost
Alternative 1	Upgrade to Full City Standard	$7,100,000
Alternative 2	Low Pressure Force Main and Standard Water Distribution	$1,970,000

Figure 5-1a Existing Rosedale Valley Subdivision

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Figure 5-1b Existing Rosedale Valley Subdivision Water Servicing PHD Pressure

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Figure 5-1c Existing Rosedale Valley Subdivision Water Servicing MDD plus Fireflow

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Figure 5-1d Existing Rosedale Valley Subdivision Wastewater Servicing

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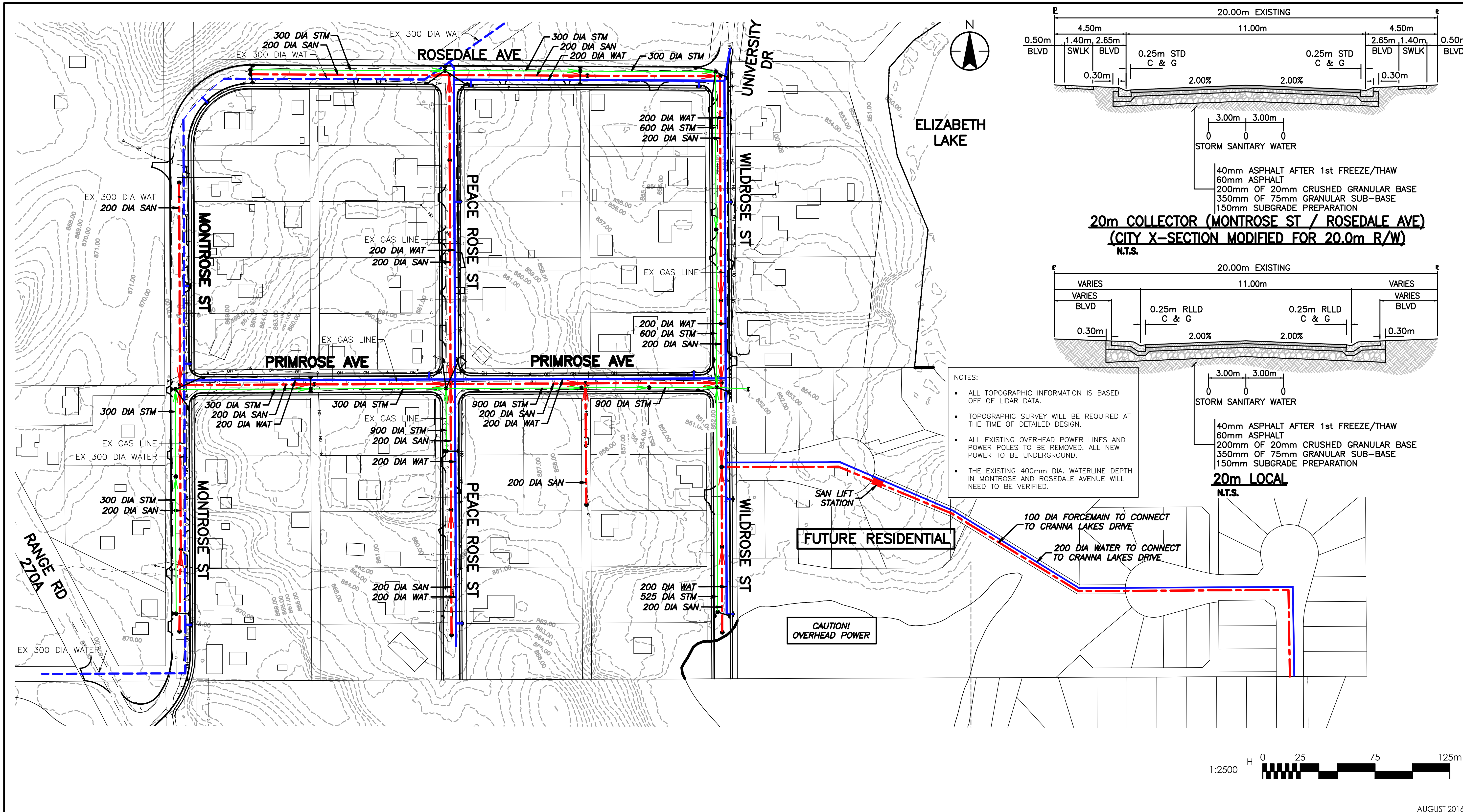

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ROSEDALE VALLEY SUBDIVISION
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5-2A

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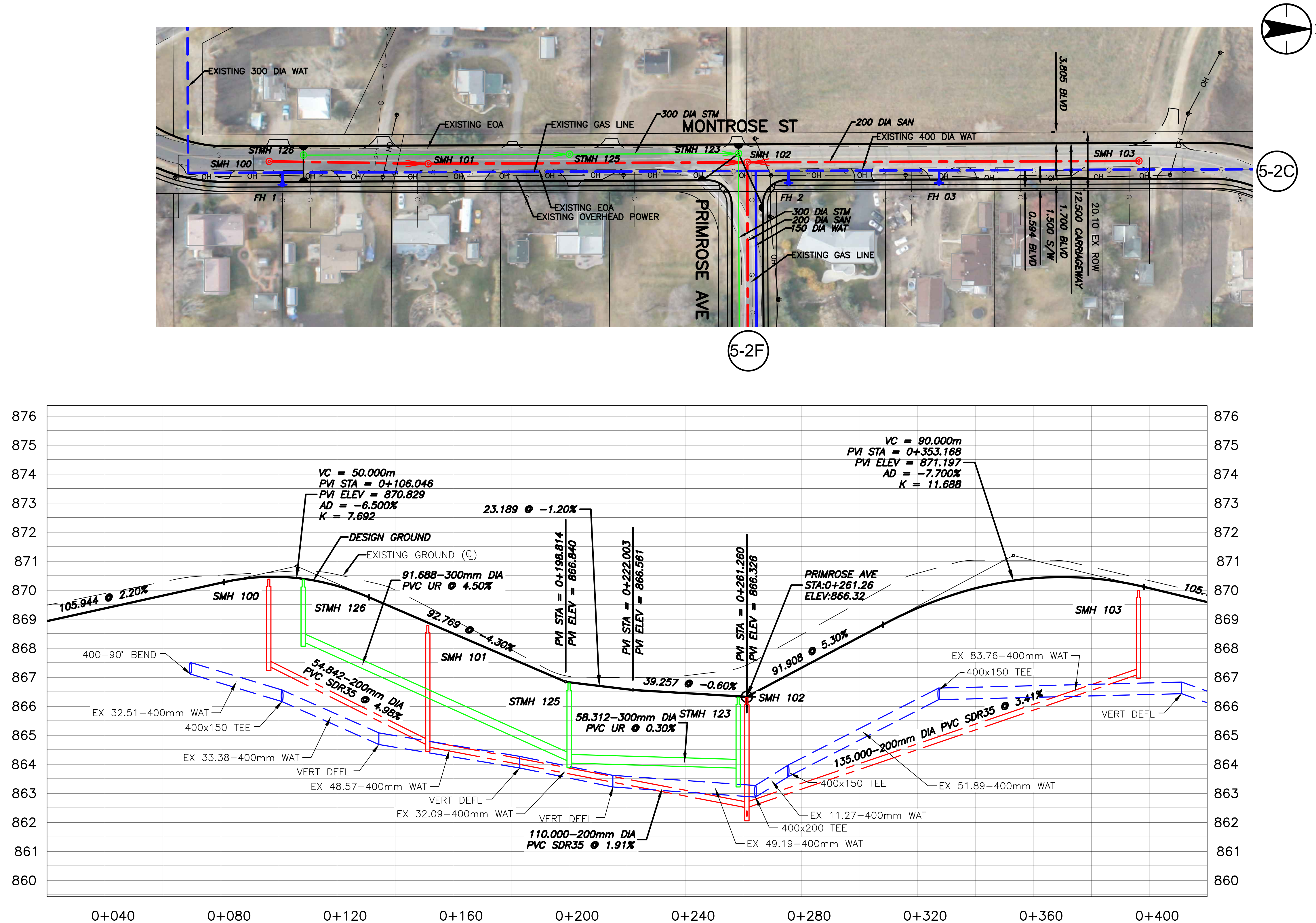

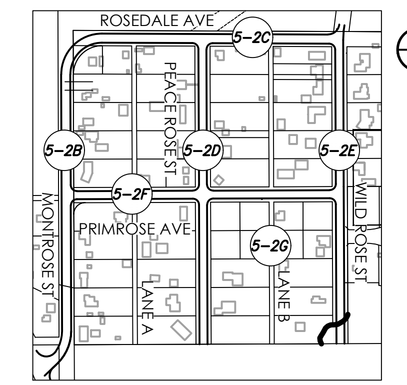

KEY PLAN
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NOTES:

- ALL TOPOGRAPHIC INFORMATION IS BASED OFF OF LIDAR DATA.
- TOPOGRAPHIC SURVEY WILL BE REQUIRED AT THE TIME OF DETAILED DESIGN.
- ALL EXISTING OVERHEAD POWER LINES AND POWER POLES TO BE REMOVED. ALL NEW POWER TO BE UNDERGROUND.
- THE EXISTING 400mm DIA. WATERLINE DEPTH IN MONTROSE AND ROSEDALE AVENUE WILL NEED TO BE VERIFIED.

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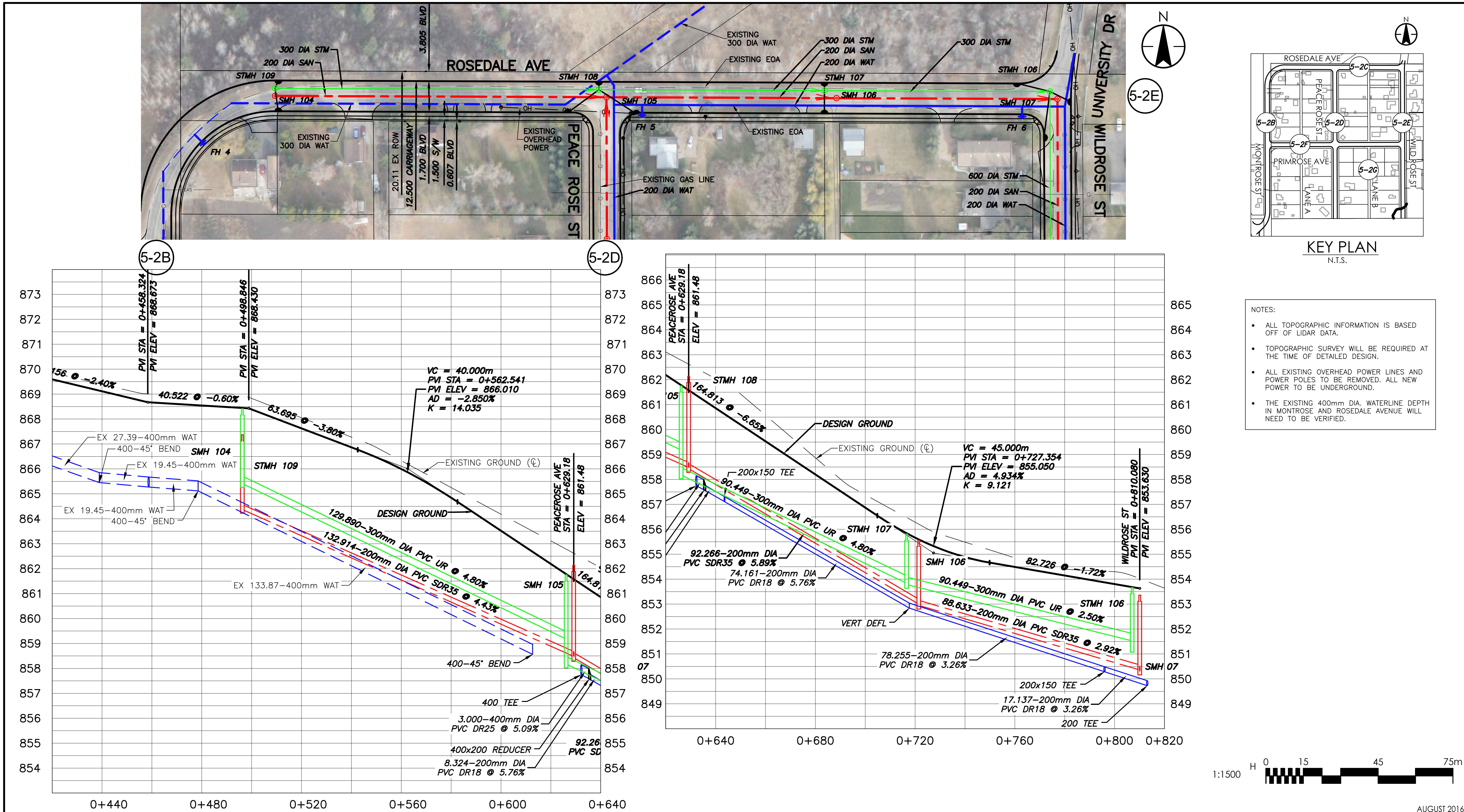
MONTROSE STREET PLAN & PROFILE

5-2B



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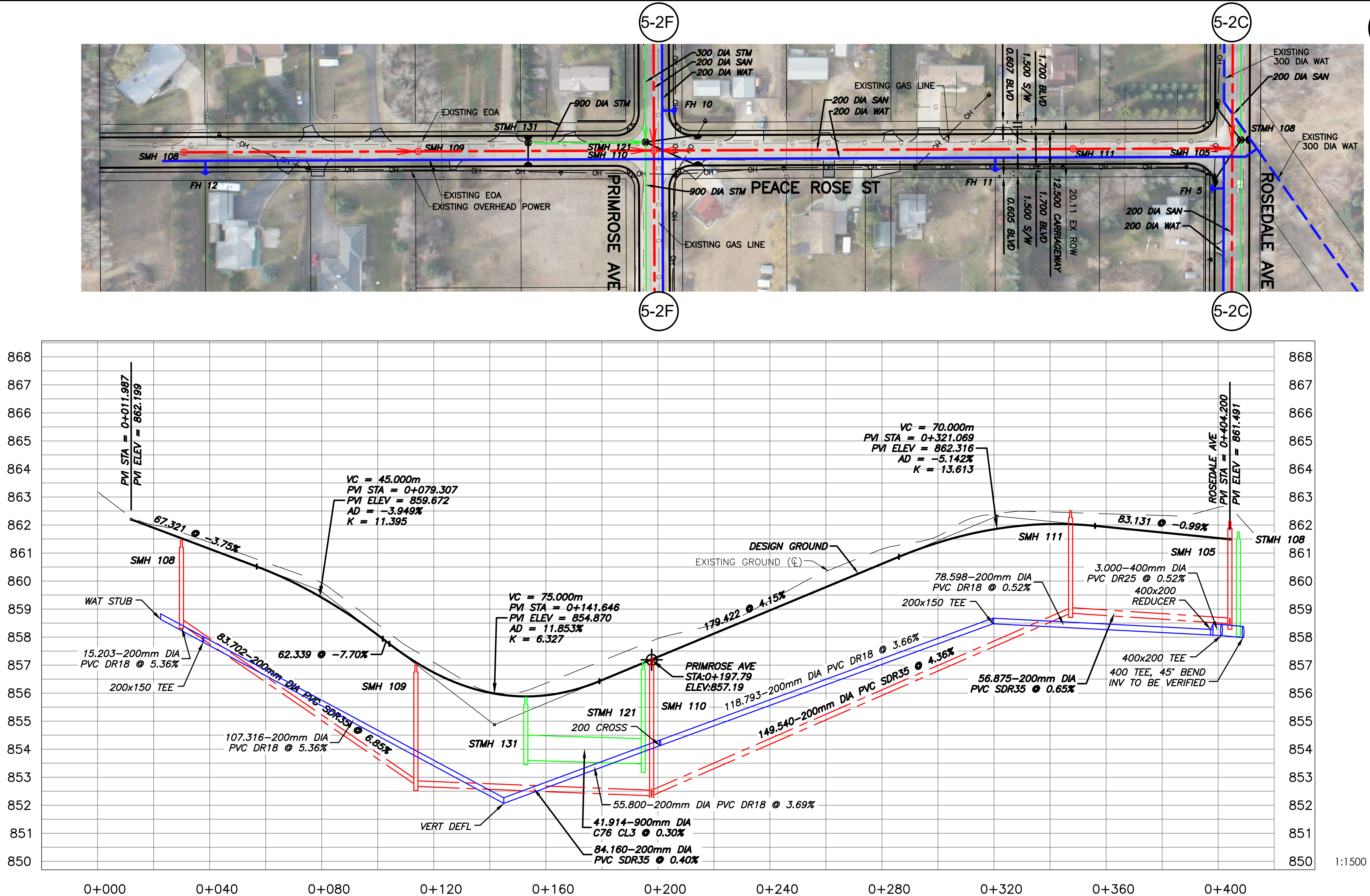
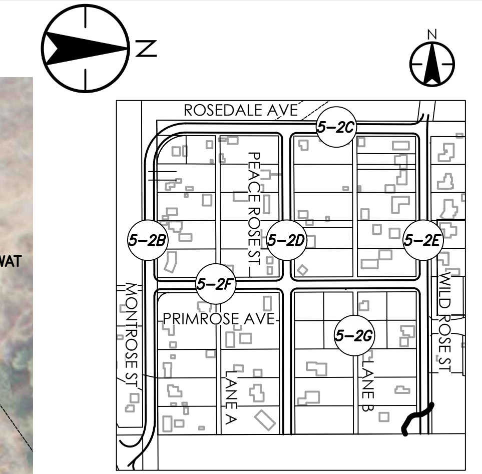
ROSEDALE AVENUE PLAN & PROFILE
5-2C





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PEACE ROSE STREET PLAN & PROFILE
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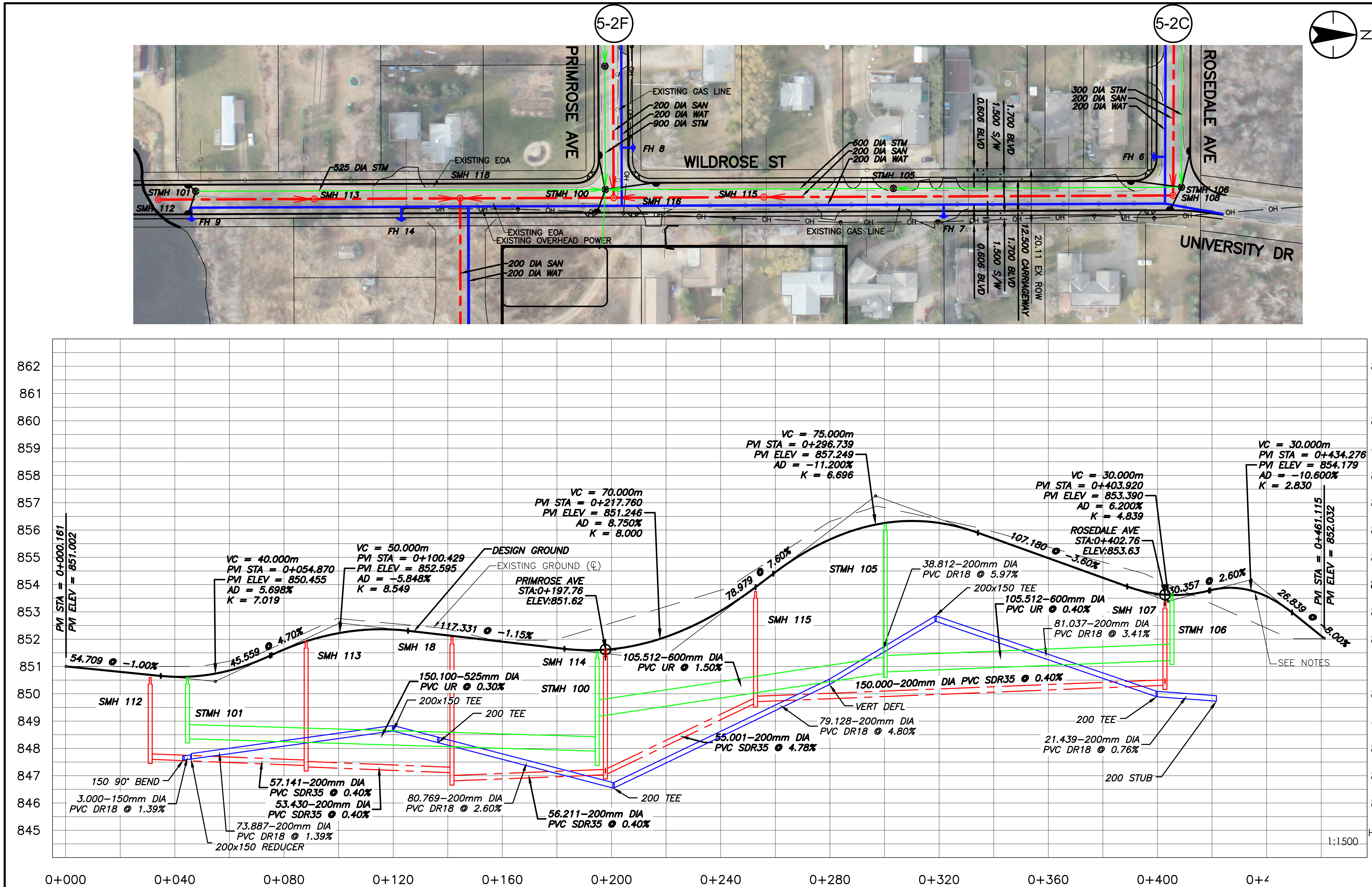

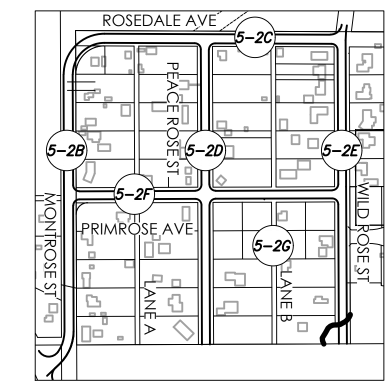

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- THE EXISTING 400mm DIA. WATERLINE DEPTH IN MONTROSE AND ROSEDALE AVENUE WILL NEED TO BE VERIFIED.
- SMALL VERTICAL CURVE RECOMMENDED TO ENSURE MAJOR OVERLAND DRAINAGE IS HELD ON SITE.

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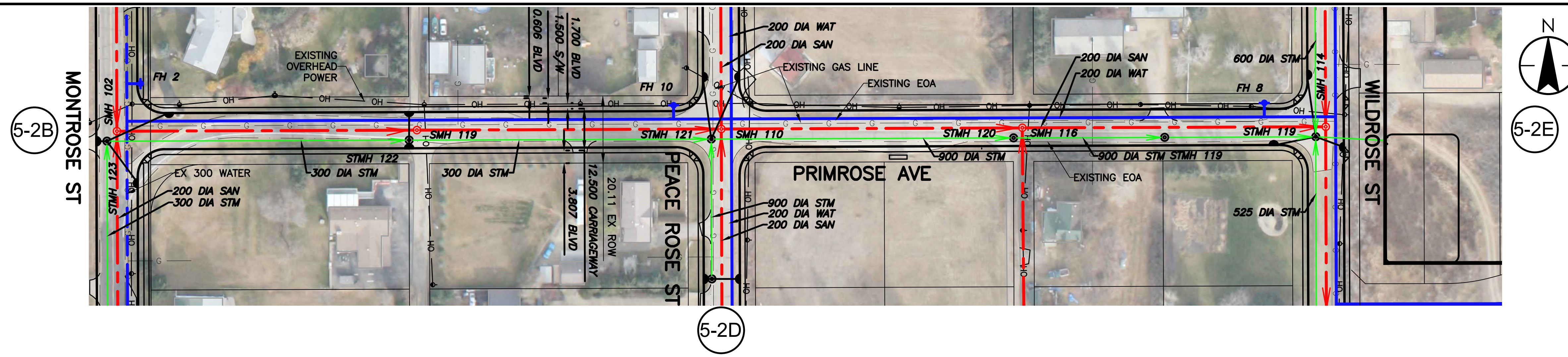
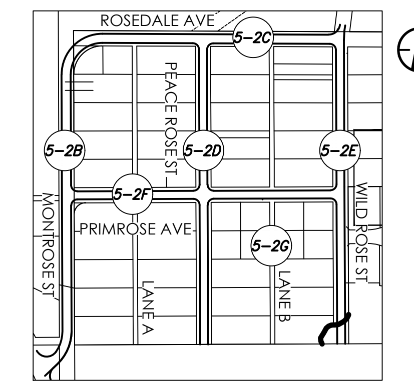
WILDROSE STREET PLAN & PROFILE
5-2E





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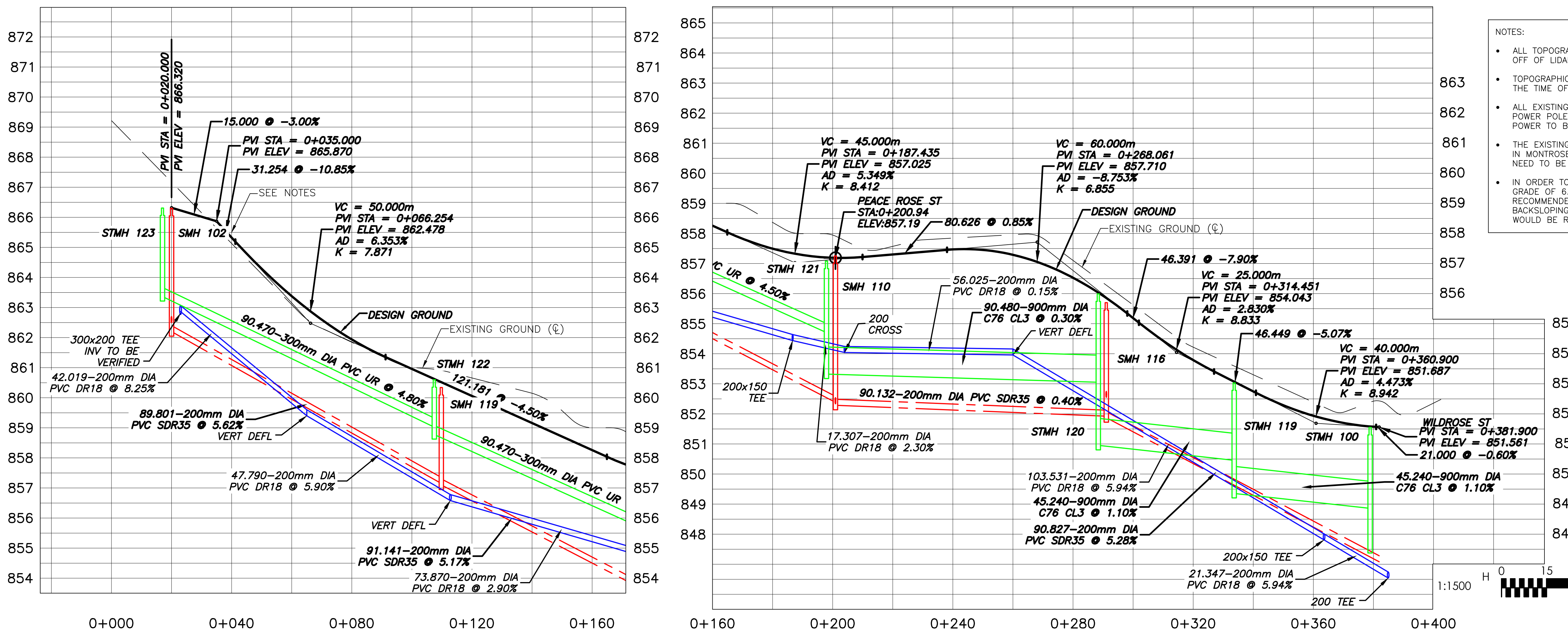

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- IN ORDER TO ACHIEVE DESIRED MAXIMUM GRADE OF 6.0%, INTERSECTION RECOMMENDED TO BE LOWERED BY 1.0m. BACKSLOPING INTO PRIVATE PROPERTY WOULD BE REQUIRED.

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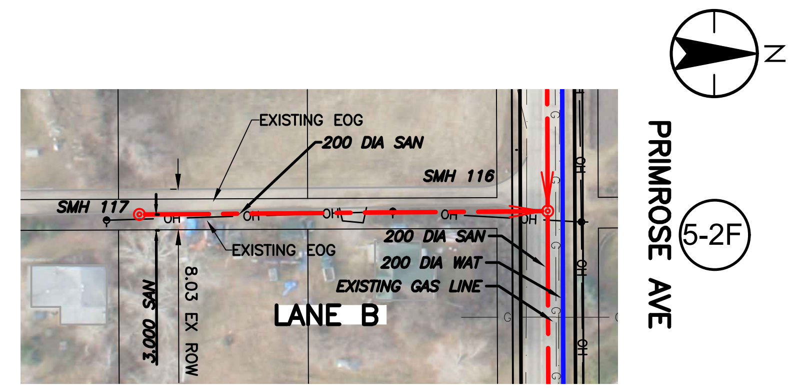
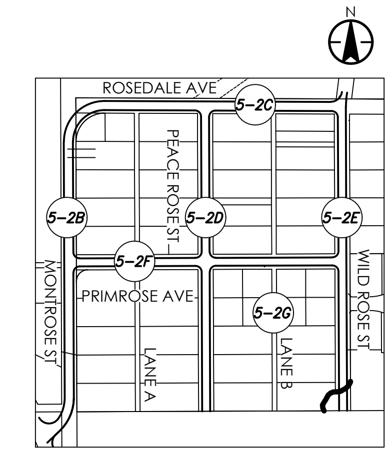
PRIMROSE AVENUE PLAN & PROFILE
5-2F





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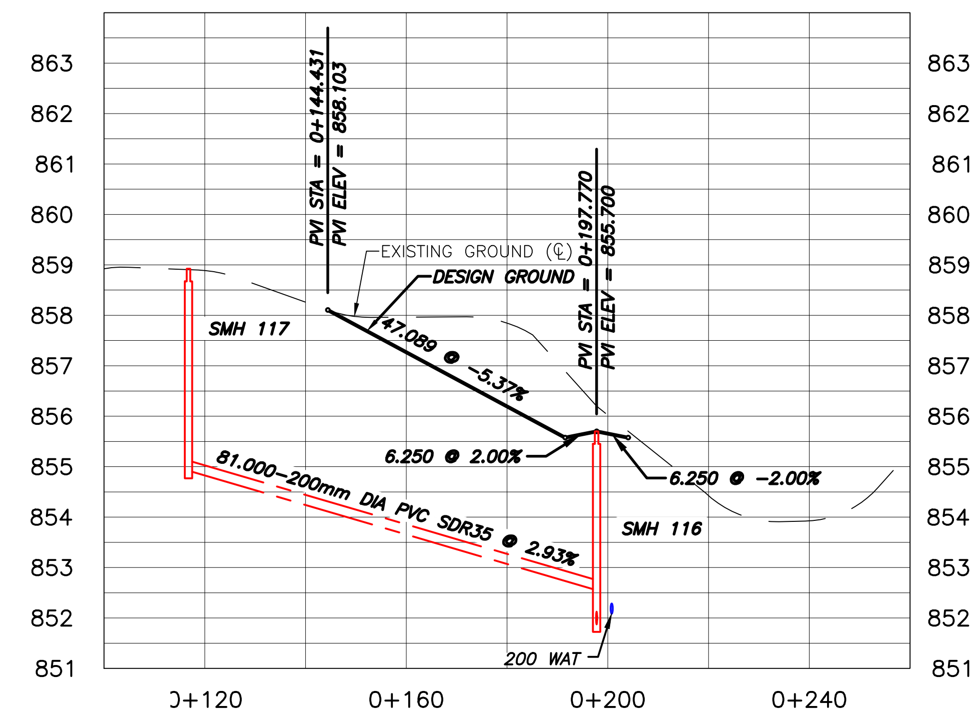

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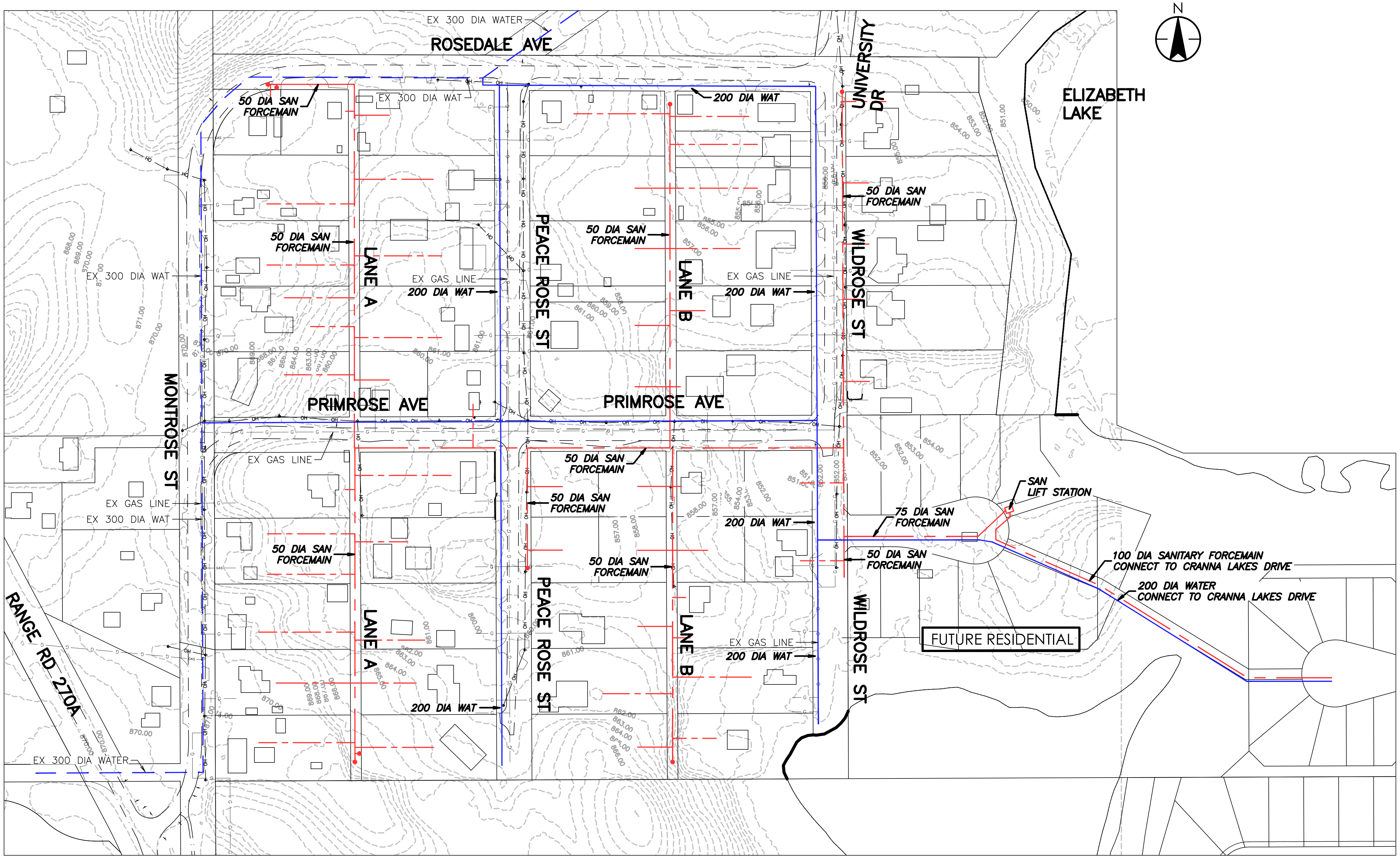
ALTERNATIVE 1 - UPGRADE TO URBAN CITY STANDARD
LANE B PLAN & PROFILE
5-2G



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- ALL SANTARY FORCEMAINS TO BE DIRECTIONAL DRILLED.
- ALL RESIDENTIAL SERVICES TO BE 35mm DIAMETER.
- LOCATIONS OF EXISTING SEPTIC TANKS UNKNOWN AND TO BE DETERMINED AT TIME OF DETAILED DESIGN.

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ALTERNATIVE 2 - BASIC WATER AND LOW PRESSURE WASTEWATER SERVICING
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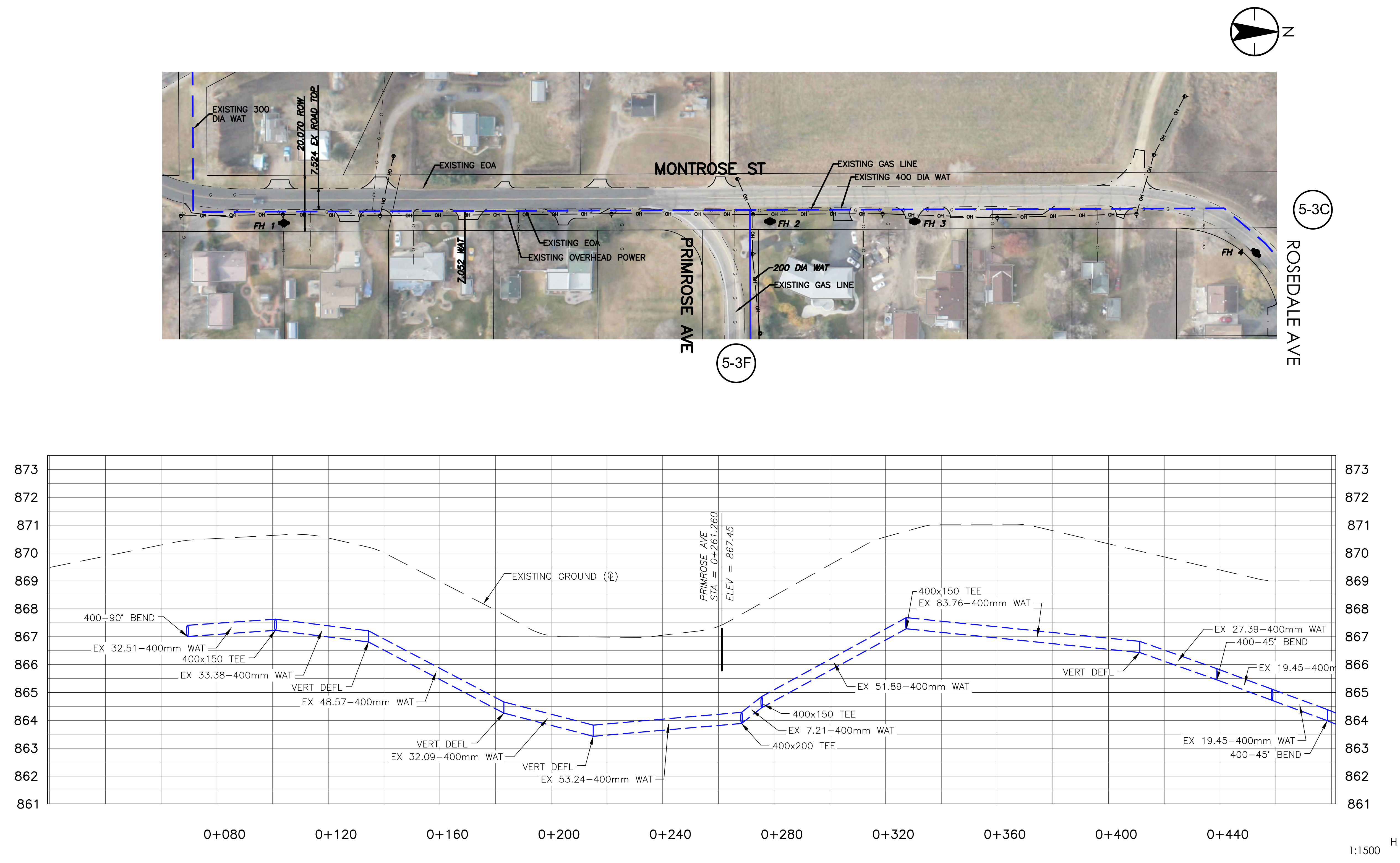

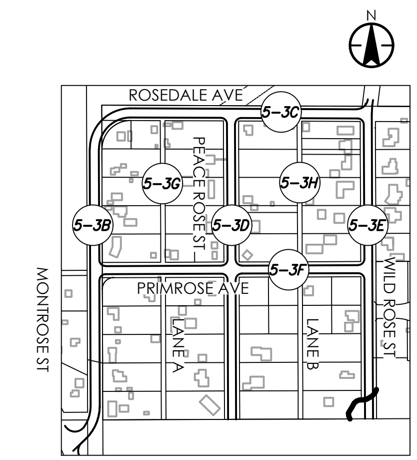

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- ALL RESIDENTIAL SERVICES TO BE 35mm DIAMETER.
- LOCATIONS OF EXISTING SEPTIC TANKS UNKNOWN AND TO BE DETERMINED AT TIME OF DETAILED DESIGN.

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ALTERNATIVE 2 - BASIC WATER AND LOW PRESSURE WASTEWATER SERVICING MONTROSE STREET PLAN & PROFILE
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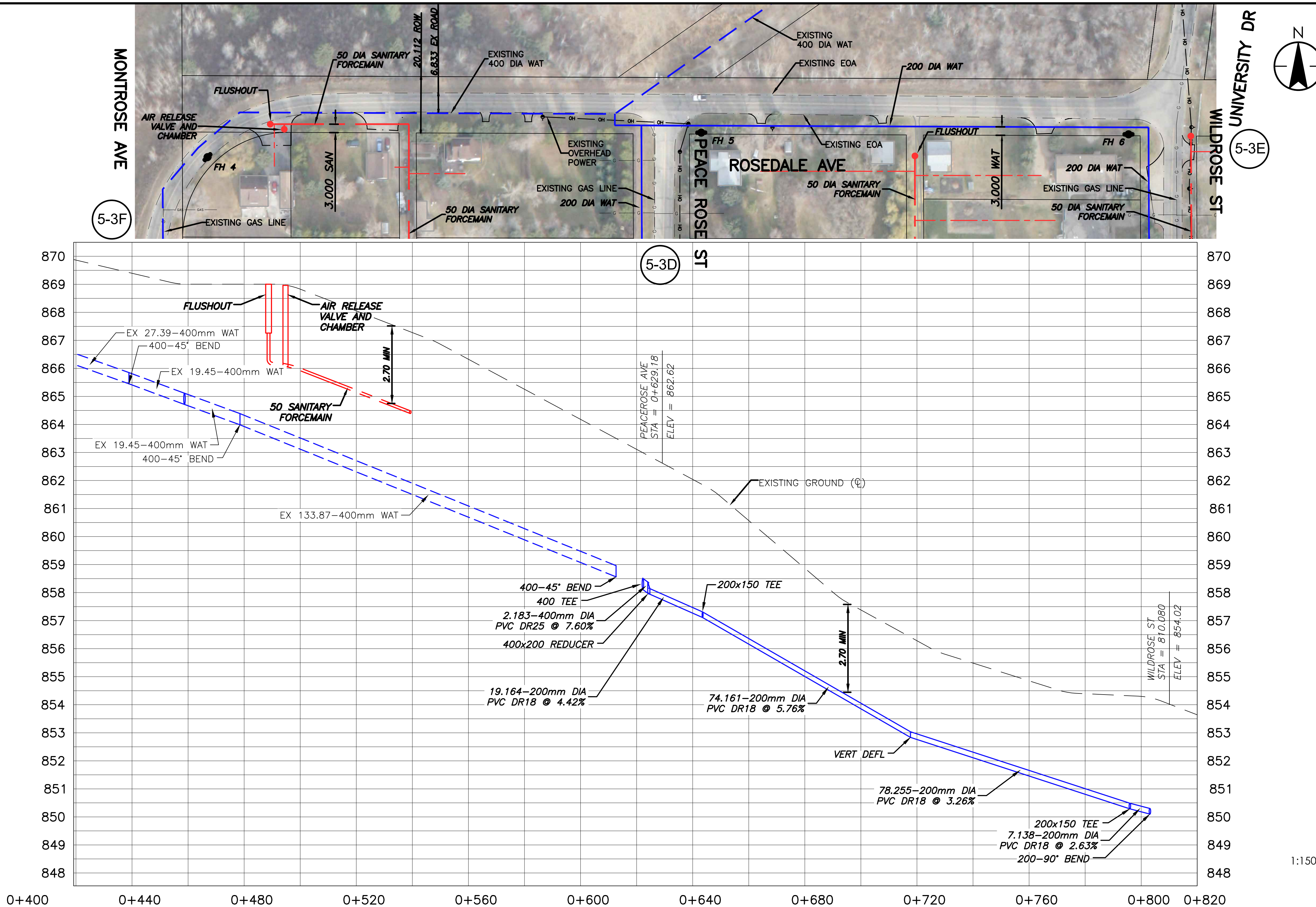

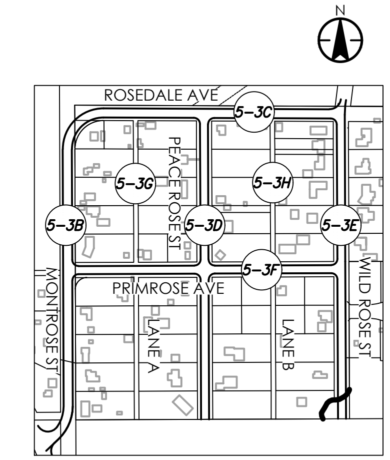

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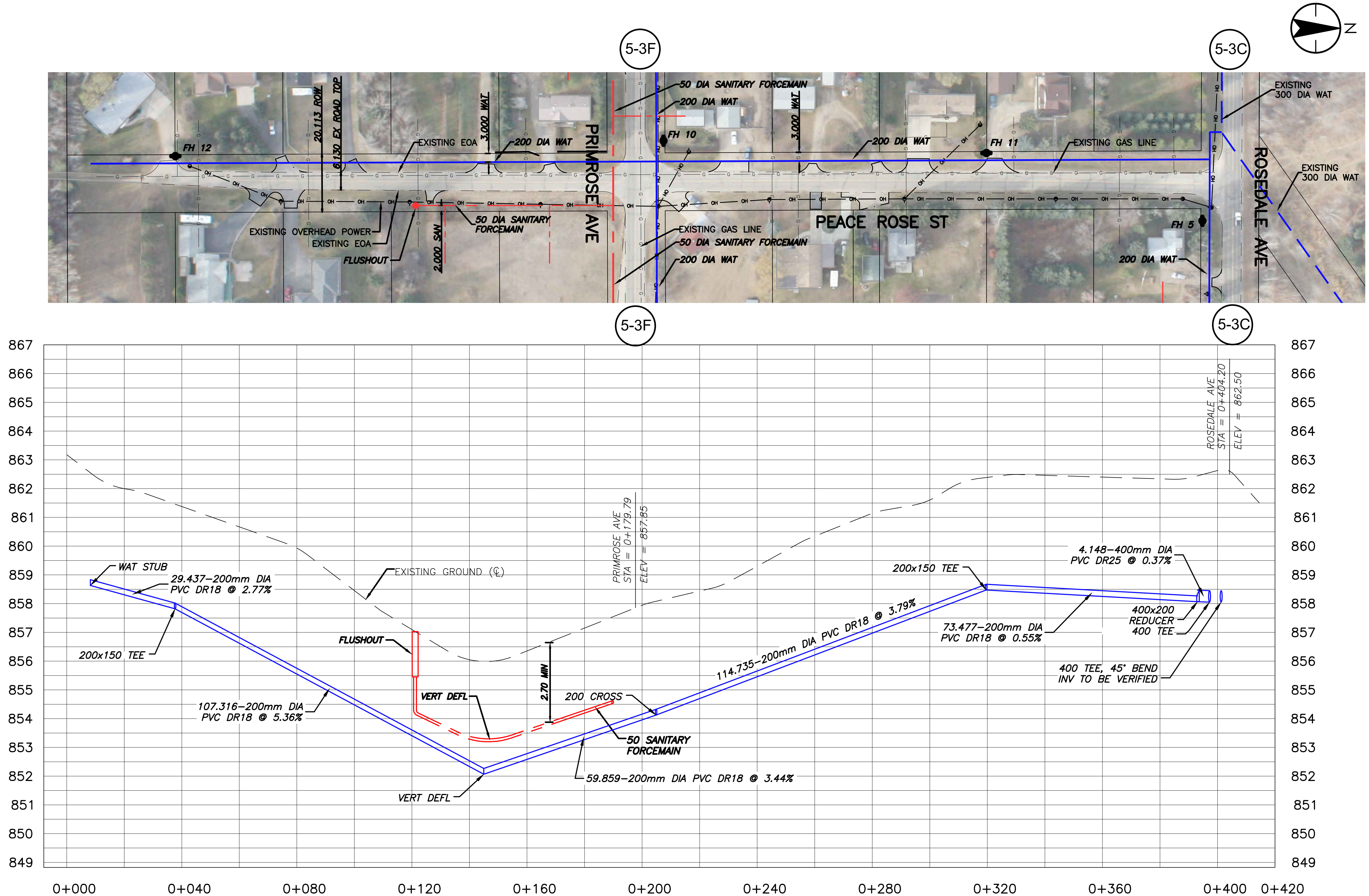

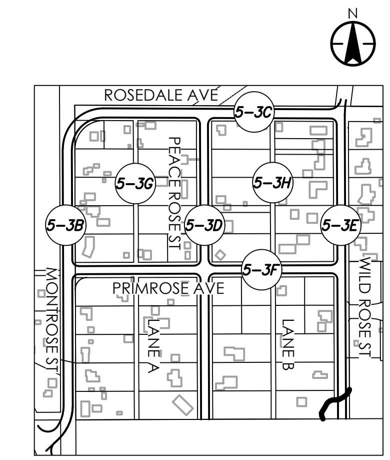

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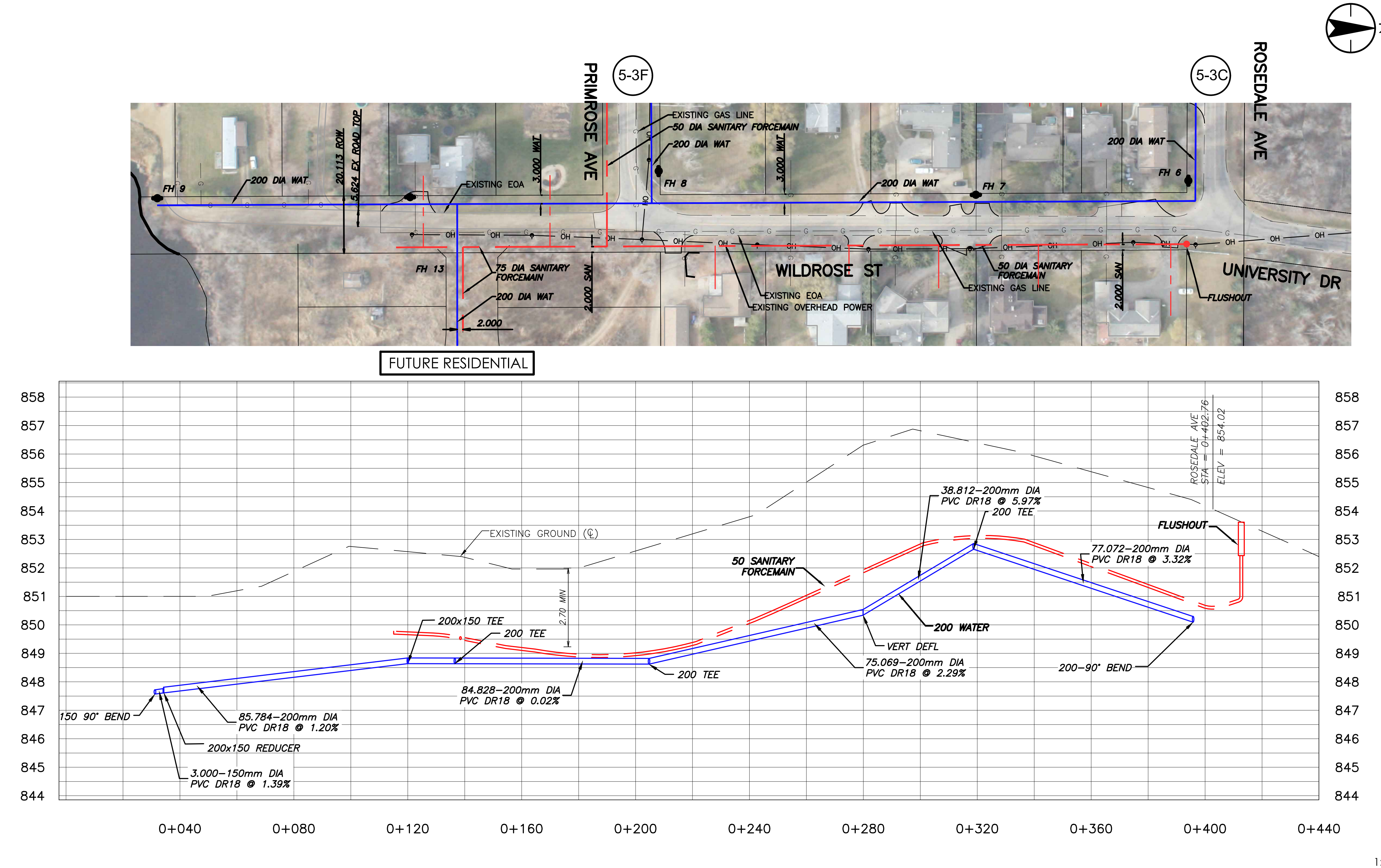

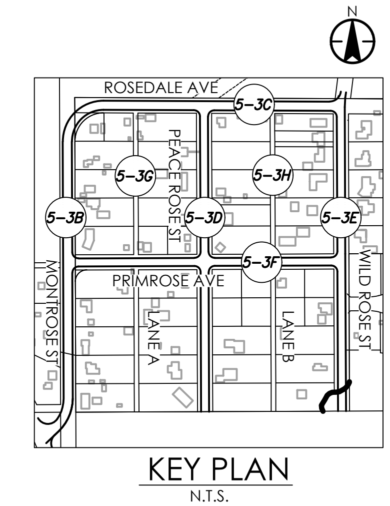

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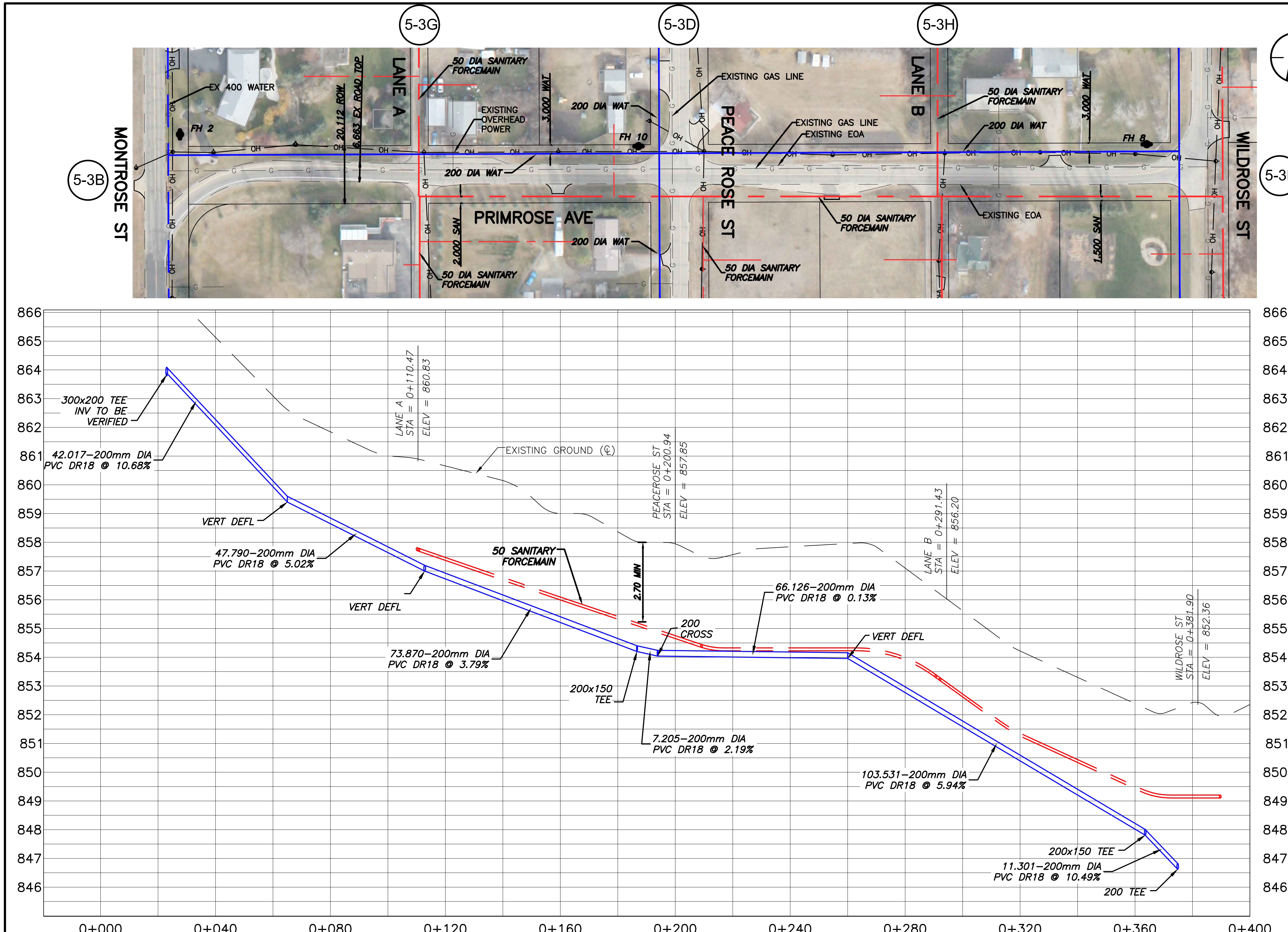

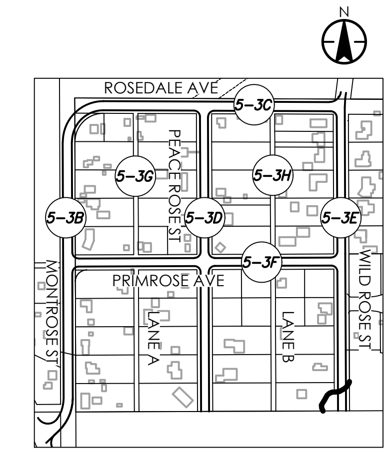

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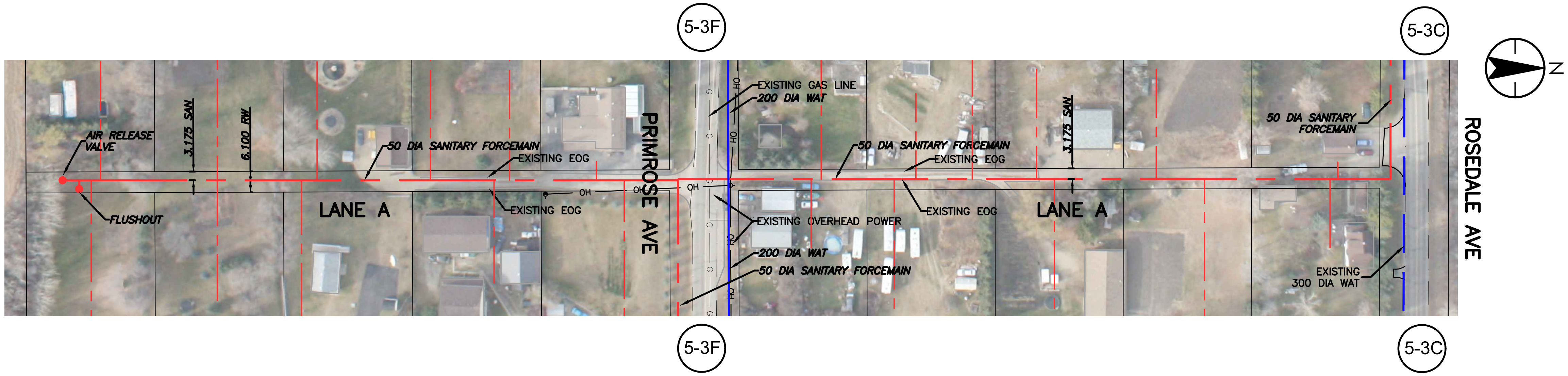

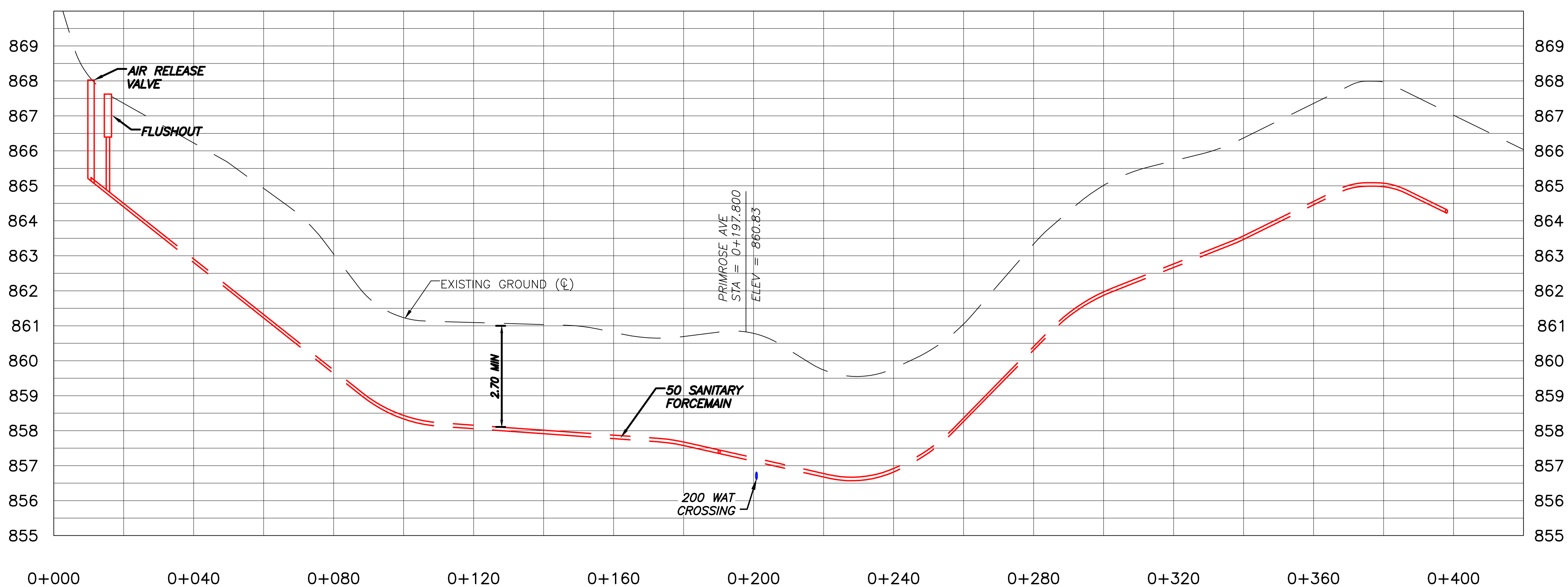

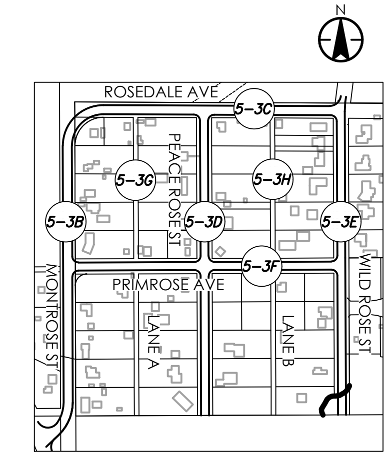

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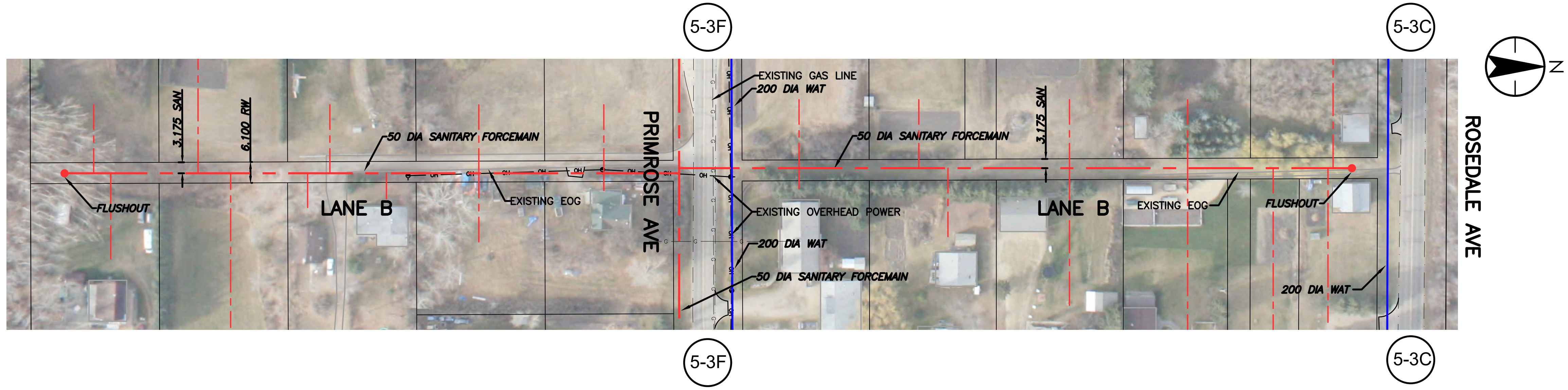

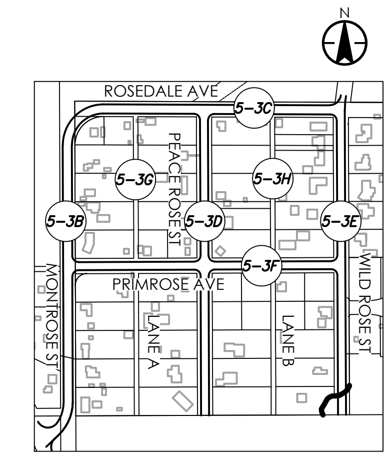

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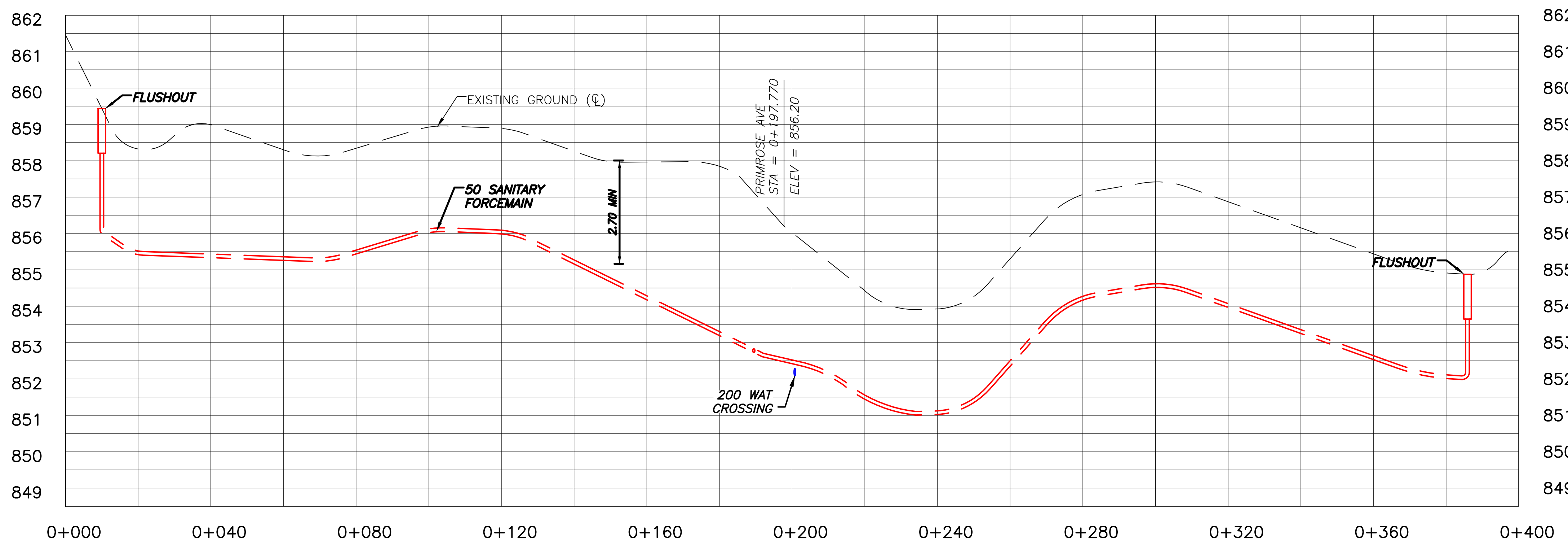

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6 IRON RAIL BUSINESS PARK

6.1 PLANNING CONCEPT

The Iron Rail Business Park is an existing rural industrial park located in NE 23-40-26-W4M, on the south side of Highway 12, approximately 4.9 km east of Lacombe. When fully built out, the Iron Rail Business Park will encompass approximately 113 ha of area. Approximately 39 ha has already been developed. **Figure 6-1** at the end of this section illustrates the developable area and is based off the concept shown in the "Parkview Industrial Park Site Development Guidelines", revised by UMA Engineering in September, 2016.

The first phase has been constructed, but only a small number of the lots have been developed at the time of this report. The subdivision is currently serviced by individual private wells and septic tanks.

The purpose of this Section is to determine the cost and feasibility of extending water and sanitary services from the City of Lacombe along Highway 12 to service this subdivision.

6.2 WATER SERVICING

As shown on **Figure 6-2** at the end of this section, the Iron Rail Business Park has an elevation of 925m and greater, which is over 50m higher than the eastern city limit. This area will operate in a 951 m Pressure Zone to meet the LOS pressure criteria.

A breakdown of the demand projections for ADD, MDD and PHD conditions in this area is summarized in **Table 6-1**.

Table 6-1 Future Demand Projection – Iron Rail Business Park

Design Parameters	Projection
ADD	5.6 L/s
MDD	11.3 L/s
PHD	22.5 L/s
*Required Storage	924 (3,440) m^3

*Note that the required storage shown in the brackets includes the required fire storage of 233 L/s for 3 hours, equivalent to 2,516 m^3 due to 951m new pressure zone.

The Iron Rail Business Park can be supplied water from either the City's network or directly from the North Red Deer Regional Water Line. In either case, an in-line booster pump station is proposed to deliver a peak hour flow of 22.5 L/s for PHD scenario with pump head of 100 m to meet LOS pressure criteria. The conceptual booster pump station is recommended to locate near 34th Street and Hwy 12 within the municipal boundary, as shown in **Figure 6-3**. Due to the long distance of servicing, the pressure head of the pipelines can reach up to 173 m for ADD scenario. Thus, HDPE DR 9 or equivalent piping would be required.

The Highway 12 watermain is proposed to be a 150mm diameter line that will supply water to the Iron Rail Business Park. The 150mm water main will not be large enough to provide fire flow capacity. Should capacity for fire flows be desired, it is recommended that a communal reservoir and pump be installed in the subdivision. Alternatively, all lots could be made responsible to provide their own fire suppression measures. Private on-site water storage tanks for customers are therefore recommended for the provision of fire flow, should it be desired.

In order to provide fire flows through the municipal water mains, an on-site future reservoir and pump station would be required and is explored and simulated in the hydraulic model. In this scenario, the water would be supplied externally (from Lacombe or the North Red Deer Regional Line), but the subdivisions internal water pressures and flows would be provided by the pump station and reservoir. For this alternative, an in-line booster pump station is proposed to deliver a MDD flow of 11.3 L/s with a pump head of 25 m. The required storage for this scenario is 3,440 m^3, as shown in **Table 6-1**.

As discussed in **Section 2.5.2.2**, the required storage can be incorporated into the future southeast reservoir and pump station (R-F1) proposed in the 2013 Water Model Update report (Stantec, 2014). Depending on the timeline for development, the opportunity to use remaining storage volume to supply water to this area would be viable.

A summary of the modeling results for the system pressure under PHD condition are presented in **Figure 6-3**. All LOS criteria are satisfied, based on the modeling results.

6.3 WASTEWATER SERVICING

The Iron Rail Business Park can be serviced by an extended gravity trunk from the City. As shown in **Figure 6-2** at the end of this section, there is a 54 m elevation difference between the northwest corner of Iron Rail Business Park and the last manhole rim in the 52 Ave, the average surface slope is approximately 1.15% along the 4.7 km alignment, as shown in **Figure 6-4**. The projected peak flow from the 113 ha (including second phase) industrial development is 27 l/s. A 200 mm diameter gravity pipe along Hwy 12 will be sufficient to service the whole area. The proposed 200 mm diameter gravity pipe will eventually discharge into the existing gravity sewer in 52 Avenue and the Existing North East Lift Station, which will discharge into the proposed Lacombe NRDRWWSC Regional Lift Station. **Note that the additional of the 27 l/s from the Iron Rail Business will increase the total peak to the existing Lacombe NE lift station to 232 l/s, which is close to its capacity 240 l/s.**

The industrial lots in the Rail Business Park can be serviced by a gravity sewer system and discharge to the northwest corner.

6.4 OPINION OF PROBABLE COST

The cost to bring servicing up to the Iron Rail Business Park, including 30% contingency and professional services, would be approximately $4,100,000 as detailed in **Appendix B**. Please note that this does not include the cost of the internal servicing, which would be expected to be covered under local improvements bylaws.

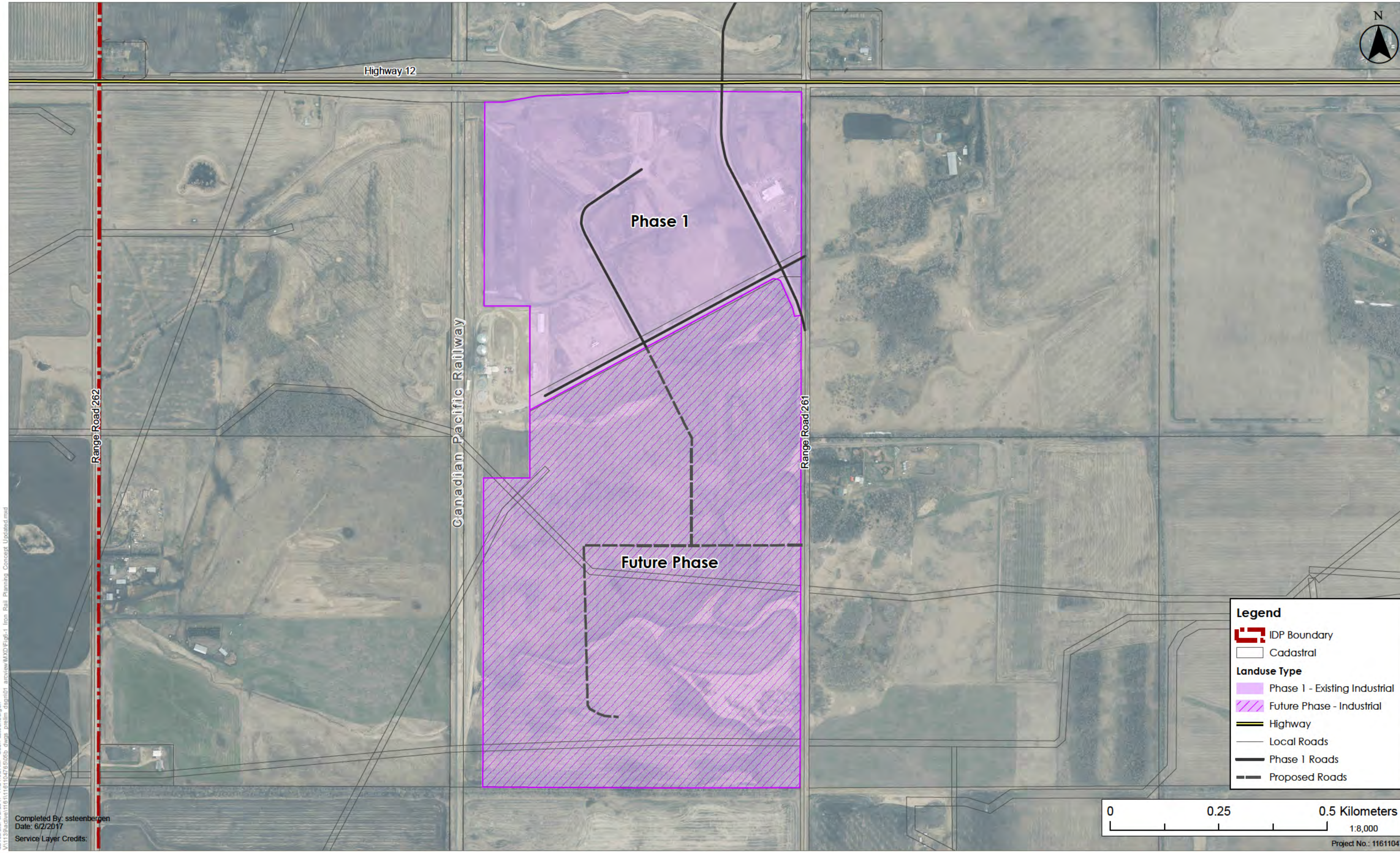

Figure 6-1 Iron Rail Business Park Planning Concept

Lacombe Intermunicipal Development Plan
2017 Servicing Study

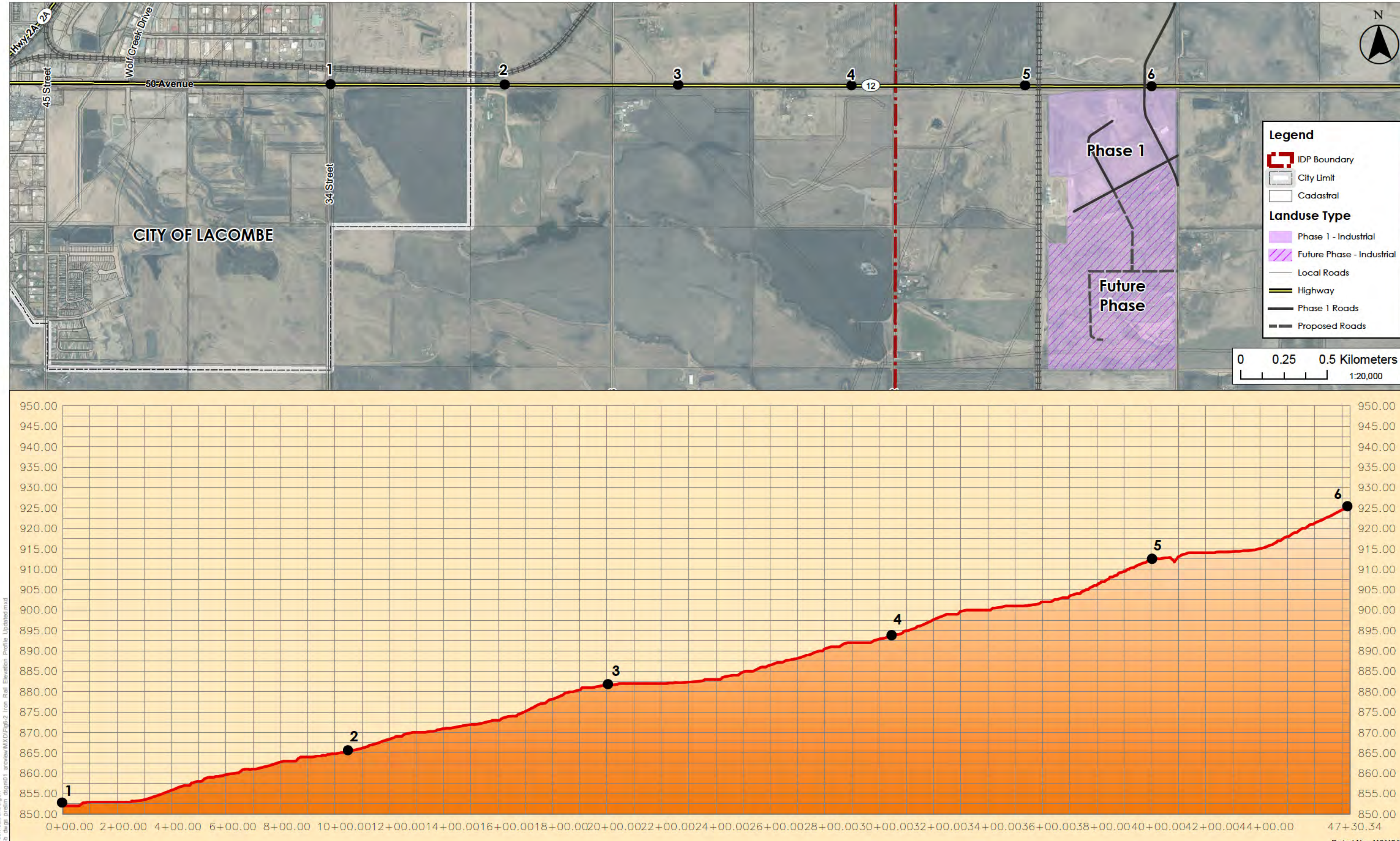

Figure 6-2 Iron Rail Business Park Elevation Profile

Intermunicipal Development Plan
2017 Servicing Study

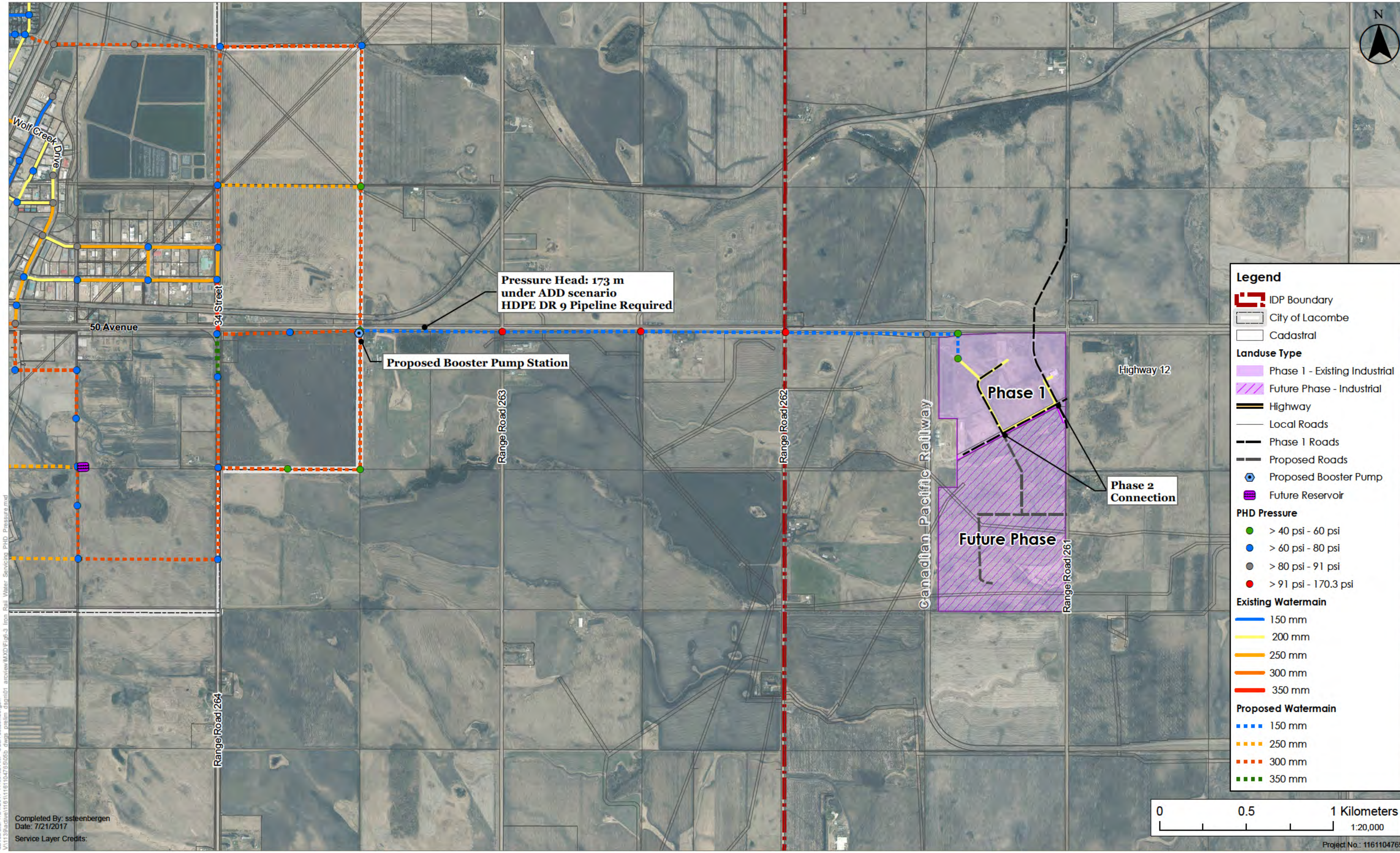

Figure 6-3 Iron Rail Business Park Water Servicing PHD Pressure

Lacombe Intermunicipal Development Plan

2017 Servicing Study

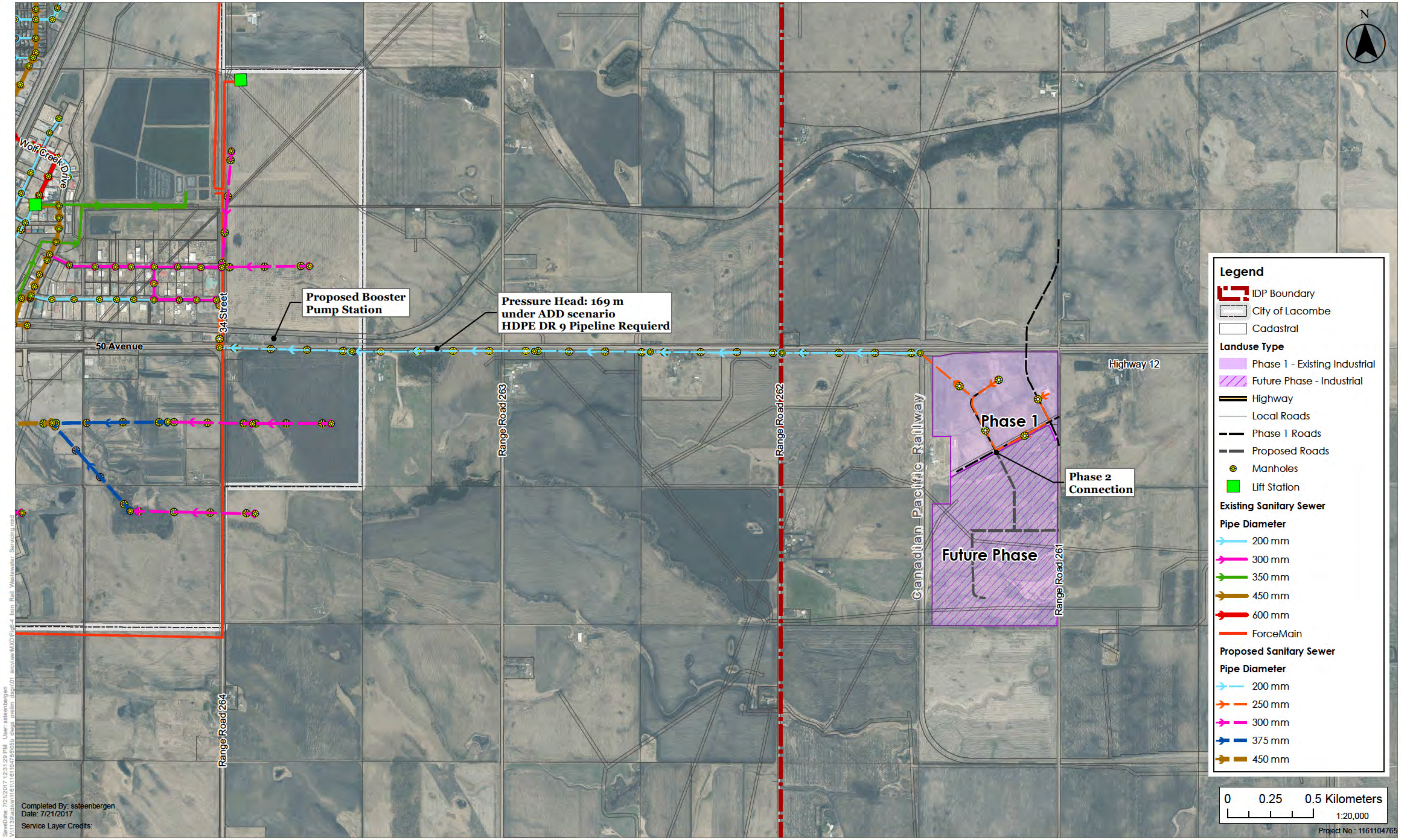

Figure 6-4 Iron Rail Business Park Wastewater Servicing

Lacombe Intermunicipal Development Plan
2017 Servicing Study

7 QUEEN ELIZABETH II (QE II) NORTH OF LACOMBE

7.1 PLANNING CONCEPT

As shown in Figure 7-1 at the end of this section and in the ASP report prepared by Lacombe County, the Queen Elizabeth (QE II) North of Lacombe area is a proposed development area that will consist of highway commercial and rural residential development. The area will be accessed from the Milton Road interchange on the Queen Elizabeth II Highway.

Currently the land within the QE II North of Lacombe area is used for agriculture, with some rural residences, and the Queen Elizabeth II North of Lacombe area. The Nursery Golf and Country Club is also located within the area.

The ASP report recommends that the area be planned to be serviced by communal water and wastewater, but it also states that it would be prudent to study the potential for the area to be serviced by the regional water and wastewater lines at the time of development. The purpose of this report section is to evaluate the feasibility and engineering considerations for tying into the regional lines. In addition, the connection to the City's infrastructure is also investigated.

In general, the QE II North of Lacombe Area and the Milton Area (Section 8) have been analyzed individually. However, there is very strong potential for the two systems to be combined in some form. Depending on timing of development for both areas, there should be future consideration for sharing water reservoirs, lift stations, and force mains.

7.2 WETLAND AREA CONSIDERATIONS

The area is made up agricultural land with pockets of residential development and the Nursery Golf and Country Club, with numerous waterbodies and wetlands. The desktop mapping identified 51 wet features including 42 marshes, one swamp, two watercourses (i.e., Whelp Brook and two segments of Wolf Creek and six waterbodies).

The marshes and swamp identified within the QE II Commercial area are generally small features that are primarily located in the east portion. The marshes appear to have been regularly cultivated throughout the historical aerial photographs reviewed.

The watercourses (i.e., Whelp Brook and two segments of Wolf Creek) have been present on the landscape since before the 1950's but have been modified by historical disturbances. The Nursery Golf and Country Club was constructed around Whelp Creek between 1980 and 1998. This development included the removal of the vegetation surrounding the creek, but no realignment of the channel was visible. Wolf Creek passes through the QE II Commercial area twice. The first location is in the east portion of the QE II Commercial area, north of Highway 2 and the second location is in the northeast corner of the QE II Commercial area. The portion of Wolf Creek in the QE II Commercial area is primarily channelized with limited vegetation surrounding the creek. Channelization of Wolf creek occurred prior to the 1950's with some additional straitening of the channel between 1950 and 1969 associated with the Queen Elizabeth II Highway construction. A narrow fringe of riparian vegetation was visible in the 1950 and 1969 historical aerial photographs. This vegetation was cleared between 1969 and 1980 and has not re-established.

The six waterbodies identified in the QE II Commercial area are unnamed and contain open water throughout the historical aerial photographs reviewed. These waterbodies appear unchanged through the historical aerial photograph record, except for the waterbody located on the west side of the Nursery Golf and Country Club. It appears that this waterbody was formerly a marsh area and was modified during the golf course construction.

The presence of marshes, a swamp, watercourses and waterbodies in the QE II Commercial area may affect development in this area and/or trigger the need for additional studies and regulatory approvals. Based on the information available, considerations and next steps related to wetlands and waterbodies are listed below:

- All marshes, swamp, watercourses and waterbodies are regulated under the Water Act and will require an approval prior to modification or removal. A wetland assessment, including field classification and delineation, will be required to support the Water Act application and the proponent will need to show use of the wetland mitigation hierarchy (i.e., avoidance, minimization and replacement). It is likely that the field assessment will identify more wetlands than what was identified as part of this desktop mapping exercise due to the scale of mapping and minimum polygon size.

- The areas classified as waterbody and watercourse (i.e., Whelp Brook and Wolf Creek) appear to be permanent features with potential to be claimed as Crown land under Section 3 of the Public Lands Act. These features will likely need to be retained within future development or approvals under the Public Lands Act will be required for development or modifications. It is possible that wetlands in addition to those classified waterbody and watercourse could be claimed as Crown land. Therefore, a water boundaries review should be submitted to AEP for all marshes swamps, watercourses and waterbodies to confirm if the features are deemed Crown land under Section 3 of the Public Lands Act prior to development.

- If wetlands or waterbodies are retained in the development, site specific buffers and setbacks should be determined and implemented for pollution prevention and flood protection of adjacent lands. Additional studies should be completed to determine the pre-development volume and frequency of surface water inputs into retained wetlands and waterbodies so that this can be matched post-development and reduce potential effects on retained waterbodies from changing the hydrology (e.g., flooding, erosion, cutting off water inputs, etc.).

- The FWMIS database indicates that Whelp Brook and Wolf Creek are fish bearing waterbodies. Development or modifications to Whelp Brook, Wolf Creek or a fish bearing waterbody (e.g., realignment, culvert/bridge construction, etc.) will require regulatory approvals under the Water Act, Public Lands Act and potentially the Fisheries Act. Applications for this type of development will likely require a supporting fish and fish habitat field survey and report.

- Although the FWMIS database does not contain records of fish for the waterbodies in the QE II Commercial area, this may be due to a lack of sampling effort. The potential for fish and fish habitat should be confirmed prior to development or modification to the waterbodies. If fish are present, there may be additional regulatory approvals required as listed above

- The AEP flood hazard mapping database did not identify records of floodplain mapping for Whelp Brook and the flood hazard mapping for Wolf Creek stops at the south side of Highway 2 and does not continue into the QE II Commercial area. The flood hazard area should be determined prior to development so that appropriate mitigation measures can be implemented (e.g., setbacks).

To be conservative, this servicing study was completed under the assumption that the small marshes would be demolished and developed as shown on **Figure 7-1**.

7.3 WATER SERVICING

Based on the contours shown in **Figure 7-2**, this area will operate in the 903 m pressure zone to meet the LOS pressure criteria.

A breakdown of the demand projections for ADD, MDD and PHD scenarios and required storage is summarized in **Table 7-1**. Note that the industrial/commercial (IC) consumption rate is used to project water demand for existing golf course assuming potable water was not used for irrigation purposes.

Table 7-1 Future Water Demand Projection – QEII North of Lacombe

Design Basis	Demand Projection
ADD	13.3 L/s
MDD	26.6 L/s
PHD	53.1 L/s
*Required Storage	2,299 m^3

*Note that due to rural residential planned in this area, the required fire storage includes fire storage of 33 L/s for 1 hours, equivalent to 119 m^3.

The proposed water distribution system consists of 200 mm to 350 mm diameter watermains developed on the basis of proposed roadway alignments, as shown in **Figure 7-2**. Due to limited storage volume remaining in the current City's water system, a conceptual future reservoir and pump station (R-F4) is proposed to provide water servicing to this area, as shown in **Figure 7-2**. Due to proximity to regional water line, a conceptual direct feed route from regional line is shown in **Figure 7-2**. Alternative water supply connection to the north of the City's water system can be considered and would add value to the system by providing redundancy and looping.

Depending on the timing of the buildout for the QE II North of Lacombe Area and the Milton area to the east, the east commercial land of QE II North of Lacombe could also be supplied by future reservoir (R-F5) in Milton area along Milton road to the west across Queen Elizabeth II Highway. This will improve the fire flow conditions of east commercial land in QE II North of Lacombe, as identified on **Figure 7-3**.

A summary of the modeling results for the system pressure under PHD condition, and available fire flow under MDD condition are presented in **Figure 7-2** and **Figure 7-3**. All LOS criteria are satisfied according to the modeling results.

7.4 WASTEWATER SERVICING

With the presence of the several water bodies and the complex topography features, it is difficult to service the QEII North Area with a gravity sewer system. The wastewater servicing figures illustrate a conceptual cascade pumping system that would be needed to service the QEII North Area. As an alternative to the cascading lift stations, a low pressure force main system should be highly considered. The system could be designed such that the entire area ties into the same LSQN (Lift Station Queen Elizabeth II North) #7 of the proposed cascading system, which will ultimately tie into the City / Regional Wastewater system.

In general, the QE II North of Lacombe Area and the Milton Area (Section 8) have been analyzed individually. However, there is very strong potential for the two systems to be combined in some form. Depending on timing of development for both areas, there should be future consideration for sharing lift stations and forcemains.

As shown in **Figure 7-4**, the 656 ha QEII North Area is divided into two large sewershed areas, the east sewershed area and the west sewershed area. In the west sewershed, upwards five local lift stations would be needed. Each local lift station would service the sub-sewershed as outlined with dash lines in the figure. The rural residential area north of the Nursery Golf and Country Club can be serviced by a small (<10 l/s) local lift station at the southeast corner of the area. The lift station will discharge to the second lift station south of the golf course. The second lift station will also receive the wastewater pumped from the south-east area to the golf course. The second lift station will discharge into a gravity trunk and then to the fourth lift station in the south. The fourth lift station discharges through a 200 mm 2.6 km forcemain to the fifth lift station (LSQN7 in the figure) in the east sub-sewershed. The fifth lift station (LSQN7) will be the major lift station conveying all the wastewater in QEII North Area, plus the Milton Area, to the Lacombe NRDRWWSC Regional Lift Station through a 4.7 km 350 mm forcemain. Generally, the developments within sub-sewershed can be serviced by gravity sewers. However, some lots around the water bodies might require private pumps to pump to the gravity sewers.

The east sewershed area, which consists of the east and west sub-sewersheds, will also require cascaded pumping. In the east sub-sewershed, which can be further divided by the C&E Trail into east and west portions, most of the future developments in the east portion will be serviced by a LPS due to the presence of the nature creeks and the environmental reserve areas, while the west portion will be serviced by a gravity trunk. A lift station with 44 l/s capacity (LSQN5 in the figure) is proposed in the west portion to pump the wastewater from the east sub-sewershed and Milton subdivision to the west portion. The west sub-sewershed will need a local lift station LSQN6 to pump the wastewater to the major lift station (LSQN7) 57 l/s capacity in the QEII North area.

7.5 OPINION OF PROBABLE COST

As illustrated in Figure 7-5 at the end of this section, a lift station and a forcemain of approximately 4.6 km length would be required to tie the North QE II Area in to the Lacombe Regional Lift Station. Similarly, approximately 2.3km of water main would be required to connect it to the regional water line. High level opinions of probable costs are summarized as follows:

Table 7-2 QE II North Opinion of Probable Costs

Opinion of Probable Costs	
Water Trunk Connection to Regional System	$1,456,500
Reservoir and Pump Station	$4,000,000
Lift Station, Force Main, and Highway Crossing	$3,780,000
30% Contingency and Professional Services	$2,770,950
Total Medium Term JEA and West Area Servicing	**$12,770,950**

Please refer to **Appendix B – Opinions of Probable Costs** for further details.

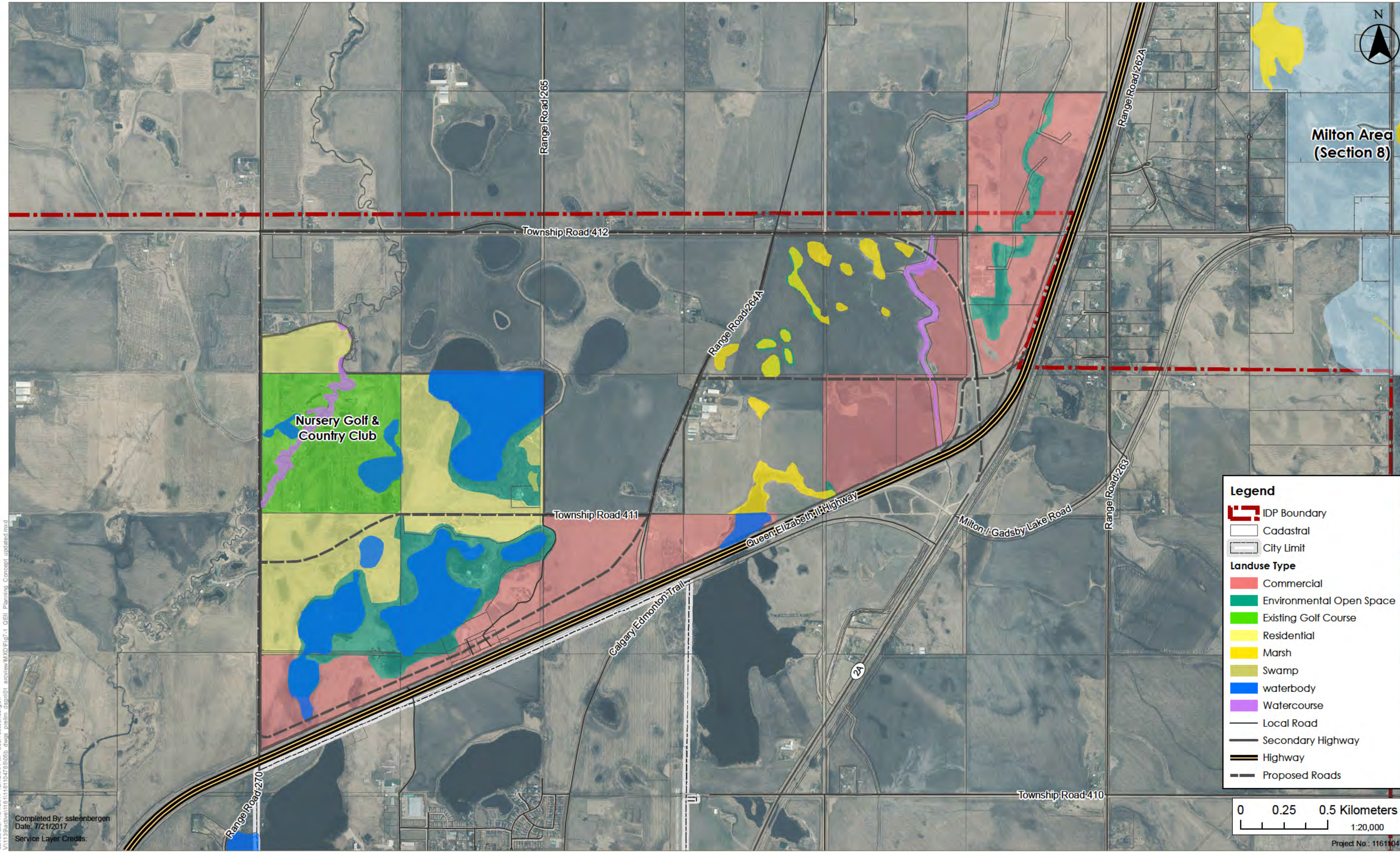

Figure 7-1 Queen Elizabeth II (QE II) North of Lacombe Planning Concept

Lacombe Intermunicipal Development Plan
2017 Servicing Study

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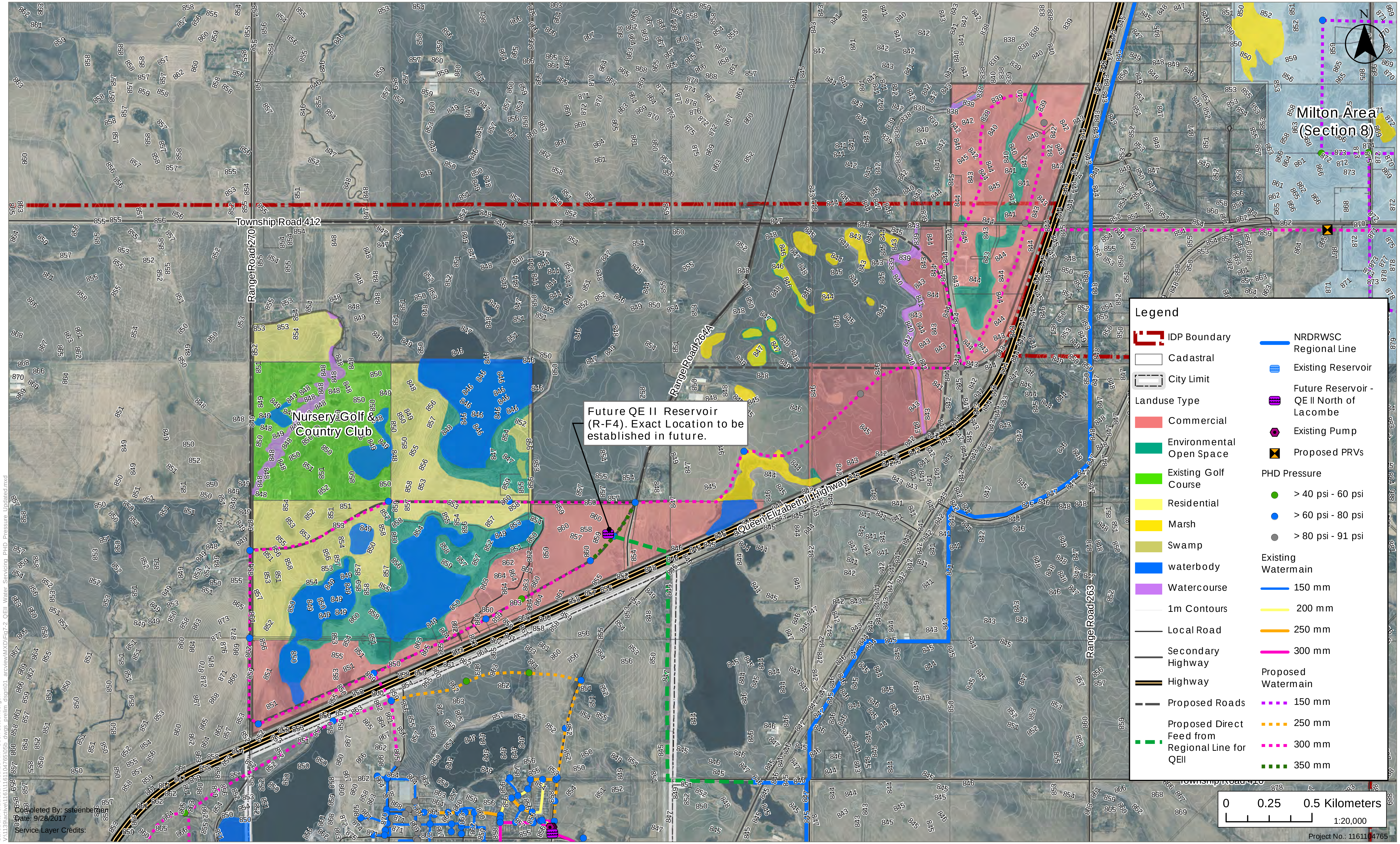

Figure 7-2 Queen Elizabeth II (QE II) North of Lacombe Water Servicing PHD Pressure

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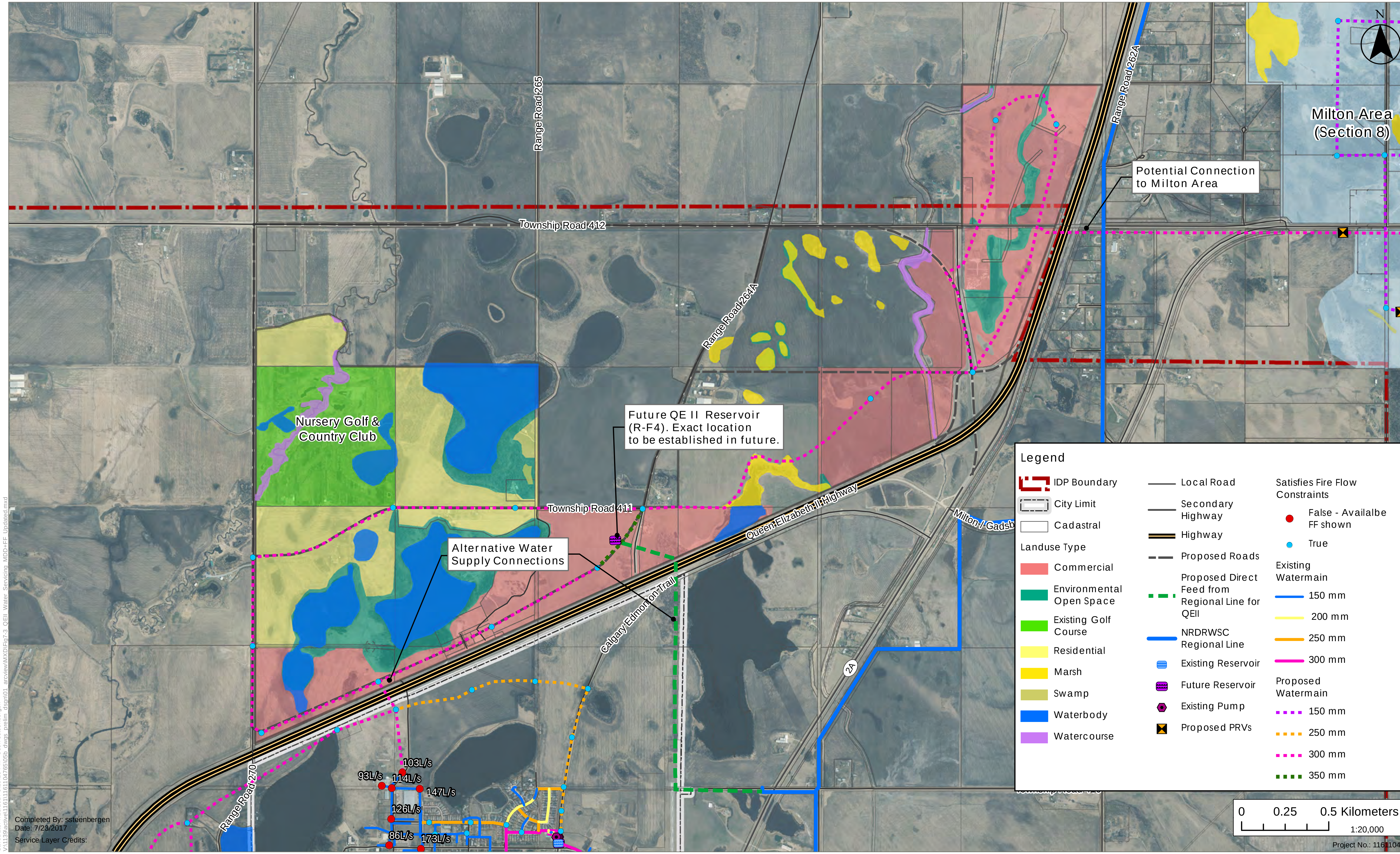

Figure 7-3 Queen Elizabeth II (QE II) North of Lacombe Water Servicing MDD plus Fire Flow

Lacombe Intermunicipal Development Plan
2017 Servicing Study

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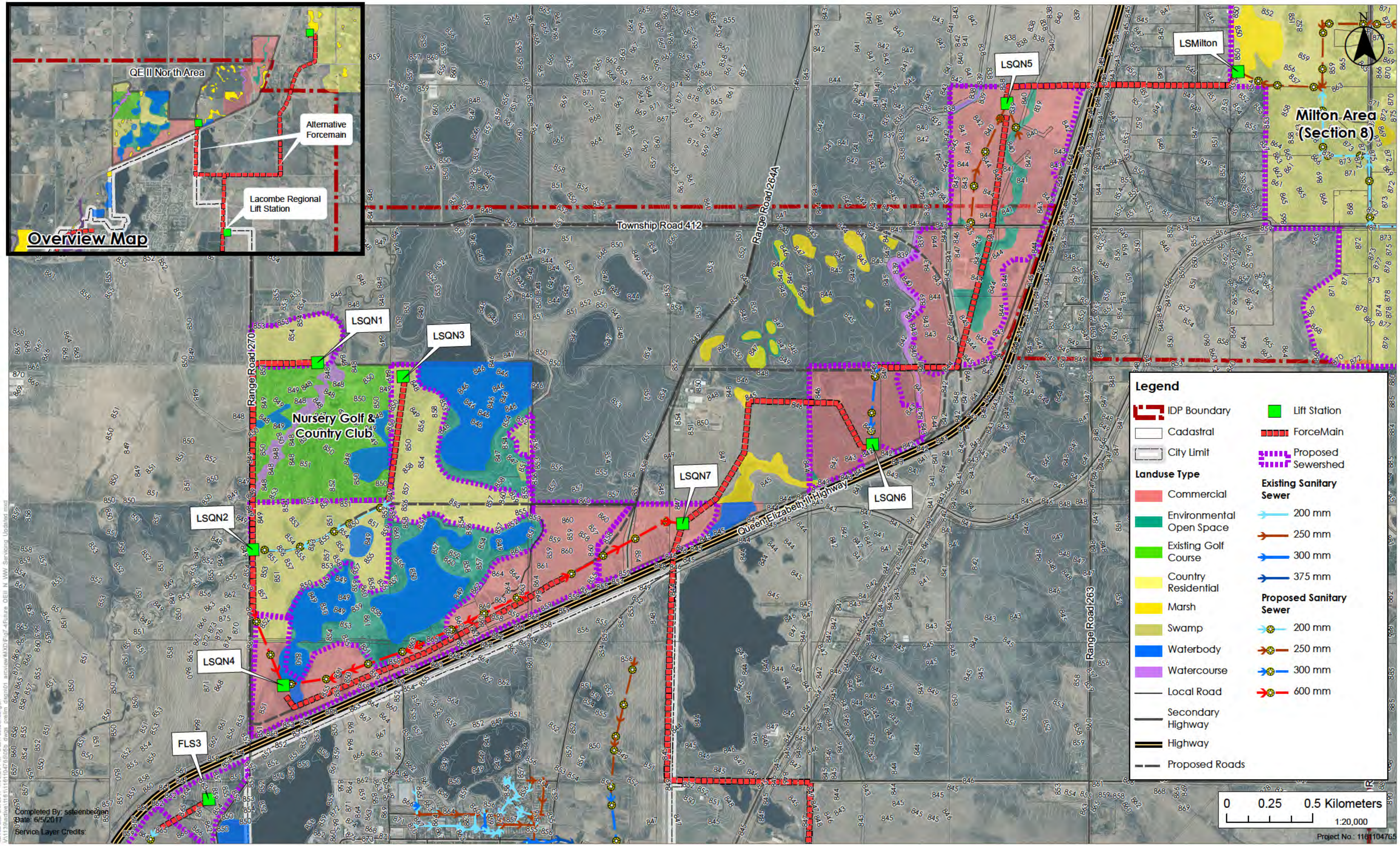

Figure 7-4 Queen Elizabeth II (QE II) North of Lacombe Wastewater Servicing System

Lacombe Intermunicipal Development Plan
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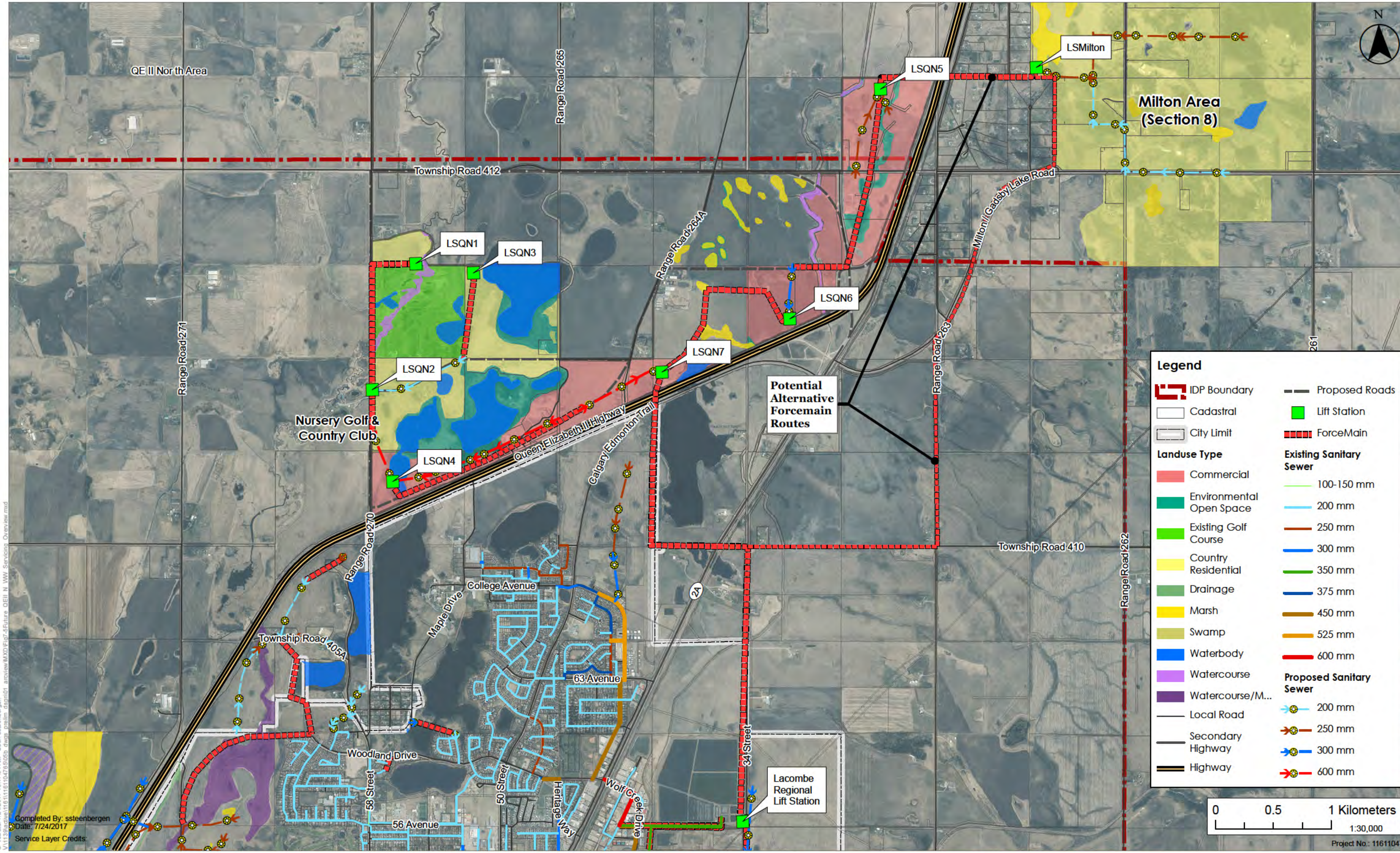

Figure 7-5 QE II North of Lacombe Wastewater Servicing System Overview

Lacombe Intermunicipal Development Plan

2017 Servicing Study

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8 MILTON AREA

8.1 PLANNING CONCEPT

The Milton Area is a proposed rural residential area located northeast of the City of Lacombe and encompasses approximately 430 ha. It is bounded on the east by Range Road 261, on the west by existing rural residential development along the Queen Elizabeth II Highway, on the north by Twp. Rd. 414, and to the south it extends 800 m south of Milton Road (Twp Rd. 412).

The land within the Milton Area is currently used for a variety of agricultural purposes, with some wetland and treed areas. There are a small number of rural residences within the area.

In January, 2008, Stantec provided Lacombe County with the "Milton Area Servicing Revised Water and Wastewater Servicing Strategy" report. This report identified the servicing requirements for developing the Milton Area as a rural residential area. For the purpose of this study, it was assumed that 1.0 acre lots would be used. The report identified the water demand and sanitary sewer requirements, and noted that the Milton Area should be connected to the regional water and sewer systems.

The purpose of this report will be to utilize the existing study data, assuming that the water and sanitary systems will be connected to the North Red Deer Regional Water Services Commission line and the North Red Deer Regional Wastewater Services Commission line.

As mentioned previously, the QE II North of Lacombe Area (Section 7) and the Milton Area have been analyzed individually. However, there is very strong potential for the two systems to be combined in some form. Depending on timing of development for both areas, there should be future consideration for sharing water reservoirs, lift stations, and forcemains.

8.2 WETLAND AREA CONSIDERATIONS

The Milton Area has remained unchanged since the 1950's and contains a mixture of agricultural lands and a high abundance of forested uplands when compared to the other four areas assessed. In general, development within this area over the historical aerial photograph record has been limited to the conversion of forested uplands to agricultural land.

Desktop wetland mapping identified 22 wet features consisting of 20 marshes, one swamp, and one waterbody. The waterbody has remained unchanged on the landscape over time and contained permanent open water in each of the historical aerial photographs reviewed. The remaining marshes and swamp are relatively unchanged throughout the historical aerial photographs reviewed.

The presence of marshes, watercourses and waterbodies in the Area East of Milton may affect development in this area and/or trigger the need for additional studies and regulatory approvals. Based on the information available, considerations and next steps related to wetlands and waterbodies are listed below:

- All marshes, swamps and waterbodies are regulated under the Water Act and will require an approval prior to modification or removal. A wetland assessment, including field classification and delineation, will be required to support the Water Act application and the proponent will need to show use of the wetland mitigation hierarchy (i.e., avoidance, minimization and replacement). It is likely that the field assessment will identify more wetlands than what was identified as part of this desktop mapping exercise due to the scale of mapping and minimum polygon size.
- The feature classified as a waterbody appears to retain permanent open water throughout the historical aerial photograph record, meaning this feature has potential to be claimed as Crown land under Section 3 of the Public Lands Act. This feature will likely need to be retained within future development and approvals under the Public Lands Act will be required for development or modifications. It is possible that wetlands in addition to the waterbody could be claimed as Crown land. Therefore, a water boundaries review should be submitted to Alberta Environment and Parks (AEP) for all swamps, marshes and waterbodies to confirm if the features are deemed Crown land under Section 3 of the Public Lands Act prior to development.
- If wetlands or waterbodies are retained in the development, site specific buffers and setbacks should be determined and implemented for pollution prevention and flood protection of adjacent lands. Additional studies should be completed to determine the pre-development volume and frequency of surface water inputs into retained wetlands and waterbodies so that this can be matched post-development and reduce potential effects on retained waterbodies from changing the hydrology (e.g., flooding, erosion, cutting off water inputs, etc.).
- The Fish and Wildlife Information Management System (FWMIS) database indicated that no fish sampling has occurred in the feature classified as a waterbody to date. However, the waterbody has the potential to be fish bearing as there have been fish recorded in waterbodies in the IDP area. If fish are present, there may be additional regulatory approvals under the Fisheries Act for development that will affect the waterbody.

It is assumed that this rural residential development will not undergo significant grading as the rolling terrain and the natural vegetation are desired to be preserved. As part of this study area, it is therefore assumed that all wetlands and marshes will be developed around and as such, they have not been factored in the developable area measurements.

8.3 WATER SERVICING

Based on the contours in **Figure 8-2**, the elevations vary from 849 metres in the northwest corner to 911 metres in the southeast corner, resulting in 62 metres of elevation variation. The portion of the northwest area that lower than 875 metres will operate in the 910 metre pressure zone, while the southeast area will need to be maintained in a new 938 metre pressure zone to meet the LOS pressure criteria. Three pressure reducing valves are required to separate the 910 metre zone from 938 metre zone.

A breakdown of the demand projections for ADD, MDD and PHD scenarios and required storage in this area is summarized in **Table 8-1**.

Table 8-1 Future Water Demand Projection – Milton Area

Design Basis	Demand Projection
ADD	4.4 l/s
MDD	8.7 l/s
PHD	17.5 l/s
*Required Storage	960 m^3

*Note that due to rural residential planned in this area, the required fire storage includes fire storage of 33 l/s for 1 hours for each pressure zone, equivalent to 238 m^3.

The proposed water distribution system consists of 150 mm watermain looped around the proposed roadway alignments, as shown in **Figure 8-2**.

In the *Milton Area Servicing Revised Water and Wastewater Servicing Strategy report (Stantec, 2008)*, it was recommended that water servicing in Milton was to be achieved through connecting to the nearby regional water line and construction of a reservoir and pumping station. Therefore, a conceptual reservoir and pump station (R-F5) is developed in the model, taking into advantage the high ground elevation, as illustrated in **Figure 8-2**. A conceptual direct feed route from the regional line is also shown in **Figure 8-2**.

Additionally, a shared reservoir between this study area and the QE II North of Lacombe Area could help ensure sufficient fire flow be provided to the east commercial land of QE II North of Lacombe area, as illustrated on **Figure 8-2**.

A summary of the modeling results for the system pressure under PHD condition and available fire flow under MDD condition are presented in **Figure 8-2** and **Figure 8-3, respectively**. All LOS criteria are satisfied according to the modeling results.

8.4 WASTEWATER SERVICING

The wastewater in the Milton subdivision is proposed to be collected by a gravity sewer collection system and then conveyed to a local lift station, with a capacity of 30 l/s, at the west of the Milton area. As shown on **Figure 7-4**, there are two potential routes in which the lift station can pump to transport the water to the Lacombe Regional Lift Station, which is currently under construction.

- The lift station can pump to the west and then south through a 4.6 km long 200 mm diameter forcemain to the LSQN7, which will further discharge into the Lacombe NRDRWWSC Regional Lift Station.
- The lift station can also pump to the south along Milton Road, Rge Rd. 263, and 34th Street. This route would be approximately 10km in length, which makes the combined routing with the QE II North Area quite attractive.

8.5 OPINION OF PROBABLE COSTS

As described earlier in this section and in Section 7 – QEII North of Lacombe, there is potential for Milton to share water and wastewater infrastructure with that area. To be financially conservative, the opinion of probable cost includes the connections to the regional water and wastewater lines independently of the QE II North area. It should be noted that due to low flows, none of the water or wastewater piping requires oversizing, and as such, would not be considered a trunk or off-site levy recoverable cost.

Table 8-2 Opinion of Probable Costs - Milton

Opinion of Probable Cost	
Water Trunk Connection to Regional System	$1,229,500
Reservoir and Pump Station	$4,000,000
Lift Station and Force Main to Regional	$5,080,000
30% Contingency and Professional Services	$3,092,850
Total Medium Term JEA and West Area Servicing	**$13,402,350**

Please refer to **Appendix B – Opinions of Probable Costs** for further details.

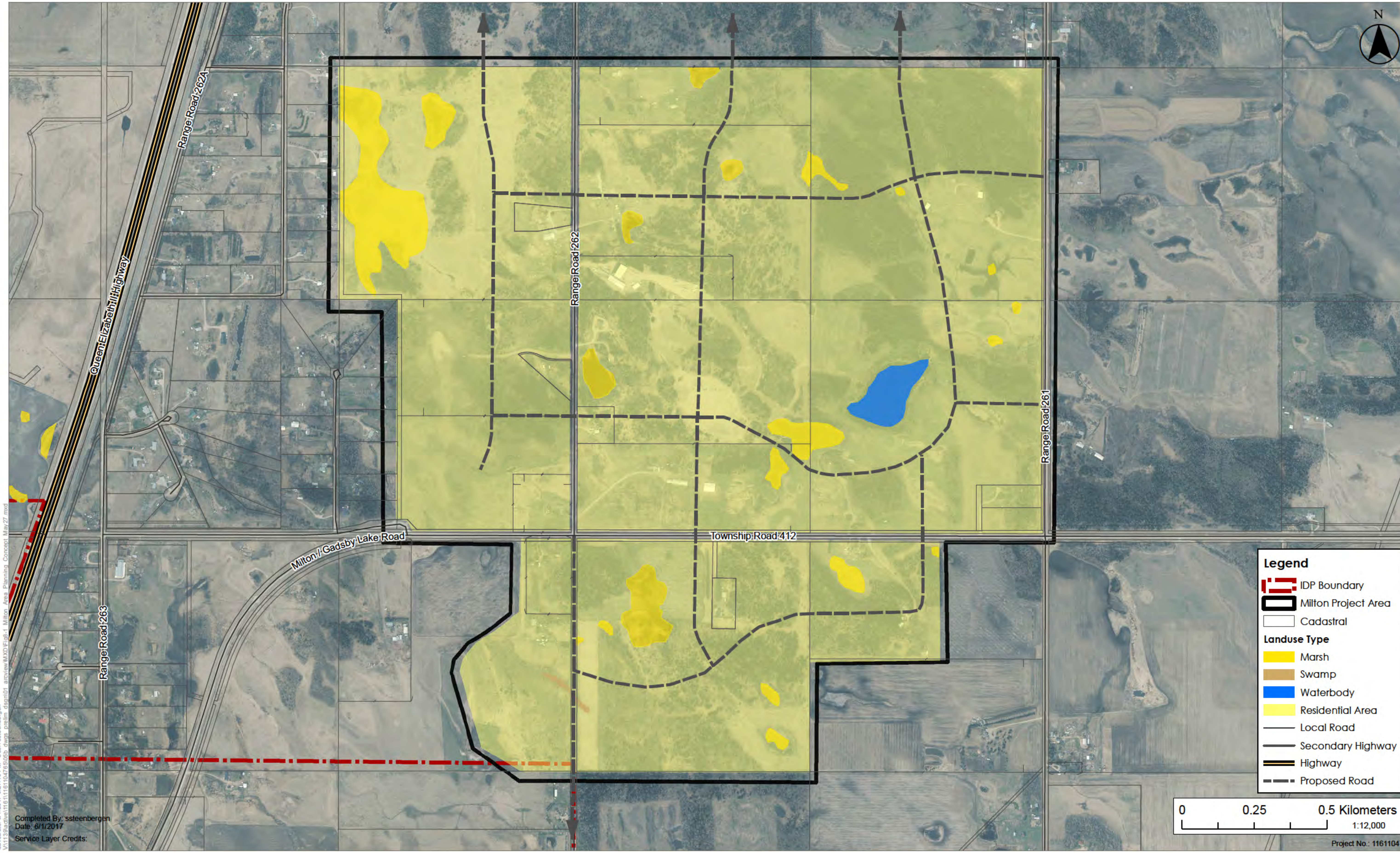

Figure 8-1 Milton Area Planning Concept

Lacombe Intermunicipal Development Plan
2017 Update Servicing Study

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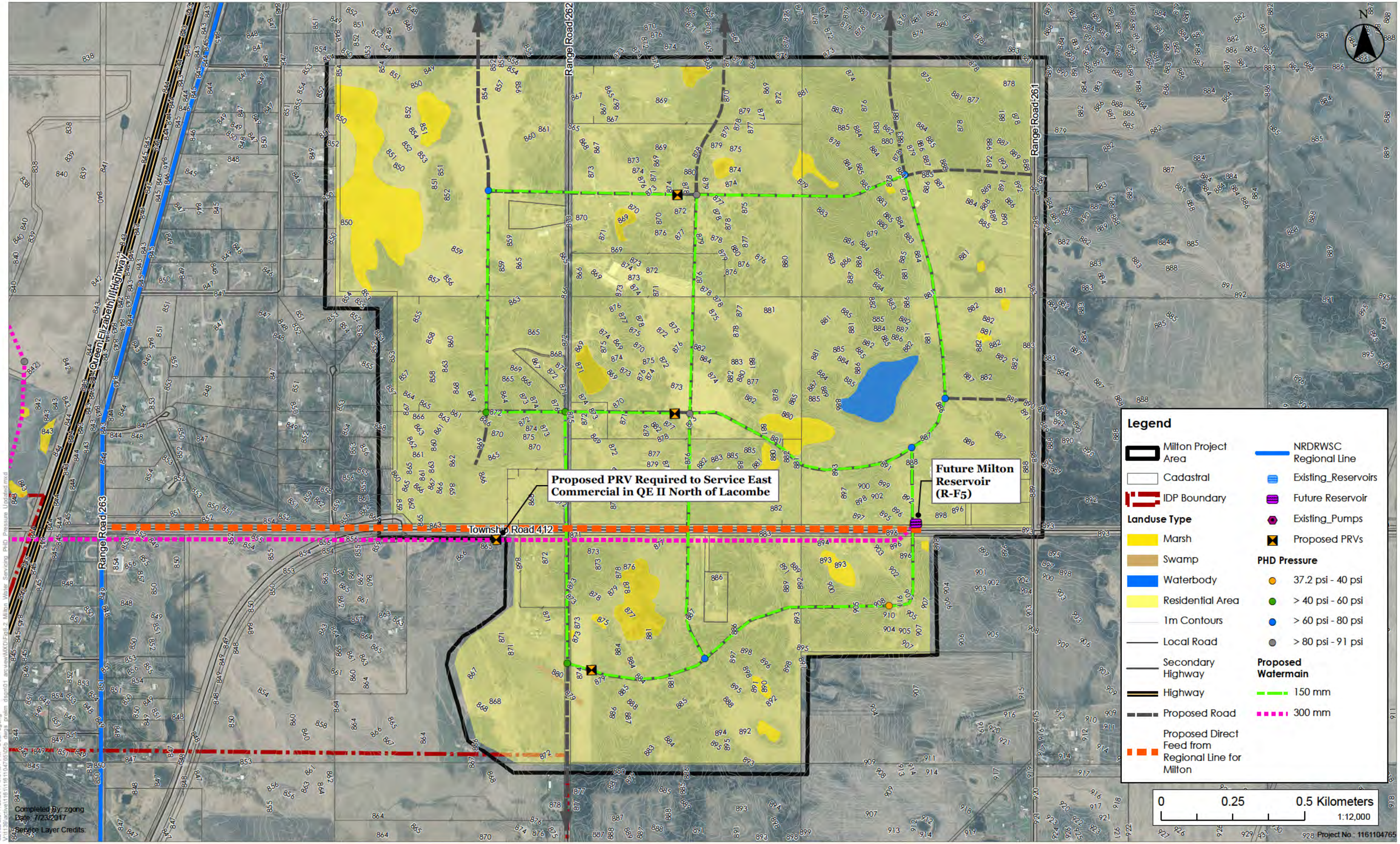

Figure 8-2 Milton Area Water Servicing PHD Pressure

Lacombe Intermunicipal Development Plan
2017 Update Servicing Study

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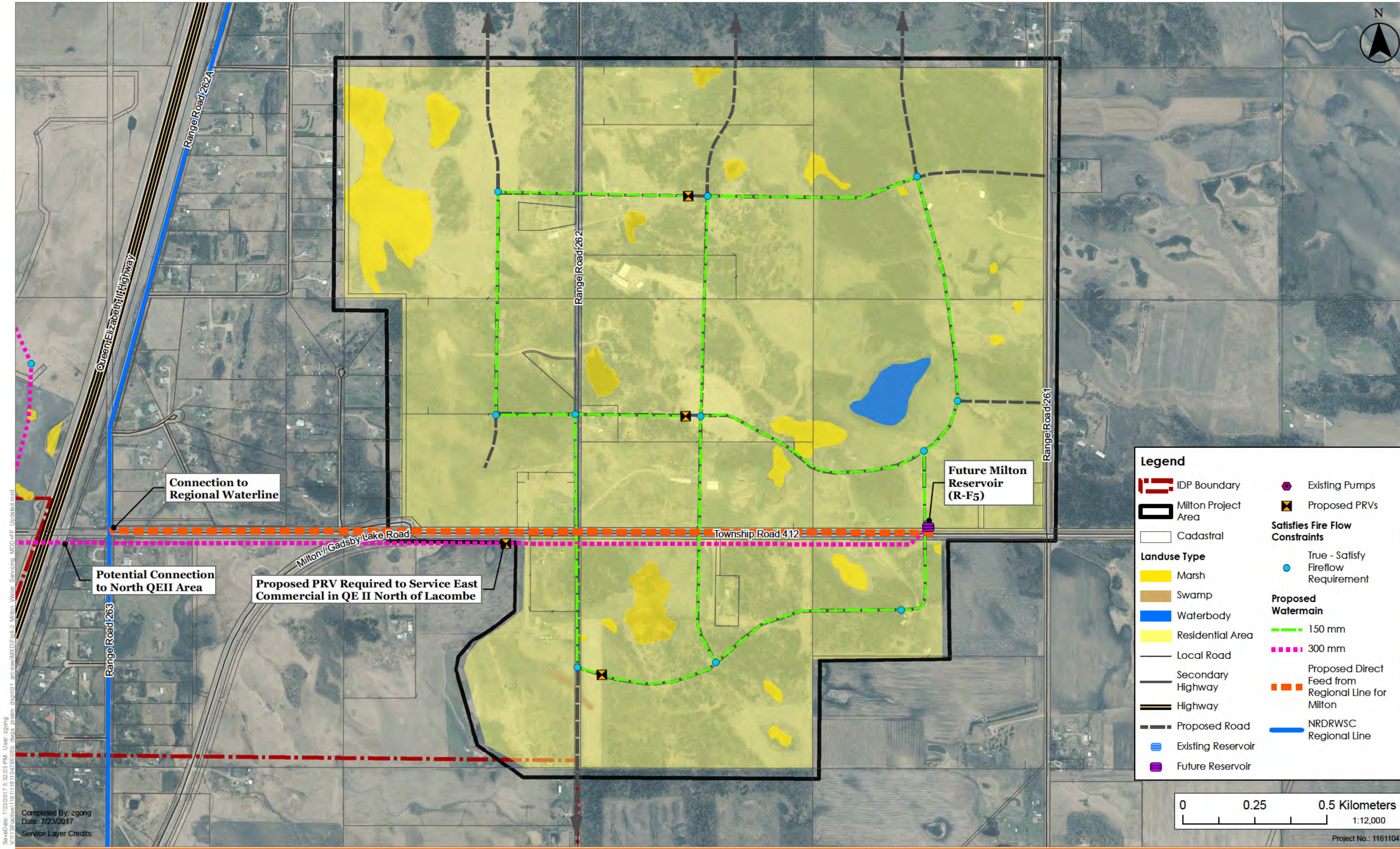

Figure 8-3 Milton Area Water Servicing MDD Plus Fire Flow

Lacombe Intermunicipal Development Plan
2017 Update Servicing Study

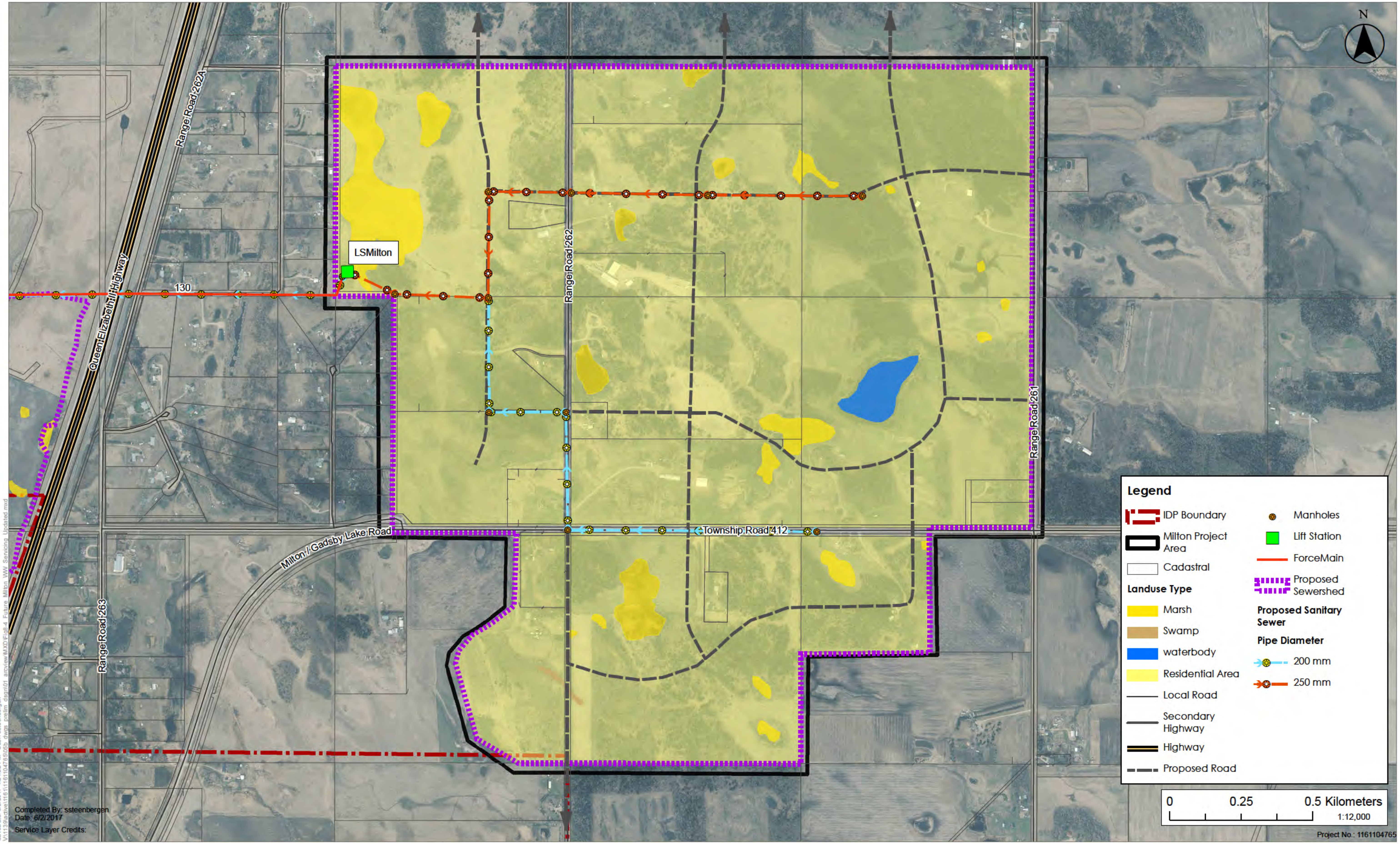

Figure 8-4 Milton Area Wastewater Servicing System

Lacombe Intermunicipal Development Plan

2017 Update Servicing Study

9 NORTH LACOMBE STORMWATER MANAGEMENT

9.1 PROJECT AREA

The North Lacombe area consist of approximately 210 ha of land within the City limits. The Queen Elizabeth II Highway forms the north boundary, Canadian University College Lands form the west boundary, existing City of Lacombe residential development form the south boundary, and Lacombe County is the east boundary. South of Henner's Pond is largely developed as residential; whereas, north and east of Henner's Pond is largely undeveloped and used for agricultural purposes.

Henner's Pond is centrally located in the west half of the North Area, and currently forms the drainage outlet for existing development. The C&E Trail roadway is located approximately 200 metres east of Henner's Pond and forms a drainage divide between the Henner's Pond and the Williams Slough catchments. Williams slough is located immediately east of the east City Limits, and Wolf Creek is located approximately 850 metres east of the east City limits. The study area topography ranges from approximately 849.4 metres at Henner's Pond, to approximately 852 metres at the drainage divide on C & E Trail, to approximately 843.4 metres at Williams Slough, and approximately 841 metres at Wolf Creek.

The purpose of this section is to provide a conceptual storm system design for the North Lacombe area as well as a preliminary design and opinion of probable cost for the North Storm Trunk, which will provide an effective outlet for Henner's Pond.

9.2 STORMWATER MANAGEMENT ANALYSIS

9.2.1 Sub-catchment Delineation

The proposed sub-catchments for the area were delineated based upon the DEM topographical data that was collected in 2016, and as shown in **Figure 9-1**. The drainage paths and sub-catchment boundaries are essentially the same for both pre and post development conditions; therefore, **Figure 9-1** can be used to reference both conditions.

The North Area consist of approximately 209.8 ha of land found within the City limits. Henner's Pond is centrally located, and currently forms the drainage outlet for existing development. Wolf Creek is located approximately 850 metres east of the east City boundary, and drains from south to north. As will be discussed in latter report sections, a storm trunk is proposed to drain east from Henner's Pond to Wolf Creek.

The hydrologic analysis methods where previously discussed in Section 2.7, and **Table 9-1** below provides the hydrologic parameters used for and resulting from the single event PCSWMM computer modeling of the North Area. These modeling results were further used to estimate the required pond storage volume for the 24 hour, 1:100 year design storm, and also for preliminary design of the North Area Storm Trunk. The PCSWMM modeling data files can be provided upon request.

Table 9-1 Sub-catchment Hydrologic Characteristics

Catchment Area	Catchment Area Description	Design Rainfall Event Return Period and Duration	Rainfall Amount (mm)	Catchment Area (ha)	% Imperv.	Runoff Depth (mm)
SC1	Residential	1:100 yr, 24 hr	103.1	39.9	55	62.41
SC2	Henner's Pond	1:100 yr, 24 hr	103.1	18.3	85	85.75
SC3	Residential/Commercial	1:100 yr, 24 hr	103.1	68.5	70	73.8
SC4	Residential/Commercial	1:100 yr, 24 hr	103.1	32.9	70	74.19
SC6	Residential/Industrial	1:100 yr, 24 hr	103.1	28.7	60	67.57
SC7	Residential/Industrial	1:100 yr, 24 hr	103.1	21.4	60	65.87
SC8 Williams Slough	Pre-development/ Agriculture	1:100 yr, 24 hr	103.1	114.2	40	43.51

9.2.2 Regional Storm Ponds

Conceptual designs for the stormwater management facilities required for future development within the North Area is explored. **Figure 9-1** provides the conceptual location of the proposed stormwater management facilities.

Table 9-2 below summarizes the sub-catchment area, permissible release rate, proposed active storage volume, approximate facility footprint, and preliminary design elevations, for each of the stormwater facilities that were modeled for the North Area.

Table 9-2 Proposed Regional Storm Pond Characteristics

Pond #	Serviced Area (ha)	Permissible Discharge Rate (l/s)	Active Storage Volume (m^3)	Approximate Facility Foot Print (ha)	Preliminary NWL Elevation (m)	Preliminary HWL Elevation (m)	Opinion of Probable Pond Cost[1] ($)
4	32.90	65.8	20,900	2.64	844.00	845.50	$658,000
6	28.70	57.4	16,500	2.18	846.00	847.50	$520,000
7	21.40	42.8	11,900	1.80	846.50	848.00	$375,000

1) Opinion of probable pond costs includes construction costs, maintenance period costs, 20% contingency, and 15% for engineering and construction management.

9.2.3 North Storm Trunk

As previously mentioned, a storm trunk is proposed to drain from Henner's Pond to Williams Slough, and then Williams Slough will be made to drain to Wolf Creek though an open channel. The North Storm Trunk within City limits is proposed to have a catchment area of approximately 177 ha, and at 2 L/s/ha this equates to a design flow rate of approximately 354 L/s. Beyond City limits, the storm trunk catchment area expands to include sub-catchments SC4 and SC8, for a permissible design flow rate of 325 ha x 2.0 L/s/ha = 650 L/s. In reality the proposed storm ditch located between Williams Slough and Wolf Creek will only convey approximately 320 L/s for the 1:100 year design storm event, and this is because it is essentially unavoidable for Williams Slough to provide a certain amount of attenuation.

The Henner Heights Outline Plan (Al-Terra 2015) proposed that Henner's Pond be used to provide stormwater attenuation for the development in this area. Sediment removal forebays were also proposed to mitigate the transport of sediment into Henner's Pond. Correspondence between UMA and AEP in 2001 suggests that utilizing Henner's Pond for stormwater management is a viable option; however, we would like to caution that it is not uncommon for a regulatory authority to change its position after such a significant amount of time has elapsed. This study assumes that Henner's Pond can be utilized for stormwater attenuation, but regardless, the required conveyance capacity and sizing of the proposed North Storm trunk would essentially be the same whether stormwater attenuation is provided in Henner's Pond or manmade storm ponds.

The results of the 1:100 year design storm event modeling for Henner's Pond are provided in **Table 9-3** below. The results suggest that the Henner's Pond water surface elevation will rise approximately 0.48 m for the 1:100 year event, and this is believed to be a reasonable level of fluctuation.

Table 9-3 Henner's Pond Characteristics

Description	Elevation (m)	Active Ponding Depth (m)	Surface Area (m^2)
NWL	849.40	0.00	145,000
Elevated Stage	850.00	0.60	166,000
Modeled 1:100 Year Results	849.88	0.48	

The proposed North Storm trunk varies from 525 mm to 675 mm in diameter between Henner's Pond and Williams Slough. Please see **Figure 9-2** and **Figure 9-3** for plan/profile drawings of the preliminary design completed for the proposed North Storm Trunk. Please note that the shown storm trunk alignment is conservative in terms of length, but that the ultimate alignment will likely be selected to avoid the centrally located wetland. The Crown owns the permanent and naturally occurring bed and shore of Williams Slough under Section 3 of the Public Lands Act. Williams Slough is not proposed to be used for stormwater management of developed lands;

however, it is proposed to be used for conveyance between the North Storm Trunk outlet and Wolf Creek located to the east. A 185 metre long riprap lined trapezoidal channel is proposed to provide an outlet from Williams Slough to Wolf Creek located immediately to the east. A basic weir structure is proposed near the west end of the trapezoidal channel to ensure a consistent normal water level elevation.

The results of the 1:100 year design storm event modeling for Williams Slough are provided in **Table 9-4** below. The results suggest that the Williams Slough water surface elevation will rise approximately 0.19 m for the 1:100 year event, and this is believed to be a reasonable level of fluctuation.

Table 9-4 Williams Slough Characteristics

Description	Elevation (m)	Active Ponding Depth (m)	Surface Area (m^2)
NWL	843.40	0.00	402,000
Elevated Stage	843.80	0.40	450,000
Modeled 1:100 Year Results	843.59	0.19	

Sub-catchment area 4 and its associated stormwater management facility is envisioned to discharge to the north end of Williams Slough, as it is not considered practical to have it drain south to the proposed north storm trunk. Sub-catchment area 6 and its associated stormwater management facility can easily be made to drain to the proposed North Storm Trunk. Sub-catchment area 7 and its associated stormwater management facility is envisioned to most likely drain east under the Lacombe Airport runway to the airport stormwater management facility which subsequently drains east to Wolf Creek. However, there is also the potential for sub-catchment area 7 to be drained north to the proposed North Storm Trunk. Therefore, in the interest of providing a flexible storm trunk design, this study assumes that sub-catchment 7 will be routed north to be intercepted by the North Storm Trunk.

9.3 OPINION OF PROBABLE COSTS

As detailed in **Appendix B Opinions of Probable Costs,** the total cost for the trunk is approximately $1,190,000, including contingency and professional services. The total cost for the ditch is approximately $270,000, including contingency and professional services.

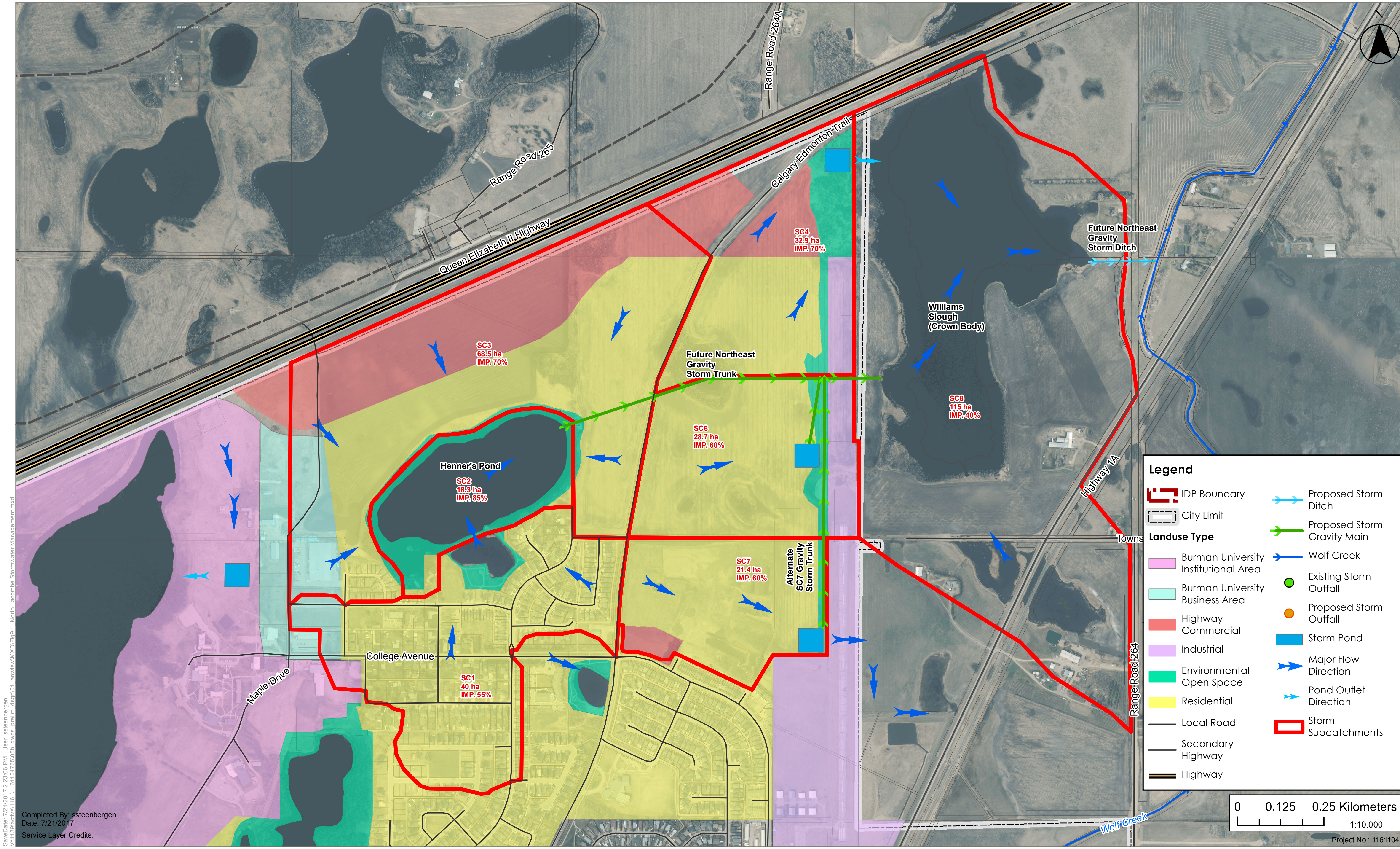

Figure 9-1 North Lacombe Stormwater Management

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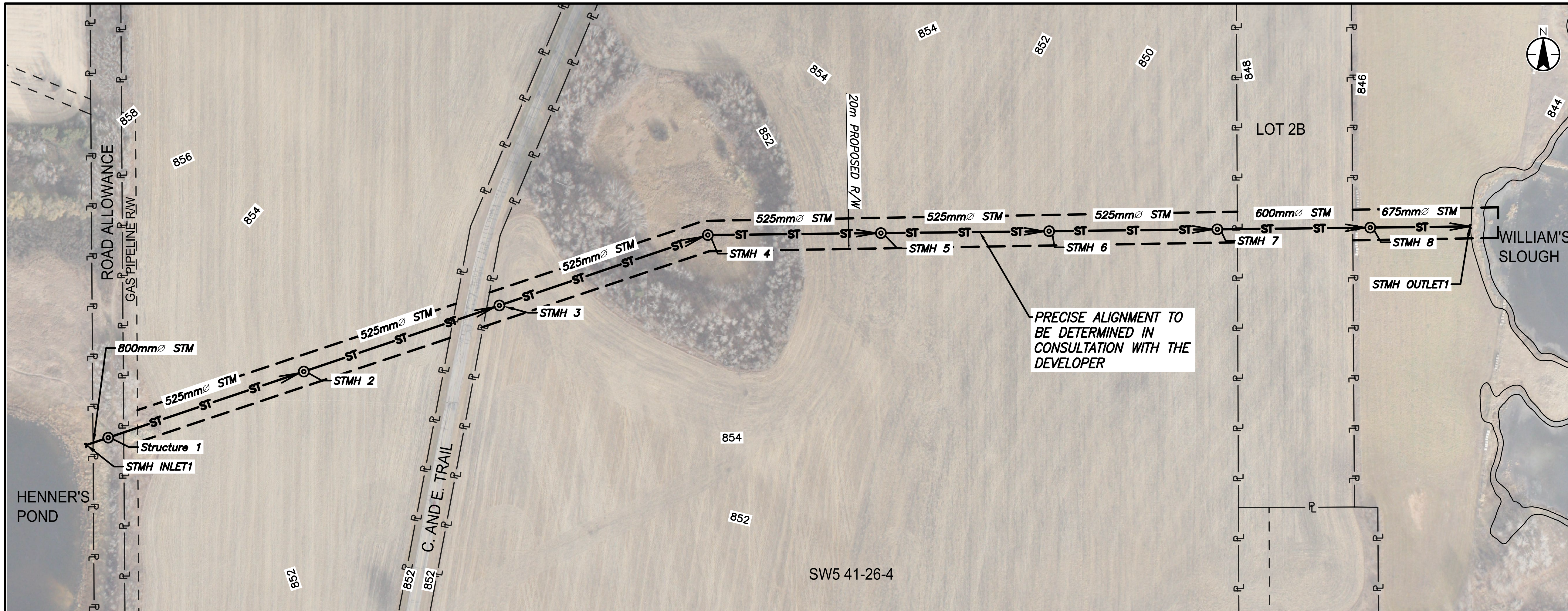

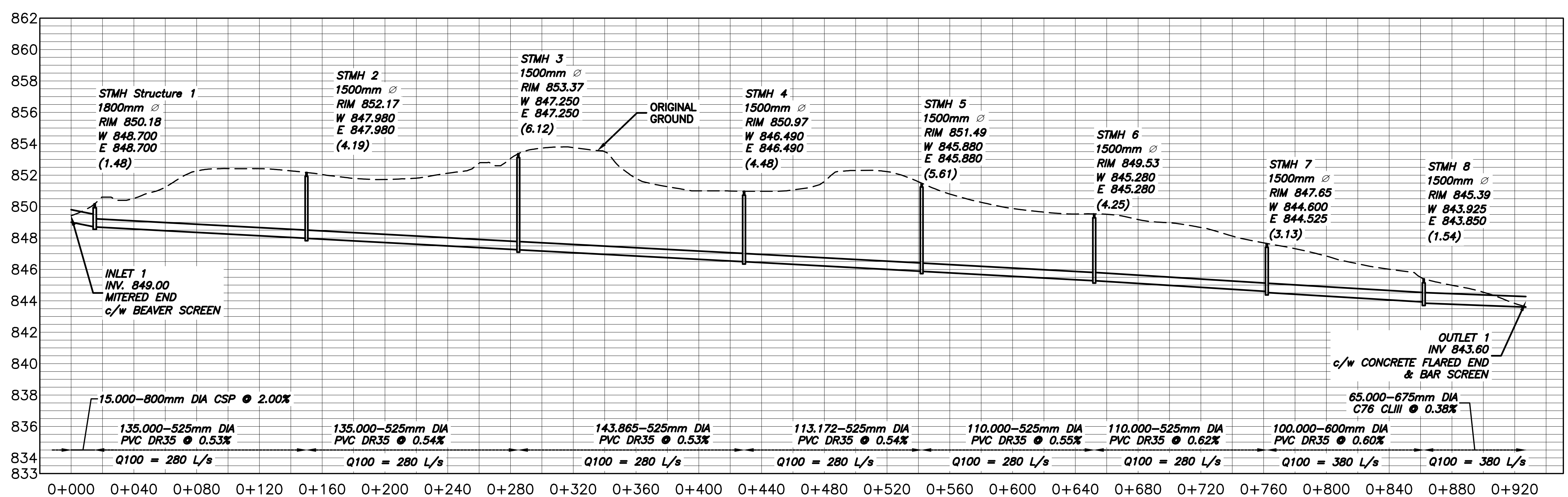

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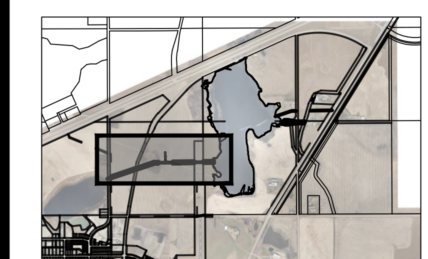
Notes

1. CONTOURS REPRESENT LIDAR DATA. TOPOGRAPHIC SURVEY TO BE COMPLETED AT TIME OF DETAILED DESIGN.

Key Plan



Revision	By	Appd.	YY.MM.DD
E —	—	—	—
D —	—	—	—
C —	—	—	—
B —	—	—	—
A ISSUED FOR REPORT	MM	BD	16.12.01
Issued	By	Appd.	YY.MM.DD

File Name: 04765c-201.dwg | Dwn. | Chkd. | Dsgn. | YY.MM.DD

Permit-Seal

Client/Project

City of Lacombe — Lacombe County

LACOMBE INTERMUNICIPAL DEVELOPMENT
2017 SERVICING STUDY
LACOMBE, AB

Title

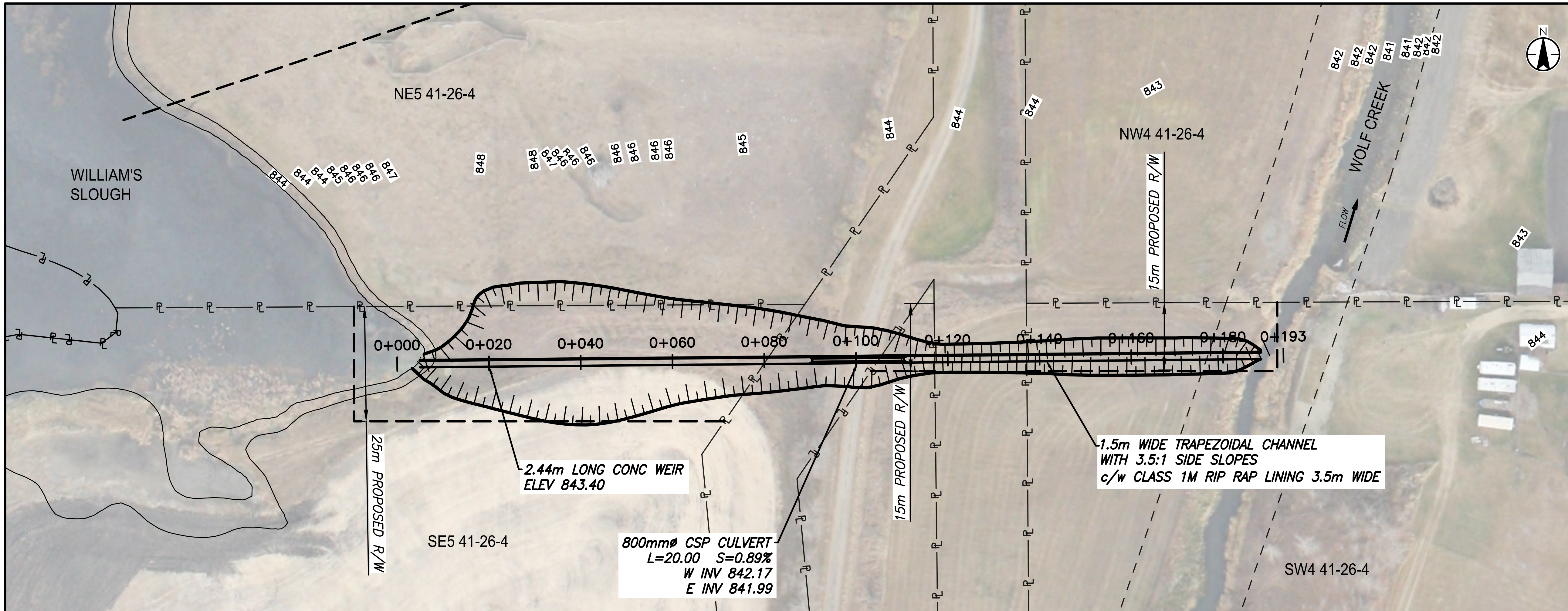
NORTH LACOMBE STORMWATER MANAGEMENT
PLAN & PROFILE STA 0+000 TO 0+950

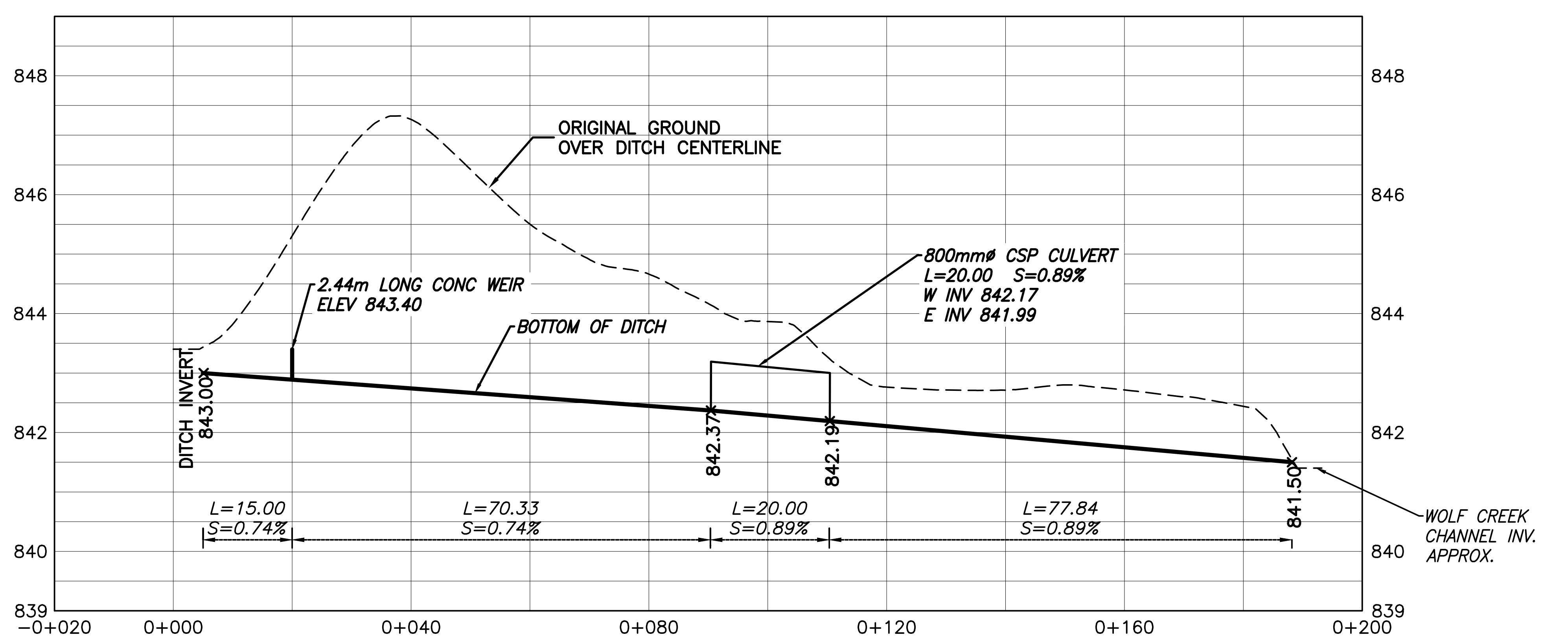
Project No. 1161104765

Scale 1:3000H 1:300V

Drawing No. 9-1

Revision 0





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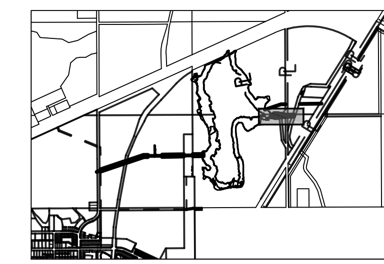
Notes

1. CONTOURS REPRESENT LIDAR DATA. TOPOGRAPHIC SURVEY TO BE COMPLETED AT TIME OF DETAILED DESIGN.
2. DITCH CUT VOLUME – 3830m³
   DITCH DISTURBANCE AREA – 2763m²

Key Plan



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Permit-Seal

Client/Project

CITY OF LACOMBE
LACOMBE COUNTY

LACOMBE INTERMUNICIPAL DEVELOPMENT
2017 SERVICING STUDY

LACOMBE, AB

Title

NORTH LACOMBE STORMWATER
MANAGEMENT
PLAN & PROFILE STA 1+000 TO 1+200

Project No. 1161104765

Scale 1:1000H 1:100V

Drawing No. 9-2

Revision 0

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ORIGINAL SHEET - ANSI B

APPENDIX A

Stormwater Management

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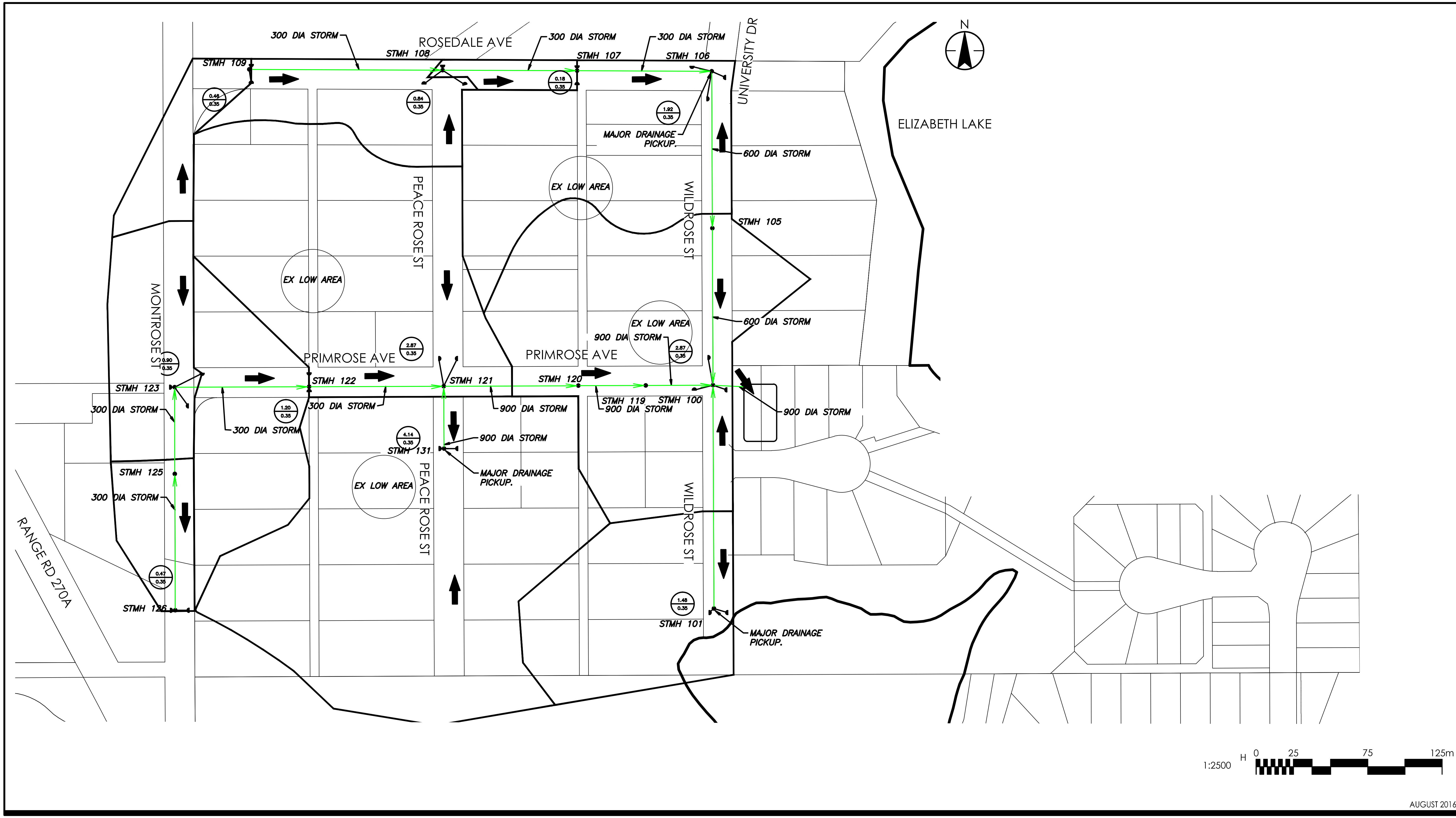


Legend

LACOMBE COUNTY & CITY OF LACOMBE
LACOMBE IDP SERVICING STUDY

Lacombe, AB

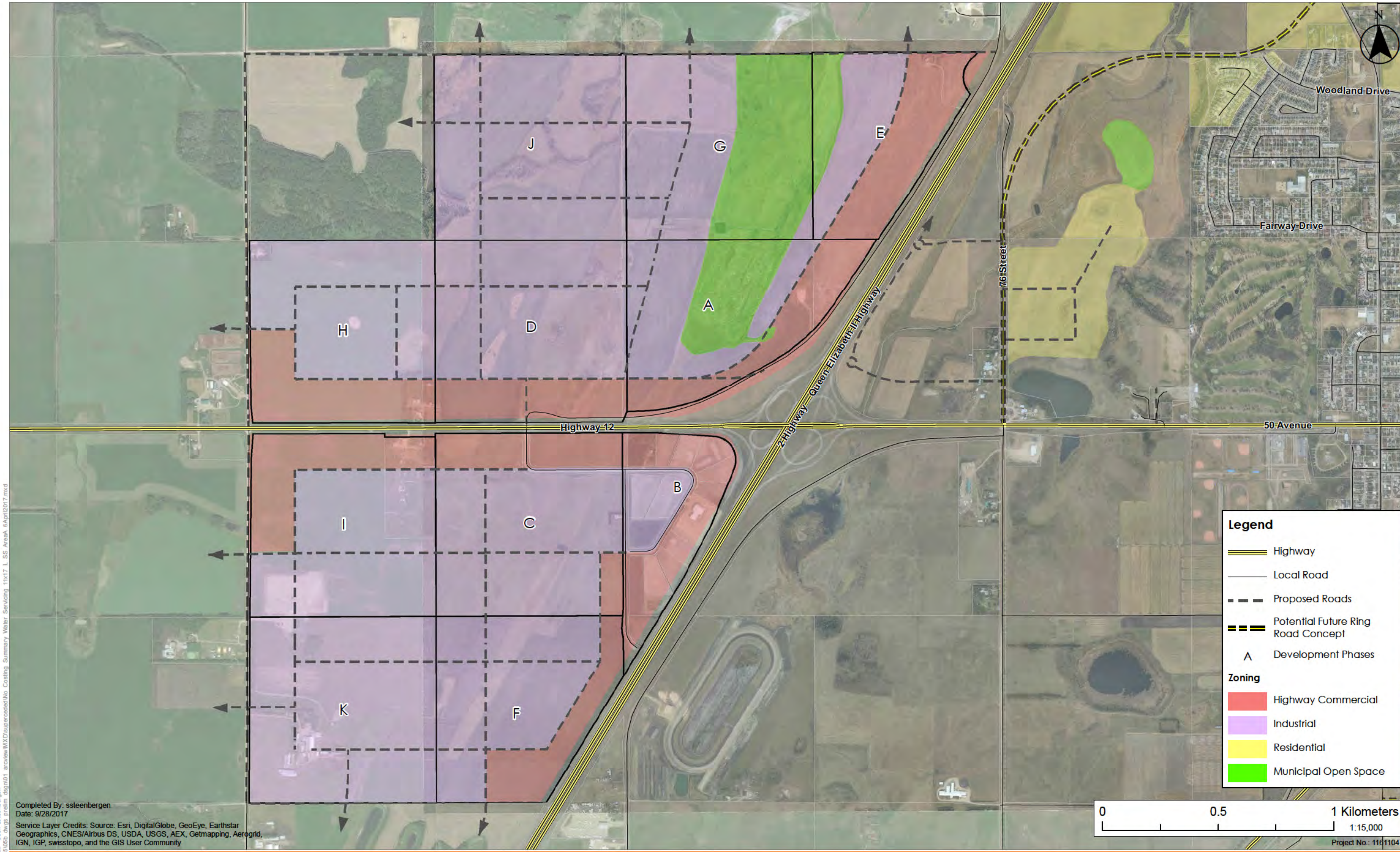
ROSEDALE WATER & WASTEWATER SERVICING-GRAVITY SEWER ALTERNATIVE STORM DESIGN

Stantec

1100 - 4900 50th Street
Red Deer AB Canada T4N 1X7
www.stantec.com

APPENDIX B

Opinions of Probable Costs



Subject Areas

Intermunicipal Development Plan

Lacombe County

City of Lacombe

Lacombe Intermunicipal Development Plan

Joint Economic Area - Water and Wastewater Infrastructure Costs Summary

November 15, 2017

ID	Legal Quarter Section	Water Trunks	Wastewater Trunks	Lift Station Phase 1 (Short & Medium Term)	Lift Station Phase 2 (Connection to Regional)	Reservoir and Pump Station	Total
Medium Term Water and Wastewater Future Infrastructure Costs							
A	SW26 40-27-4 & Portion of SE26 40-27-4	$ 1,159,125	$ 1,115,870	-	-	-	$ 2,274,995
B	NW23 40-27-4	$ 253,500	$ 461,400	$ 3,375,000	-	-	$ 4,089,900
C	NE22 40-27-4	$ 690,875	$ 178,860	-	-	-	$ 869,735
D	SE 27-40-27-4	$ 753,250	$ 178,860	-	-	-	$ 932,110
E	NE26 40-27-4	$ 189,750	$ 103,920	-	-	-	$ 293,670
F	SE22 40-27-4	$ 1,504,250	$ 178,860	-	-	-	$ 1,683,110
G	NW26 40-27-4	-	-	-	-	-	$ -
H	SW27 40-27-4	-	-	-	-	-	$ -
I	NW22 40-27-4	-	-	-	-	-	$ -
J	NE27 40-27-4	-	-	-	-	-	$ -
K	SW22 40-27-4	$ 569,250	$ 137,880	-	-	-	$ 707,130
	Total	**$ 5,120,000**	**$ 2,355,650**	**$ 3,375,000**	**$ -**	**$ -**	**$ 10,850,650**
				30% Contingency and Professional Services			$ 3,255,195.0
		(50% of $11,668,800) -->		City of Lacombe Infrastructure (July 22, 2016 Memo)			$ 5,834,400
				Total Medium Term JEA Trunk Infrastructure Cost			**$ 19,940,245**

ID	Legal Quarter Section	Water Trunks	Wastewater Trunks	Lift Station Phase 1 (Short & Medium Term)	Lift Station Phase 2 (Connection to Regional)	Reservoir and Pump Station	Total
Long Term Future Water and Wastewater Infrastructure Costs							
A	SW26 40-27-4 & Portion of SE26 40-27-4	-	-	-	-	-	$ -
B	NW23 40-27-4	-	-	-	$ 3,340,000	-	$ 3,340,000
C	NE22 40-27-4	-	-	-	-	-	$ -
D	SE 27-40-27-4	-	-	-	-	$ 9,000,000	$ 9,000,000
E	NE26 40-27-4	-	-	-	-	-	$ -
F	SE22 40-27-4	-	-	-	-	-	$ -
G	NW26 40-27-4	$ 379,500	$ 207,840	-	-	-	$ 587,340
H	SW27 40-27-4	$ 399,250	$ 137,880	-	-	-	$ 537,130
I	NW22 40-27-4	$ 589,000	$ 137,880	-	-	-	$ 726,880
J	NE27 40-27-4	$ 526,750	$ 137,880	-	-	-	$ 664,630
K	SW22 40-27-4	-	-	-	-	-	$ -
	Total	**$ 1,894,500**	**$ 621,480**	**$ -**	**$ 3,340,000**	**$ 9,000,000**	**$ 14,855,980**
				30% Contingency and Professional Services			$ 4,456,794.0
				Total JEA Trunk Infrastructure Costs			**$ 19,312,774**

Note

As per the memo dated January 6, 2017, the total estimated serviceable area without a reservoir and pump station and the long term future wastewater connection is 323 Ha (0.05 L/s/Ha) . It should be noted that the higher elevated portions of quarter sections C, D, and K may not be serviceable until the reservoir and pump station are constructed. That area is approximately 60 Hectares.

Medium Term Future Infrastructure Costs	
Total Area (Ha)	347
Net Developable Area (Ha)	258
Total Cost	**$ 19,940,245**
Cost per Developable Ha	**$ 77,288**

Long Term Future Infrastructure Costs	
Total Area (Ha)	286
Net Developable Area	212
Total Cost	**$ 19,312,774**
Cost per Developable Ha	**$ 91,098**

Total Infrastructure Costs	
Total Area (Ha)	633
Net Developable Area	470
Total Cost	**$ 39,253,019**
Est. Off-site Levies ($/Ha)	**$ 83,517**

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Lacombe Intermunicipal Development Plan

Joint Economic Area - Storm Infrastructure Costs Summary

November 15, 2017

Medium Term Future Storm Infrastructure Costs		
ID	**Legal Quarter Section**	**Stormwater Trunks**
A	SW26 40-27-4 & Portion of SE26 40-27-4	$ 1,486,500
B	NW23 40-27-4	$ 81,280
C	NE22 40-27-4	$ 93,280
D	SE 27-40-27-4	$ 317,600
E	NE26 40-27-4	-
F	SE22 40-27-4	$ 1,263,820
G	NW26 40-27-4	-
H	SW27 40-27-4	-
I	NW22 40-27-4	-
J	NE27 40-27-4	-
K	SW22 40-27-4	$ 426,520
	Total	**$ 3,669,000**
	30% Contingency and Professional Services	$ 1,100,700
		$ 4,769,700

Long Term Future Storm Infrastructure Costs		
ID	**Legal Quarter Section**	**Stormwater Trunks**
A	SW26 40-27-4 & Portion of SE26 40-27-4	-
B	NW23 40-27-4	-
C	NE22 40-27-4	-
D	SE 27-40-27-4	-
E	NE26 40-27-4	-
F	SE22 40-27-4	-
G	NW26 40-27-4	-
H	SW27 40-27-4	$ 264,400
I	NW22 40-27-4	$ 426,520
J	NE27 40-27-4	-
K	SW22 40-27-4	-
	Total	**$ 690,920**
	30% Contingency and Professional Services	$ 207,276
		$ 898,196

Medium Term Future Storm Infrastructure Costs	
Total Area (Ha)	317
Net Developable Area (Ha)	234
Total Cost	**$ 4,769,700**
Cost per Developable Ha (Excludes Quarter Section B)	**$ 20,383.33**

Long Term Future Infrastructure Costs	
Total Area (Ha)	286
Net Developable Area	212
Total Cost	**$ 898,196**
Cost per Developable Ha	**$ 4,236.77**

Total Infrastructure Costs	
Total Area (Ha)	603
Net Developable Area	446
Total Cost	**$ 5,667,896.00**
Est. Off-site Levies ($/Ha)	**$ 12,708.29**

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Lacombe Intermunicipal Development Plan

Joint Economic Area - Off-Site Levy Rate Summary

November 15, 2017

Medium Term Off-Site Levy Rates				
ID	**Legal Quarter Section**	**Water and Wastewater**	**Stormwater***	**Total**
A	SW26 40-27-4 & Portion of SE26 40-27-4	$ 77,288	$ 20,383	$ 97,671
B	NW23 40-27-4	$ 77,288		$ 77,288
C	NE22 40-27-4	$ 77,288	$ 20,383	$ 97,671
D	SE 27-40-27-4	$ 77,288	$ 20,383	$ 97,671
E	NE26 40-27-4	$ 77,288	$ 20,383	$ 97,671
F	SE22 40-27-4	$ 77,288	$ 20,383	$ 97,671
G	NW26 40-27-4			$ -
H	SW27 40-27-4			$ -
I	NW22 40-27-4			$ -
J	NE27 40-27-4			$ -
K	SW22 40-27-4	$ 77,288	$ 20,383	$ 97,671

* $81,280 cost for storm trunk in quarter section B to be spread among all Medium Term Development, except for Quarter Section B, which is already developed ($81,280 / 220 ha remaining = $370/ha).

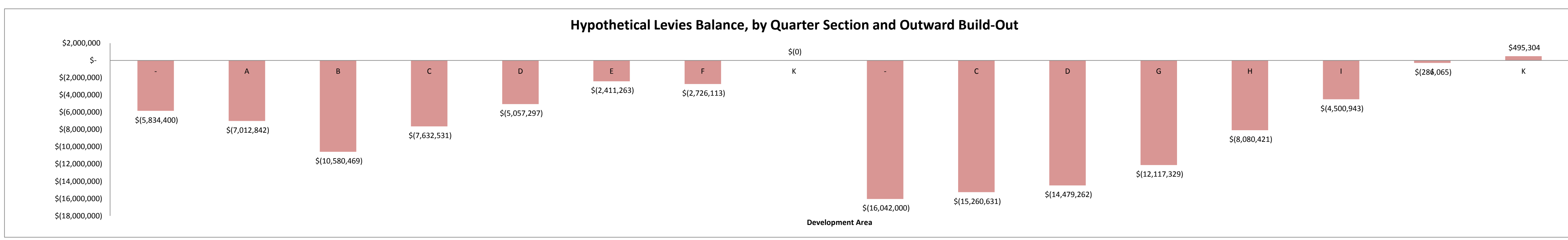
Long Term Off-Site Levy Rates				
ID	**Legal Quarter Section**	**Water and Wastewater**	**Stormwater**	**Total**
A	SW26 40-27-4 & Portion of SE26 40-27-4			$ -
B	NW23 40-27-4			$ -
C	NE22 40-27-4	$ 91,098	$ 4,237	$ 95,335
D	SE 27-40-27-4	$ 91,098	$ 4,237	$ 95,335
E	NE26 40-27-4			$ -
F	SE22 40-27-4			$ -
G	NW26 40-27-4	$ 91,098	$ 4,237	$ 95,335
H	SW27 40-27-4	$ 91,098	$ 4,237	$ 95,335
I	NW22 40-27-4	$ 91,098	$ 4,237	$ 95,335
J	NE27 40-27-4	$ 91,098	$ 4,237	$ 95,335
K	SW22 40-27-4	$ 91,098	$ 4,237	$ 95,335

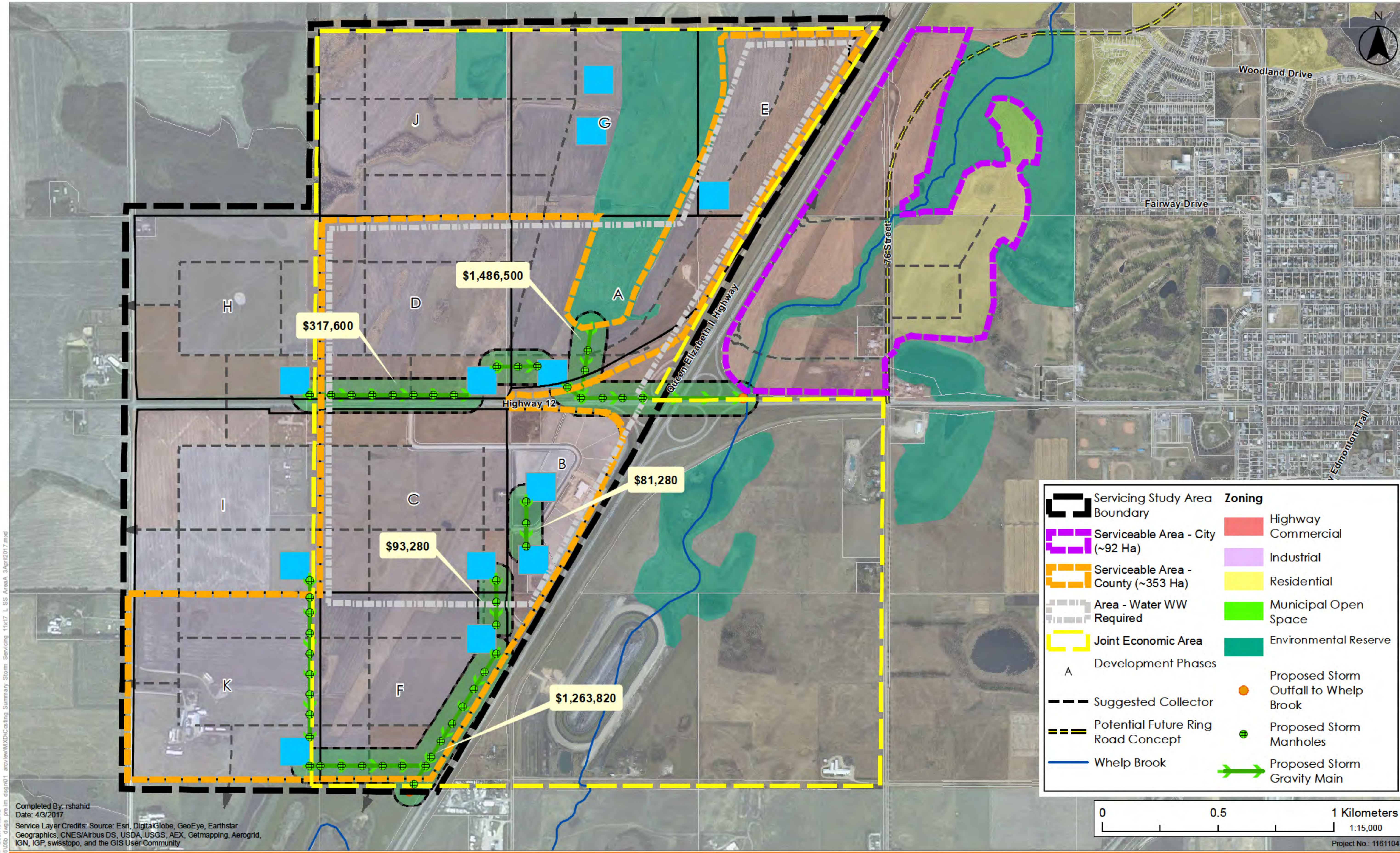
Joint Economic Area West of Lacombe - Off-Site Levy Cash Flow Projection
1161104765
November 15, 2017

	Off-Site Levies Rates (Sanitary and Water)	Off-Site Levies Rates (Storm)	Gross Area (Ha)	Net Area (Ha)
Medium Term	$ 77 288	$ 20 383	347	258
Long Term	$ 91 098	$ 4 237	286	212

Infrastructure Item	Development Area																	Total
	Medium Term Development								Long Term Development									
	-	A	B	C	D	E	F	K	-	C	D	G	H	I	J	K		
	Initial Connection to City Water and Wastewater	SW26 40-27-4 & Portion of SE26 40-27-4	NW23 40-27-4	NE22 40-27-4 (Lower Elevated Portion)	SE 27-40-27-4 (Lower Elevated Portion)	NE26 40-27-4	SE22 40-27-4	SW22 40-27-4	Reservoir and Pump Station, Lift Station Upgrades	NE22 40-27-4 (Higher Elevated Portion)	SE 27-40-27-4 (Higher Elevated Portion)	NW26 40-27-4	SW27 40-27-4	NW22 40-27-4	NE27 40-27-4	SW22 40-27-4		
Gross Area (Ha)	0	56	30	54	54	43	56	54	0	10	10	64	64	64	64	10		633
Developable Area (Subtract Mr ER and Road Right-ofWay) (Ha)	0	38	24	43	43	31	36	43	0	8	8	32	52	52	52	8		470
	Projected Future Costs, By Location																	
City of Lacombe Water and Wastewater Connections	$ 4 488 000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 4 488 000
Water Trunks	$ -	$ 1 159 125	$ 253 500	$ 690 875	$ 753 250	$ 189 750	$ 1 504 250	$ 569 250	$ -	$ -	$ -	$ 379 500	$ 399 250	$ 589 000	$ 526 750	$ -		$ 7 014 500
Wastewater Trunks	$ -	$ 1 115 870	$ 461 400	$ 178 860	$ 178 860	$ 103 920	$ 178 860	$ 137 880	$ -	$ -	$ -	$ 207 840	$ 137 880	$ 137 880	$ 137 880	$ -		$ 2 977 130
Lift Station Phase 1 - Intermediate Term	$ -	$ -	$ 3 375 000	$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -	$ -	$ -			$ 3 375 000
Lift Station Phase 2 - Long Term	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 3 340 000	$ -	$ -	$ -	$ -	$ -	$ -			$ 3 340 000
Reservoir and Pump Station	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 9 000 000	$ -	$ -	$ -	$ -	$ -	$ -			$ 9 000 000
Stormwater Trunks	$ -	$ 1 486 500	$ 81 280	$ 93 280	$ 317 600	-	$ 1 263 820	$ 426 520		$ -	$ -	$ -	$ 264 400	$ 426 520	$ -	$ -		$ 4 359 920
Professional Services & Contingency (30% Construction)	$ 1 346 400	$ 1 128 449	$ 1 251 354	$ 288 905	$ 374 913	$ 88 101	$ 884 079	$ 340 095	$ 3 702 000	$ -	$ -	$ 176 202	$ 240 459	$ 346 020	$ 199 389	$ -		$ 10 366 365
Total Projected Future Costs	**$ 5,834,400**	**$ 4,889,944**	**$ 5,422,534**	**$ 1,251,920**	**$ 1,624,623**	**$ 381,771**	**$ 3,831,009**	**$ 1,473,745**	**$ 16,042,000**	**$ -**	**$ -**	**$ 763,542**	**$ 1,041,989**	**$ 1,499,420**	**$ 864,019**	**$ -**		**$ 44,920,915**
Levy Payments	$ -	$ 3 711 501.98	$ 1 854 906.51	$ 4 199 858	$ 4 199 858	$ 3 027 804	$ 3 516 160	$ 4 199 858	$ -	$ 781 368 84	$ 781 369	$ 3 125 475 35	$ 5 078 897	$ 5 078 897	$ 5 078 897	$ 781 368.84		$ 45 416 219
Net Projected Recovery	**$ (5,834,400)**	**$ (1,178,442)**	**$ (3,567,627)**	**$ 2,947,938**	**$ 2,575,235**	**$ 2,646,033**	**$ (314,849)**	**$ 2,726,113**	**$ (16,042,000)**	**$ 781,369**	**$ 781,369**	**$ 2,361,933**	**$ 4,036,908**	**$ 3,579,477**	**$ 4,214,878**	**$ 781,369**		**$ 495,304**

Medium Term Development								Long Term Development							
-	A	B	C	D	E	F	K	-	C	D	G	H	I	J	K
Initial Connection to City Water and Wastewater	SW26 40-27-4 & Portion of SE26 40-27-4	NW23 40-27-4	NE22 40-27-4	SE 27-40-27-4	NE26 40-27-4	SE22 40-27-4	SW22 40-27-4	Reservoir and Pump Station, Lift Station Upgrades	NW26 40-27-4	SE 27-40-27-4	NW26 40-27-4	SW27 40-27-4	NW22 40-27-4	NE27 40-27-4	SW22 40-27-4





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LACOMBE COUNTY

CITY OF LACOMBE

Note:

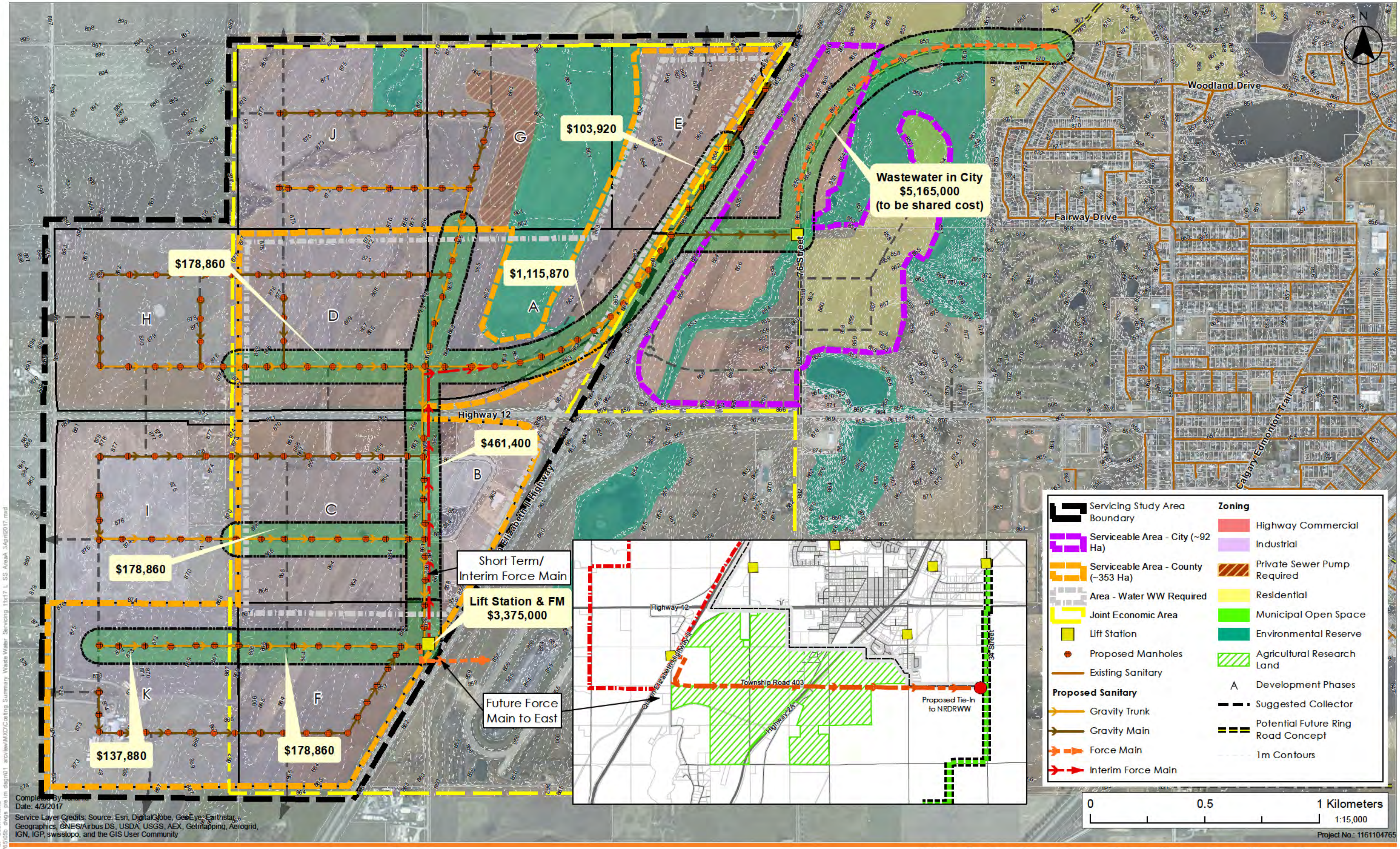
Cost shown above do not include contigency nor professional services.
Please refer to the summary tables for additional details.

Stormwater Construction Costing Summary

Intermunicipal Development Plan

Lacombe County

City of Lacombe



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LACOMBE COUNTY

CITY OF LACOMBE

Note:

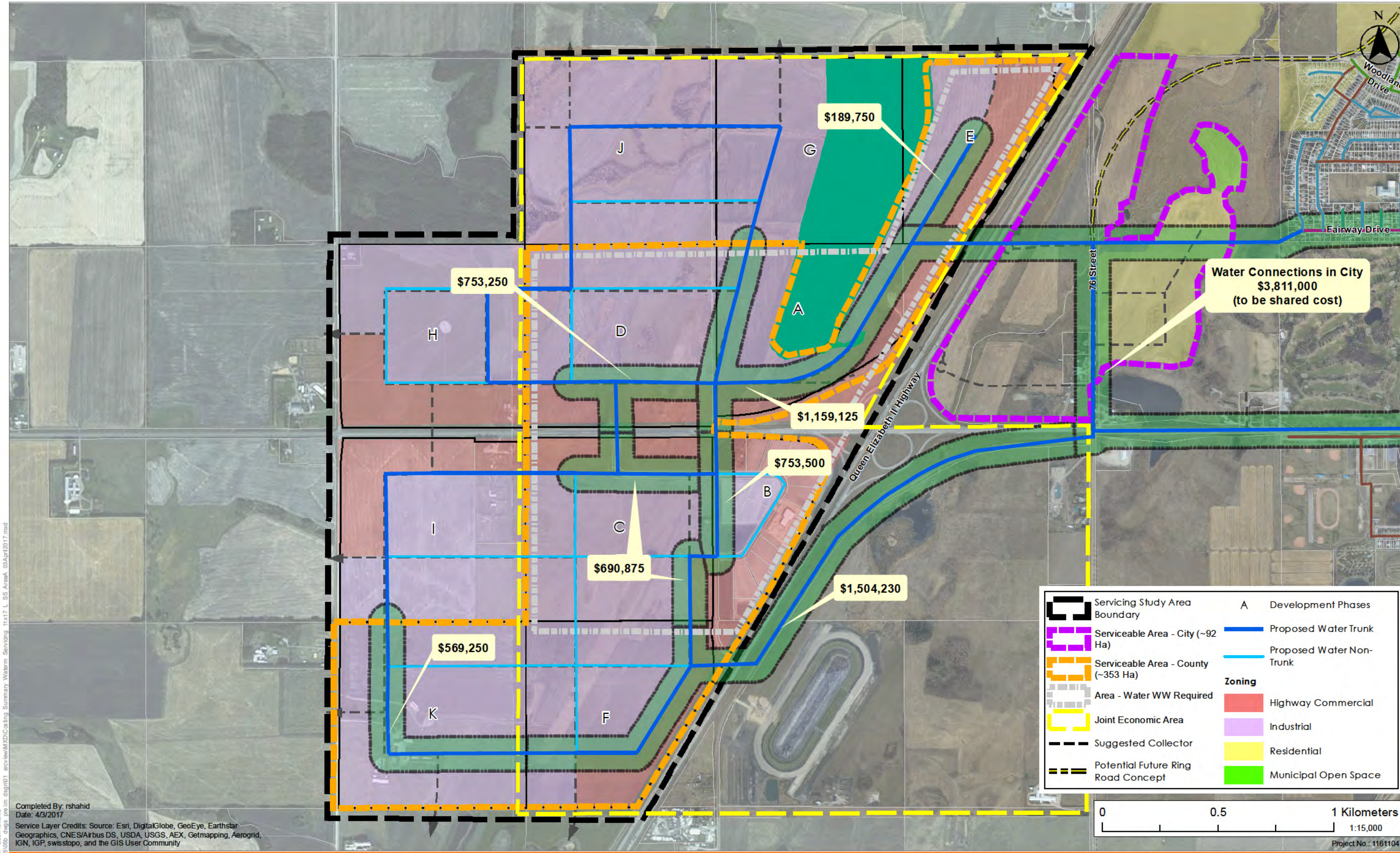
Cost shown above do not include contigency nor professional services.
Please refer to the summary tables for additional details.

Wastewater Construction Costing Summary

Intermunicipal Development Plan

Lacombe County

City of Lacombe



Stantec LACOMBE COUNTY CITY OF LACOMBE

Note:

Cost shown above do not include contigency nor professional services.
Please refer to the summary tables for additional details.

Water Construction Costing Summary

Intermunicipal Development Plan

Lacombe County

City of Lacombe

Item No.					Total Cost
QUARTER SECTION A (SW26 40-27-4 & Portion of SE26 40-27-4)					
A. WATER TRUNKS					
0.1	400 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$500.00	1500	$750,000.00
0.2	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$425.00	800	$340,000.00
0.3	Hydrants including leads	each	$9,875.00	7	$69,125.00
	Total Water Cost				$1,159,125.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	60	600	$36,000.00
	b) 375 mm Dia	m	$80.00	1550	$124,000.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	0	$0.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	1750	$558,250.00
	d) 6.0 m - 7.0 m Depth	m	$550.00	400	$220,000.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	107	$177,620.00
	Total Wastewater Cost				$1,115,870.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 450 mm Dia PVC - UR	m	$200.00		$0.00
	a) 525 mm Dia PVC - UR	m	$220.00		$0.00
	a) 600 mm Dia PVC - UR	m	$250.00	180	$45,000.00
	a) 750 mm Dia Conc - CL3	m	$370.00	80	$29,600.00
	a) 1200 mm Dia Conc - CL3	m	$900.00	1010	$909,000.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth PVC	m	$120.00	180	$21,600.00
	b) 4.0 m - 5.0 m Depth PVC	m	$180.00		$0.00
	c) 5.0 m - 6.0 m Depth PVC	m	$319.00		$0.00
	d) 6.0 m - 7.0 m Depth PVC	m	$550.00		$0.00
	a) 3.0 m - 4.0 m Depth Conc	m	$200.00	780	$156,000.00
	b) 4.0 m - 5.0 m Depth Conc	m	$290.00	310	$89,900.00
	c) 5.0 m - 6.0 m Depth Conc	m	$500.00		$0.00
	d) 6.0 m - 7.0 m Depth Conc	m	$750.00		$0.00
0.3	a)1200 mm 1S. Manhole type 5A c/w frame & cover	v.m	$3,300.00	13	$42,900.00
0.3	b)1800 mm 1S. Manhole type 5A c/w frame & cover	v.m	$5,500.00	35	$192,500.00
	Total Stormwater Cost				$1,486,500.00

Item No.					Total Cost
QUARTER SECTION B - Existing Industrial Park (NW23 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$425.00	550	$233,750.00
0.2	Hydrants including leads	each	$9,875.00	2	$19,750.00
	Total Water Cost				$253,500.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	0	$0.00
	b) 375 mm Dia	m	$80.00	500	$40,000.00
	c) 450 mm Dia	m	$130.00	475	$61,750.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	300	$36,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	175	$31,500.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	350	$111,650.00
	d) 6.0 m - 7.0 m Depth	m	$550.00	50	$27,500.00
	e) 7.0 m - 8.0 m Depth	m	$700.00	100	$70,000.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	50	$83,000.00
0.4	Lift Station and Forcemain to North				
	a) Pump Upgrade	LS	$3,000,000.00	1	$3,000,000.00
	b) Forcemain	m	$300.00	1250	$375,000.00
0.5	Lift Station Upgrade and Force Main to Regional				
	a) Pump Upgrade	LS	$100,000.00	1	$100,000.00
	b) Forcemain	m	$450.00	7200	$3,240,000.00
	Total Wastewater Cost				$7,176,400.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 525 mm Dia PVC - UR	m	$220.00	200	$44,000.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth PVC	m	$120.00	200	$24,000.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	8	$13,280.00
	Total Stormwater Cost				$81,280.00

Item No.					Total Cost
QUARTER SECTION C (NE22 40-27-4)					
A. WATER TRUNKS					
0.1	350 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$460.00	200	$92,000.00
0.2	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$425.00	1200	$510,000.00
0.3	Hydrants including leads	each	$9,875.00	9	$88,875.00
	Total Water Cost				$690,875.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	800	$48,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	800	$96,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	21	$34,860.00
	Total Wastewater Cost				$178,860.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 525 mm Dia PVC - UR	m	$220.00	200	$44,000.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	b) 4.0 m - 5.0 m Depth PVC	m	$180.00	200	$36,000.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	8	$13,280.00
	Total Stormwater Cost				$93,280.00

Item No.					Total Cost
QUARTER SECTION D (SE 27-40-27-4)					
A. WATER TRUNKS					
0.1	350 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$460.00	400	$184,000.00
0.2	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$425.00	1200	$510,000.00
0.3	Hydrants including leads	each	$9,875.00	6	$59,250.00
0.4	Pump Station and Reservoir	each	$9,000,000.00	1	$9,000,000.00
	Total Water Cost				$9,753,250.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	800	$48,000.00
	a) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	800	$96,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	21	$34,860.00
	Total Wastewater Cost				$178,860.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 450 mm Dia PVC - UR	m	$200.00		$0.00
	a) 525 mm Dia PVC - UR	m	$220.00		$0.00
	a) 600 mm Dia PVC - UR	m	$250.00	680	$170,000.00
	a) 750 mm Dia Conc - CL3	m	$370.00		$0.00
	a) 1200 mm Dia Conc - CL3	m	$900.00		$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth PVC	m	$120.00	680	$81,600.00
	b) 4.0 m - 5.0 m Depth PVC	m	$180.00		$0.00
	c) 5.0 m - 6.0 m Depth PVC	m	$319.00		$0.00
	d) 6.0 m - 7.0 m Depth PVC	m	$550.00		$0.00
	a) 3.0 m - 4.0 m Depth Conc	m	$200.00		$0.00
	b) 4.0 m - 5.0 m Depth Conc	m	$290.00		$0.00
	c) 5.0 m - 6.0 m Depth Conc	m	$500.00		$0.00
	d) 6.0 m - 7.0 m Depth Conc	m	$750.00		$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00		$0.00
0.3	1200 mm 1S. Manhole type 5A c/w frame & cover	v.m	$3,300.00	20	$66,000.00
0.3	1500 mm 1S. Manhole type 5A c/w frame & cover	v.m	$4,400.00		$0.00
0.3	1800 mm 1S. Manhole type 5A c/w frame & cover	v.m	$5,500.00		$0.00
	Total Stormwater Cost				$317,600.00

Joint Economic Area Water, Wastewater and Storm Trunk Costs

Item No.					Total Cost
QUARTER SECTION E (NE26 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$425.00	400	$170,000.00
0.2	Hydrants including leads	each	$9,875.00	2	$19,750.00
	Total Water Cost				$189,750.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w Bedding				
	a) 300 mm Dia	m	$60.00	400	$24,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	200	$24,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	200	$36,000.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	12	$19,920.00
	Total Wastewater Cost				$103,920.00

Item No.					Total Cost
QUARTER SECTION F (SE22 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings (internal trunks)	m	$425.00	1150	$488,750.00
0.2	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings (Loop to Highway 12 trunk)	m	$425.00	2250	$956,250.00
0.3	Hydrants including leads	each	$9,875.00	6	$59,250.00
	Total Water Cost				$1,504,250.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	800	$48,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	800	$96,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	21	$34,860.00
	Total Wastewater Cost				$178,860.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 450 mm Dia PVC - UR	m	$200.00		$0.00
	a) 525 mm Dia PVC - UR	m	$220.00		$0.00
	a) 600 mm Dia PVC - UR	m	$250.00	780	$195,000.00
	a) 750 mm Dia Conc - CL3	m	$370.00	520	$192,400.00
	a) 1200 mm Dia Conc - CL3	m	$900.00		$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth PVC	m	$120.00		$0.00
	b) 4.0 m - 5.0 m Depth PVC	m	$180.00		$0.00
	c) 5.0 m - 6.0 m Depth PVC	m	$319.00	780	$248,820.00
	d) 6.0 m - 7.0 m Depth PVC	m	$550.00		$0.00
	a) 3.0 m - 4.0 m Depth Conc	m	$200.00		$0.00
	b) 4.0 m - 5.0 m Depth Conc	m	$290.00		$0.00
	c) 5.0 m - 6.0 m Depth Conc	m	$500.00		$0.00
	d) 6.0 m - 7.0 m Depth Conc	m	$750.00	520	$390,000.00
0.3	1200 mm 1S. Manhole type 5A c/w frame & cover	v.m	$3,300.00	72	$237,600.00
	Total Stormwater Cost				$1,263,820.00

Joint Economic Area Water, Wastewater and Storm Trunk Costs

Item No.					Total Cost
QUARTER SECTION G (NW26 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$425.00	800	$340,000.00
0.2	Hydrants including leads	each	$9,875.00	4	$39,500.00
	Total Water Cost				$379,500.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	800	$48,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	400	$48,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	400	$72,000.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
					$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	24	$39,840.00
	Total Wastewater Cost				$207,840.00

Item No.					Total Cost
QUARTER SECTION H (SW27 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$425.00	800	$340,000.00
0.2	Hydrants including leads	each	$9,875.00	6	$59,250.00
	Total Water Cost				$399,250.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	600	$36,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	600	$72,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	18	$29,880.00
	Total Wastewater Cost				$137,880.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 450 mm Dia PVC - UR	m	$200.00		$0.00
	a) 525 mm Dia PVC - UR	m	$220.00	680	$149,600.00
	a) 600 mm Dia PVC - UR	m	$250.00		$0.00
	a) 750 mm Dia Conc - CL3	m	$370.00		$0.00
	a) 1200 mm Dia Conc - CL3	m	$900.00		$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth PVC	m	$120.00	680	$81,600.00
	b) 4.0 m - 5.0 m Depth PVC	m	$180.00		$0.00
	c) 5.0 m - 6.0 m Depth PVC	m	$319.00		$0.00
	d) 6.0 m - 7.0 m Depth PVC	m	$550.00		$0.00
	a) 3.0 m - 4.0 m Depth Conc	m	$200.00		$0.00
	b) 4.0 m - 5.0 m Depth Conc	m	$290.00		$0.00
	c) 5.0 m - 6.0 m Depth Conc	m	$500.00		$0.00
	d) 6.0 m - 7.0 m Depth Conc	m	$750.00		$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	20	$33,200.00
0.3	1200 mm 1S. Manhole type 5A c/w frame & cover	v.m	$3,300.00		$0.00
0.3	1500 mm 1S. Manhole type 5A c/w frame & cover	v.m	$4,400.00		$0.00
0.3	1800 mm 1S. Manhole type 5A c/w frame & cover	v.m	$5,500.00		$0.00
	Total Stormwater Cost				$264,400.00

Item No.					Total Cost
QUARTER SECTION I (NW22 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$425.00	1200	$510,000.00
0.2	Hydrants including leads	each	$9,875.00	8	$79,000.00
	Total Water Cost				$589,000.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	600	$36,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	600	$72,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	18	$29,880.00
	Total Wastewater Cost				$137,880.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 450 mm Dia PVC - UR	m	$200.00		$0.00
	a) 525 mm Dia PVC - UR	m	$220.00	680	$149,600.00
	a) 600 mm Dia PVC - UR	m	$250.00		$0.00
	a) 750 mm Dia Conc - CL3	m	$370.00		$0.00
	a) 1200 mm Dia Conc - CL3	m	$900.00		$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth PVC	m	$120.00		$0.00
	b) 4.0 m - 5.0 m Depth PVC	m	$180.00		$0.00
	c) 5.0 m - 6.0 m Depth PVC	m	$319.00	680	$216,920.00
	d) 6.0 m - 7.0 m Depth PVC	m	$550.00		$0.00
	a) 3.0 m - 4.0 m Depth Conc	m	$200.00		$0.00
	b) 4.0 m - 5.0 m Depth Conc	m	$290.00		$0.00
	c) 5.0 m - 6.0 m Depth Conc	m	$500.00		$0.00
	d) 6.0 m - 7.0 m Depth Conc	m	$750.00		$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$2,000.00	30	$60,000.00
0.3	1200 mm 1S. Manhole type 5A c/w frame & cover	v.m	$3,300.00		$0.00
0.3	1500 mm 1S. Manhole type 5A c/w frame & cover	v.m	$4,400.00		$0.00
0.3	1800 mm 1S. Manhole type 5A c/w frame & cover	v.m	$5,500.00		$0.00
	Total Stormwater Cost				$426,520.00

Item No.					Total Cost
QUARTER SECTION J (NE27 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$425.00	1100	$467,500.00
0.2	Hydrants including leads	each	$9,875.00	6	$59,250.00
	Total Water Cost				$526,750.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	600	$36,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	600	$72,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	18	$29,880.00
	Total Wastewater Cost				$137,880.00

Item No.					Total Cost
QUARTER SECTION K (SW22 40-27-4)					
A. WATER TRUNKS					
0.1	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m	m	$425.00	1200	$510,000.00
0.2	Hydrants including leads	each	$9,875.00	6	$59,250.00
	Total Water Cost				$569,250.00
B. WASTEWATER TRUNKS					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	$60.00	600	$36,000.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.□				
	a) 3.0 m - 4.0 m Depth	m	$120.00	600	$72,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	18	$29,880.00
	Total Wastewater Cost				$137,880.00
C. STORMWATER TRUNKS					
0.1	Storm pipe c/w bedding				
	a) 450 mm Dia PVC - UR	m	$200.00		$0.00
	a) 525 mm Dia PVC - UR	m	$220.00	680	$149,600.00
	a) 600 mm Dia PVC - UR	m	$250.00		$0.00
	a) 750 mm Dia Conc - CL3	m	$370.00		$0.00
	a) 1200 mm Dia Conc - CL3	m	$900.00		$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.□				
	a) 3.0 m - 4.0 m Depth PVC	m	$120.00		$0.00
	b) 4.0 m - 5.0 m Depth PVC	m	$180.00		$0.00
	c) 5.0 m - 6.0 m Depth PVC	m	$319.00	680	$216,920.00
	d) 6.0 m - 7.0 m Depth PVC	m	$550.00		$0.00
	a) 3.0 m - 4.0 m Depth Conc	m	$200.00		$0.00
	b) 4.0 m - 5.0 m Depth Conc	m	$290.00		$0.00
	c) 5.0 m - 6.0 m Depth Conc	m	$500.00		$0.00
	d) 6.0 m - 7.0 m Depth Conc	m	$750.00		$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$2,000.00	30	$60,000.00
0.3	1200 mm 1S. Manhole type 5A c/w frame & cover	v.m	$3,300.00		$0.00
0.3	1500 mm 1S. Manhole type 5A c/w frame & cover	v.m	$4,400.00		$0.00
0.3	1800 mm 1S. Manhole type 5A c/w frame & cover	v.m	$5,500.00		$0.00
	Total Stormwater Cost				$426,520.00

ORDER OF MAGNITUDE CONCEPTUAL OPINION OF PROBABLE COST

Item No.	Item of Work	Unit	Unit Price	Quantity	Total Cost
OFF-SITE SERVICING (MOBILIZATION BUILT INTO UNIT RATES)					
A. WATER MAINS					
0.1	Highway 12 - 300 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves, fittings, and boulevard restoraton.				
	a) 300 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves and fittings.	m	$450.00	900	$405,000.00
	b) 300 mm watermain HDPE DR17 Directionally Drilled Water Main c/w valves and fittings	m	$550.00	700	$385,000.00
	c) Hydrants including leads	each	$10,000.00	8	$80,000.00
	d) Roadway Restoration	m^2	$80.00	200	$16,000.00
	Subtotal				**$886,000.00**
	ALTERNATIVE ALIGNMENT (UNDER ROADWAY) ***NOT INCLUDED IN TOTAL***				
	Highway 12 - 300 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves and fittings.				
	a) 300 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves and fittings.	*m*	*$650.00*	*1,600*	*$1,040,000.00*
	b) Hydrants including leads	*each*	*$10,000.00*	*8*	*$80,000.00*
	c) Roadway Restoration	m^2	*$80.00*	*16,000*	*$1,280,000.00*
	Subtotal				***$2,400,000.00***
0.2	Range Road 271				
	a) 350 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves and fittings, and ditch restoration	m	$450.00	800	$360,000.00
	b) Hydrants including leads	each	$10,000.00	4	$40,000.00
	Subtotal				**$400,000.00**
0.3	NW25-40-27-4 - South Side (Green Field, **Assuming Land Excluded**)				
	a) 300 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves and fittings.	m	$350.00	800	$280,000.00
	b) Hydrants including leads	each	$10,000.00	4	$40,000.00
	c) Roadway Restoration	m^2	$60.00	8,000	$480,000.00
	Subtotal				**$800,000.00**
0.4	Fairway Drive & 56 Street				
	a) Remove Existing Main	m	$50.00	800	$40,000.00
	b) Temporary Water Servicing	LS	$30,000.00	1	$30,000.00

Item No.	Item of Work	Unit	Unit Price	Quantity	Total Cost
	c) 300 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves and fittings.	m	$500.00	800	$400,000.00
	d) Service Connections with Curb Stops	each	$4,500.00	30	$135,000.00
	e) Roadway Restoration	m^2	$60.00	8,000	$480,000.00
	f) **R/W Purchase (City to confirm)**	LS	$50,000.00	1	$50,000.00
	Subtotal				**$1,135,000.00**
0.5	North Midway Section				
	a) 350 mm watermain PVC DR18 c/w trench excavation to 3.0m depth,valves and fittings, and ditch restoration	m	$400.00	400	$160,000.00
	b) Hydrants including leads	each	$10,000.00	3	$30,000.00
	Subtotal				**$190,000.00**
0.6	QE II Highway Crossing (Trenchless)				
	a) 350mm Dia HDPE Case Bored Crossing	LS	$400,000.00	1	$400,000.00
	Subtotal				**$400,000.00**
	TOTAL WATER MAINS				**$3,811,000.00**
B. LIFT STATION & FORCEMAIN **(Excludes Land Acquisition)**					
0.1	Lift Station (Drywell / Wetwell, Assumed 60L/S Design Flow)	each	$4,000,000.00	1	$4,000,000.00
0.2	Force Main PVC DR18 c/w trench excavation to 3.0m depth,valves				
	a) From QEII Highway to Lift Station	m	$350.00	400	$140,000.00
	b) From Lift Station to Exising Town System	m	$350.00	1,500	$525,000.00
0.3	Connection to Existing System	LS	$100,000.00	1	$100,000.00
0.4	QEII Highway Crossing - 350mm Dia HDPE Case Bored Crossing	LS	$400,000.00	1	$400,000.00
	TOTAL LIFT STATION AND FORCEMAIN (Excludes Land)				$5,165,000.00
SUMMARY					
	A. WATER MAINS				$3,811,000.00
	B. LIFT STATION & FORCEMAIN				$5,165,000.00
	Total Construction				**$8,976,000.00**
	10% Professional Services				$897,600.00
	20% Contingency				$1,795,200.00
	Subtotal				**$11,668,800.00**
	5% GST				$583,440.00
	Total				**$12,252,240.00**

Rosedale Servicing

Alternative 1 - Upgrade Rosedale to Urban City of Lacombe Standards

Part A1: General Requirements	$930,000.00
Part A2: Demolition and Grading	$668,500.00
Part A3: Storm Sewer	$673,120.68
Part A4: Sanitary Sewer & Contribution to Lift Station	$881,652.00
Part A5: Watermain	$571,197.60
Part A6: Service Connections	$150,546.00
Part A7: Concrete Work	$607,400.00
Part A8: Roadway Excavation, Subgrade, Sub Base and Base Preparation	$799,580.00
Part A9: Asphaltic Concrete Paving	$523,300.00
Part A10: Pavement Markings	$3,700.00
Part A11: Landscaping and Fine Grading	$115,000.00
SUBTOTAL	**$5,923,996.28**
10% CONTINGENCY	**$592,399.63**
10% PROFESSIONAL SERVICES	**$592,399.63**
TOTAL - TENDER AMOUNT	**$7,108,795.54**

Item No.	Item of Work	Unit	Estimated Quantity	Unit Price	Total
Part A1: General Requirements					
A1.1	Mobilization and Demobilization	lump sum	1	$500,000.00	$500,000.00
A1.2	Traffic Accommodation	lump sum	1	$30,000.00	$30,000.00
A1.3	Illumination	lump sum	1	$400,000.00	$400,000.00
	Subtotal Part A1:				**$930,000.00**
Part A2: Demolition and Grading					
A2.1	ACP Remove Full Depth (Average Depth 150mm)	sq. m	15,000	$8.00	$120,000.00
A2.2	Remove and Dispose Existing Granular Base	sq. m	15,000	$9.90	$148,500.00
A2.3	Storm Pond	lump sum	1	$400,000.00	$400,000.00
	Subtotal Part A2:				**$668,500.00**
Part A3: Storm Sewer					
A3.1	Trench excavation, backfill and compaction				
A3.1.1	a) 2.0 - 4.0m depth	lin. m	1,011	$120.00	$121,320.00
A3.1.2	b) 4.0 - 5.0m depth	lin. m	245	$175.00	$42,875.00
A3.2	Storm Sewer Pipe: Supply and Installation of:				
A3.2.1	a) 300mm PVC UR	lin. m	650	$50.46	$32,799.00
A3.2.2	b) 525mm PVC UR	lin. m	150	$132.22	$19,833.00
A3.2.3	c) 600mm PVC UR	lin. m	211	$235.00	$49,585.00
A3.2.4	d) 900mm C76 CL3	lin. m	245	$603.56	$147,872.20
A3.3	1200 mm manhole or catchbasin manhole, including precast barrels, slab top, grade rings, and base	v.m.	48	$1,750.00	$83,650.00
A3.4	250mm PVC UR Catch Basin Leads, including trench excavation, backfill and compaction	lin. m	282	$183.64	$51,786.48
A3.5	Type K-1 catchbasin assemblies, including frame and cover, side inlet (if applicable), precast CB collar, and precast barrel c/w monolithic or separate base	each	26	$3,800.00	$98,800.00
A3.6	Remove unsuitable material and replace with screened rock backfill material (provisional)	cu. m	380	$45.00	$17,100.00
A3.7	900mm Outlet	lump sum	1	$7,500.00	$7,500.00
	Subtotal Part A3:				**$673,120.68**

Item No.	Item of Work	Unit	Estimated Quantity	Unit Price	Total
Part A4: Sanitary Sewer & Contribution to Lift Station					
A4.1	Trench excavation, backfill and compaction				
A4.1.2	a) 3.0 - 4.0m depth	lin. m	1,350	$175.00	$236,250.00
A4.1.3	b) 4.0 - 5.0m depth	lin. m	810	$210.00	$170,100.00
A4.2	Remove unsuitable material and replace with screened rock backfill material (provisional)	cu. m	650	$45.00	$29,250.00
A4.3	200mm PVC SDR 35 Sanitary sewer pipe	lin. m	2,160	$57.20	$123,552.00
A4.4	1200 mm Type 5A standard manhole, including precast barrels, base, slab top, grade rings and/or bricks	vert. m	70	$1,750.00	$122,500.00
A4.5	Contribution to Rosemont Lift Station	lump sum	1	$200,000.00	$200,000.00
	Subtotal Part A4:				**$881,652.00**
Part A5: Watermain					
A5.1	Trench excavation, backfill and compaction				
A5.1.2	a) 3.0 - 4.0m depth	lin. m	1,600	$175.00	$280,000.00
A5.2	Remove unsuitable material and replace with screened rock backfill material (provisional)	cu. m	500	$45.00	$22,500.00
A5.3	Watermain				
A5.3.1	a) 200mm diameter, PVC DR18	lin. m	1,580	$77.00	$121,660.00
A5.3.2	b) 400mm diameter, PVC DR18	lin. m	20	$144.38	$2,887.60
A5.4	Supply and Installation of Fittings (Crosses, Tees, etc.)				
A5.4.1	150mm x 150mm Tee	each	2	$650.00	$1,300.00
A5.4.2	200mm x 150mm Tee	each	7	$800.00	$5,600.00
A5.4.3	200mm x 200mm Tee	each	2	$850.00	$1,700.00
A5.4.4	300mm x 150mm Tee	each	4	$1,000.00	$4,000.00
A5.4.5	300mm x 300mm Tee	each	2	$1,100.00	$2,200.00
A5.4.6	300mm x 200mm Reducer	each	2	$600.00	$1,200.00
A5.4.7	200mm x 150mm Reducer	each	1	$550.00	$550.00
A5.4.8	200mm Valves	each	10	$2,000.00	$20,000.00
A5.4.9	200mm x 200mm Cross	each	1	$2,100.00	$2,100.00

Item No.	Item of Work	Unit	Estimated Quantity	Unit Price	Total
A5.4.10	300mm - 45° Bend	each	1	$350.00	$350.00
A5.4.11	150mm - 90° Bend	each	1	$300.00	$300.00
A5.4.12	150mm Plug	each	1	$400.00	$400.00
A5.4.13	200mm Plug	each	1	$450.00	$450.00
A5.5	Supply and Install hydrant c/w 150mm dia. Leads, valve and assembly	each	13	$8,000.00	$104,000.00
	Subtotal Part A5:				**$571,197.60**
Part A6: Service Connections					
A6.1	Trenching, excavation, backfill and compaction for combined trench for water and sanitary services.	m	605	$175.00	$105,875.00
A6.2	Remove unsuitable material and replace with screened rock backfill material (provisional)	cu. m	182	$45.00	$8,190.00
A6.3	150mm PVC SDR28 Sanitary service includes all fittings, saddles, breaking into manholes	m	605	$40.00	$24,200.00
A6.4	25mm Class 160 P.E.3406 Water Service	m	605	$13.00	$7,865.00
A6.5	Water Service Fittings 25mm Corporation Cock	each	46	$96.00	$4,416.00
	Subtotal Part A6:				**$150,546.00**
Part A7: Concrete Work					
A7.1	250mm Standard Curb & Gutter	lin. m	1,500	$95.00	$142,500.00
A7.2	1.4m Separate Sidewalk including Granular Base	sq. m	1,100	$190.00	$209,000.00
A7.3	1.1m Rolled Mono Sidewalk including Granular Base	m	1,100	$205.00	$225,500.00
A7.4	Curb Ramps (Paraplegic)	each	16	$1,900.00	$30,400.00
	Subtotal Part A7:				**$607,400.00**
Part A8: Roadway Excavation, Subgrade, Sub Base and Base Preparation					
A8.1	Topsoil Stripping (Up to 200mm)	sq. m	9,000	$8.72	$78,480.00
A8.2	Waste Excavation and Dispose Off Site	cu. m	7,000	$15.00	$105,000.00
A8.3	75mm minus granular sub-base				
A8.3.1	a) 250mm thickness (Local Residential)	sq. m	16,000	$13.50	$216,000.00
A8.3.2	b) 350mm thickness (Minor Residential Collector)	sq. m	9,000	$18.90	$170,100.00
A8.4	20mm minus granular base				
A8.4.1	a) 100mm thickness (Local Residential)	sq. m	16,000	$6.50	$104,000.00
A8.4.2	b) 200mm thickness (Minor Residential Collector)	sq. m	9,000	$12.00	$108,000.00
A8.4.3	c) 250mm thickness (Gravel Lane)	sq. m	1,200	$15.00	$18,000.00
	Subtotal Part A8:				**$799,580.00**

Item No.	Item of Work	Unit	Estimated Quantity	Unit Price	Total
Part A9: Asphaltic Concrete Paving					
A9.1	Asphalt 40mm Depth, Top Lift (Minor Residential Collector)	sq. m	7,900	$13.00	$102,700.00
A9.2	Asphalt 60mm Depth, Bottom Lift (Minor Residential Collector)	sq. m	7,900	$18.00	$142,200.00
A9.3	Asphalt 80mm Depth, (Local Residential)	sq. m	11,600	$24.00	$278,400.00
	Subtotal Part A9:				**$523,300.00**
Part A10: Pavement Markings					
A10.1	Pavement Markings, Solid Lines 100mm Wide	lin. m	1,850	$2.00	$3,700.00
	Subtotal Part A9:				**$3,700.00**
Part A11: Landscaping and Fine Grading					
A11.1	Topsoil Placement and Fine Grading	sq. m	20,000	$4.50	$90,000.00
A11.2	Seeding	sq. m	20,000	$1.25	$25,000.00
	Subtotal Part A11:				**$115,000.00**

Rosedale Servicing

Alternative 2 - Rural Water and Low Pressure Wastewater Servicing

Part A1: General Requirements	$143,000.00
Part A2: Sanitary Sewer & Contribution to Lift Station	$514,550.00
Part A3: Watermain	$571,197.60
Part A4: Service Connections	$285,036.00
Part A5: Site Restoration	$62,208.00
SUBTOTAL	**$1,575,991.60**
15% CONTINGENCY	**$236,398.74**
10% PROFESSIONAL SERVICES	**$157,599.16**
TOTAL	**$1,969,989.50**

Item No.	Item of Work	Unit	Estimated Quantity	Unit Price	Total
Part A1: General Requirements					
A1.1	Mobilization and Demobilization	lump sum	1	$130,000.00	$130,000.00
A1.2	Traffic Accommodation	lump sum	1	$13,000.00	$13,000.00
	Subtotal Part A1:				**$143,000.00**
Part A2: Sanitary Sewer & Contribution to Lift Station					
A2.1	Supply and Horizontal Directionally Drilled HDPE Pressure Sewer Main c/w tracer wire and "Little Fink" end connections or approved				
	a) 50 mm DR 11	lin. m	1,690	$125.00	$211,250.00
	b) 75 mm DR 11	lin. m	250	$150.00	$37,500.00
A2.2	Isolation Valves				
	a) 50 mm	each	7	$2,000.00	$14,000.00
	b) 75 mm	each	3	$2,200.00	$6,600.00
A2.3	Flushouts (900mm Barrel)	each	6	$5,000.00	$30,000.00
A2.4	Blowoff/ Air Release Assembly (1,200mm dia. Barrel)	each	1	$15,200.00	$15,200.00
A2.5	Contribution to Rosemont Lift Station	lump sum	1	$200,000.00	$200,000.00
	Subtotal Part A2:				**$514,550.00**
Part A3: Watermain					
A3.1	Trench excavation, backfill and compaction				
A3.1.1	a) 3.0 - 4.0m depth	lin. m	1,600	$175.00	$280,000.00
A3.2	Remove unsuitable material and replace with screened rock backfill material (provisional)	cu. m	500	$45.00	$22,500.00
A3.3	Watermain				
A3.3.1	a) 200mm diameter, PVC DR18	lin. m	1,580	$77.00	$121,660.00
A3.3.2	b) 400mm diameter, PVC DR18	lin. m	20	$144.38	$2,887.60
A3.4	Supply and Installation of Fittings (Crosses, Tees, etc.)				
A3.4.1	150mm x 150mm Tee	each	2	$650.00	$1,300.00
A3.4.2	200mm x 150mm Tee	each	7	$800.00	$5,600.00
A3.4.3	200mm x 200mm Tee	each	2	$850.00	$1,700.00
A3.4.4	300mm x 150mm Tee	each	4	$1,000.00	$4,000.00
A3.4.5	300mm x 300mm Tee	each	2	$1,100.00	$2,200.00
A3.4.6	300mm x 200mm Reducer	each	2	$600.00	$1,200.00
A3.4.7	200mm x 150mm Reducer	each	1	$550.00	$550.00

Item No.	Item of Work	Unit	Estimated Quantity	Unit Price	Total
A3.4.8	200mm Valves	each	10	$2,000.00	$20,000.00
A3.4.9	200mm x 200mm Cross	each	1	$2,100.00	$2,100.00
A3.4.10	300mm - 45° Bend	each	1	$350.00	$350.00
A3.4.11	150mm - 90° Bend	each	1	$300.00	$300.00
A3.4.12	150mm Plug	each	1	$400.00	$400.00
A3.4.13	200mm Plug	each	1	$450.00	$450.00
A3.5	Supply and Install hydrant c/w 150mm dia. Leads, valve and assembly	each	13	$8,000.00	$104,000.00
	Subtotal Part A3:				**$571,197.60**
Part A4: Service Connections					
A4.1	Trenching, excavation, backfill and compaction for water service connections	m	605	$175.00	$105,875.00
A4.2	Remove unsuitable material and replace with screened rock backfill material (provisional)	cu. m	182	$45.00	$8,190.00
A4.3	25mm Class 160 P.E.3406 Water Service	m	605	$13.00	$7,865.00
A4.4	Water Service Fittings 25mm Corporation Cock	each	46	$96.00	$4,416.00
A4.5	Sewer Service Connections to Main including supply and install 38mm service each valves and curb box	each lot	46	$515.00	$23,690.00
A4.6	Service Excavation Pits inlcuding backfill and compaction to 95% S.P.D	each lot	30	$3,500.00	$105,000.00
A4.7	Supply and Directionally Drill 38mm HDPE DR 11 including tracer wire and "Little Fink"	lin. m	1,500	$20.00	$30,000.00
	Subtotal Part A4:				**$285,036.00**
Part A5: Site Restoration					
A5.1	Topsoil Stripping (Up to 200mm)	sq. m	1,400	$8.72	$12,208.00
A8.2	Driveway/Roadway Restoration	sq. m	1,000	$50.00	$50,000.00
	Subtotal Part A5:				**$62,208.00**

Lacombe Intermunicipal Development Plan

Iron Rail Business Park - Opinion of Probable Costs Summary

July 24, 2017

Item No.					**Total Cost**
A. WATER TRUNKS					
0.1	Directional Drilled 200 mm watermain HDPE DR9 c/w valves and fittings.	m	$250.00	4900	$1,225,000.00
0.2	Flushing hydrants including leads	each	$9,875.00	2	$19,750.00
0.3	Case Bored Rail Crossing	LS	$100,000.00	1	$100,000.00
0.4	Pump Station	LS	$650,000.00	1	$650,000.00
	Total Water Cost				$1,994,750.00
B. WASTEWATER					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 250 mm Dia	m	$ 60.00	4900	$294,000.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	4900	$588,000.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
	d) 6.0 m - 7.0 m Depth	m	$550.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	120	$199,200.00
0.4	Case Bored Rail Crossing	LS	$100,000.00	1	$100,000.00
	Total Wastewater Cost				$1,181,200.00

SUMMARY					
	A. WATER TRUNKS				$1,994,750.00
	B. WASTEWATER				$1,181,200.00
	30% Contingency and Professional Services				$952,785.00
	Total				**$4,128,735.00**

Note: Costs do not include on site water and wastewater mains or an additional reservoir and pump station for fireflows.

Lacombe Intermunicipal Development Plan

Queen Elizabeth II (QE II) North of Lacombe - Opinion of Probable Costs Summary

July 24, 2017

Item No.					Total Cost
A. WATER TRUNKS					
0.1	400 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$500.00	0	$0.00
0.2	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$425.00	2300	$977,500.00
0.3	QEII Highway Crossing	LS	$400,000.00	1	$400,000.00
0.4	Hydrants including leads	each	$9,875.00	8	$79,000.00
0.5	Reservoir and Pump Station	each	$4,000,000.00	1	$4,000,000.00
	Total Water Cost				$5,456,500.00
B. WASTEWATER					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	60	0	$0.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.□				
	a) 3.0 m - 4.0 m Depth	m	$120.00	0	$0.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
	d) 6.0 m - 7.0 m Depth	m	$550.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	0	$0.00
0.4	Lift Station and Forcemain				
	a) Lift Station	LS	$2,000,000.00	1	$2,000,000.00
	b) Forcemain	m	$300.00	4600	$1,380,000.00
	c) Steel Encased Highway Crossing	LS	$400,000.00	1	$400,000.00
	Total Wastewater Cost				$3,780,000.00
SUMMARY					
	A. WATER TRUNKS				$5,456,500.00
	B. WASTEWATER				$3,780,000.00
	30% Contingency and Professional Services				$2,770,950.00
	Total				**$12,007,450.00**

Stantec

Lacombe Intermunicipal Development Plan

Milton Area - Opinion of Probable Costs Summary

July 24, 2017

Item No.					**Total Cost**
A. WATER TRUNKS					
0.1	400 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$500.00	0	$0.00
0.2	300 mm watermain PVC DR18 c/w trench excavation to 3.0 m depth,valves and fittings.	m	$425.00	2800	$1,190,000.00
0.3	Reservoir and Pump Station	each	$4,000,000.00	1	$4,000,000.00
0.4	Hydrants including leads	each	$9,875.00	4	$39,500.00
	Total Water Cost				$5,229,500.00
B. WASTEWATER					
0.1	Sanitary pipe PVC SDR 35 c/w bedding				
	a) 300 mm Dia	m	60	0	$0.00
	b) 375 mm Dia	m	$80.00	0	$0.00
0.2	Trench excavation, backfill, and compaction to 95% S.P.D.				
	a) 3.0 m - 4.0 m Depth	m	$120.00	0	$0.00
	b) 4.0 m - 5.0 m Depth	m	$180.00	0	$0.00
	c) 5.0 m - 6.0 m Depth	m	$319.00	0	$0.00
	d) 6.0 m - 7.0 m Depth	m	$550.00	0	$0.00
0.3	1200 mm Dia. Manhole type 5A c/w frame & cover	v.m	$1,660.00	0	$0.00
0.4	Lift Station and Forcemain to North				
	a) Lift Station	LS	$2,500,000.00	1	$2,500,000.00
	b) Forcemain	m	$300.00	8600	$2,580,000.00
	Total Wastewater Cost				$5,080,000.00

SUMMARY					
	A. WATER TRUNKS				$5,229,500.00
	B. WASTEWATER				$5,080,000.00
	30% Contingency and Professional Services				$3,092,850.00
	Total				**$13,402,350.00**

Stantec Consulting
Lacombe North Storm Trunk Opinion of Probable Cost (Preliminary Design)
December 1, 2016

Project Segment	Construction Costs including 15% Contingency	Engineering Costs 10% of Construction Costs	Total Costs
Storm Ditch between Williams Slough and Wolf Creek	244,605.00	24,460.50	269,065.50
Storm Trunk between Henners Pond and Williams Slough	1,081,862.50	108,186.25	1,190,048.75
		Total:	**$1,459,000.00**

Lacombe North Storm Trunk Opinion of Probable Cost (Preliminary Design)
December 1, 2016
Storm Trunk between Henners Pond and Williams Slough

Item	Additional Description	Quantity	Unit	Unit Cost ($)	Total ($)
Mobilization and Demobilization	---	1	lump sum	$75,000.00	$75,000.00
Rock Excavation	Geotech not yet completed	700	m3	$35.00	$24,500.00
Dewatering during construction	Excavation zone dewatering	1	lump sum	$15,000.00	$15,000.00
Wet zone contruction	Working in wet zones at inlet and outlet to storm trunk; 2 areas	1	lump sum	$15,000.00	$15,000.00
Trench excavation 0-3 m depth	Includes stripping, backfill, and compaction	215	lin.m	$200.00	$43,000.00
Trench excavation 3-5 m depth	Includes stripping, backfill, and compaction	410	lin.m	$350.00	$143,500.00
Trench excavation 5-7 m depth	Includes stripping, backfill, and compaction	305	lin.m	$500.00	$152,500.00
525 mm PVC pipe	Includes bedding gravel	750	lin.m	$200.00	$150,000.00
600 mm PVC pipe	Includes bedding gravel	100	lin.m	$225.00	$22,500.00
675 mm PVC pipe	Includes bedding gravel	65	lin.m	$250.00	$16,250.00
800 mm CSP pipe	Includes bedding gravel	15	lin.m	$300.00	$4,500.00
1500mm dia. MH - (including precast base, 1200 barrels, benching, tops, grade rings, and F49 frame and covers)	Includes stripping, excavation, backfill, and bedding gravel	32	vert.m	$5,000.00	$160,000.00
1500x1500 1-S Vaults - (including precast base, weir wall, stop logs, tops, grade rings, F49 frame and covers)	Includes stripping, excavation, backfill, and bedding gravel; approx 2.5 m tall	1	each	$20,000.00	$20,000.00
Beaver proofing of inlets	1 inlets	1	each	$5,000.00	$5,000.00
Conc Flared End 675 mm	Includes bar screen	1	each	$6,000.00	$6,000.00
Class 1 RipRap aprons at pipe inlets and outlets; 2 of them	Includes riprap granular filter aggregate and non-woven geotextile	100	m2	$150.00	$15,000.00
Premium for any existing utility crossings	Unknown at this time	1	lump sum	$10,000.00	$10,000.00
Erosion and Sediment Control	---	1	lump sum	$5,000.00	$5,000.00
ROW Land Costs	Assumed to be $30,000 / ha	1.7	ha	$30,000.00	$51,000.00
Wetland Compensation	This is only an order of magnitude estimate at this time	1	lump sum	$7,000.00	$7,000.00
Subtotal					**$940,750.00**
Contingency (15%)					**$141,112.50**
Subtotal					**$1,081,862.50**
Engineering\Design, Administration, Field, & Geotechnical (10%)					**$108,186.25**
Total:					**$1,190,048.75**

Wetland compensation cost has a very high level of uncertainty.

Lacombe North Storm Trunk Opinion of Probable Cost (Preliminary Design)
December 1, 2016
Storm Ditch between Williams Slough and Wolf Creek

Item	Additional Description	Quantity	Unit	Unit Cost ($)	Total ($)
Mobilization and Demobilization	---	1	lump sum	$25,000.00	$25,000.00
Clearing and Grubbing	---	0	lump sum	$5,000.00	$0.00
Stripping and Stockpiling	Includes screening for re-use; total footprint area 3000 m2; assume 0.3 m topsoil thickness	900	m3	$7.00	$6,300.00
Common Excavation with transport and stockpiling within 5 km	Ditch total cut volume 4,500 m3	4500	m3	$12.00	$54,000.00
Wet zone contruction	Working in wet zones at both ends of ditch	1	lump sum	$5,000.00	$5,000.00
Topsoil Re-placement from Stockpile	---	900	m3	$5.00	$4,500.00
Imported Topsoil Placement	Upland landscaping	80	m3	$25.00	$2,000.00
Upland Plantings	Trees, Shurbs	1	lump sum	$4,000.00	$4,000.00
Upland Seeding	Includes seed bed preparation; side slopes only	3000	m2	$2.00	$6,000.00
800 mm CSP culvert	Includes excavation, bedding gravel, clay plugs, and backfill	20	lin.m	$750.00	$15,000.00
2.44 m long cast in place concrete weir	Includes stripping, excavation, backfill, and bedding gravel, reinforcing, cast in place concrete, curing, and backfilling	1	each	$10,000.00	$10,000.00
Class 1M RipRap in bottom of ditch	Includes riprap granular filter aggregate and non-woven geotextile; assume 3.5 m width and 165 m length	580	m2	$85.00	$49,300.00
Erosion matting on side slopes	Temporary coconut matting	2400	m2	$4.00	$9,600.00
Erosion and Sediment Control	Other	1	lump sum	$2,500.00	$2,500.00
Landscaping Maintenance	10 months over two years	10	month	$600.00	$6,000.00
ROW Land Costs	Assumed to be $30,000 / ha	0.35	ha	$30,000.00	$10,500.00
Wetland Compensation	This is only an order of magnitude estimate at this time	1	lump sum	$3,000.00	$3,000.00
Subtotal					**$212,700.00**
Contingency (15%)					**$31,905.00**
Subtotal					**$244,605.00**
Engineering\Design, Administration, Field, & Geotechnical (10%)					**$24,460.50**
Total:					**$269,065.50**

Wetland compensation cost has a very high level of uncertainty.

APPENDIX C

Water Reservoir Sensitivity Analysis Table

Summary of Storage Volume Sensitivity Analysis

Year	Population (0.8% Growth Rate)	Population (2% Growth Rate)	Population (5% Growth Rate)	ADD Demand (0.8% Growth Rate) (L/s)	ADD Demand (2 % Growth Rate) (L/s)	ADD Demand (5 % Growth Rate) (L/s)	Total Storage Required (0.8% Growth Rate) (m^3)	Total Storage Required (2 % Growth Rate) (m^3)	Total Storage Required (5 % Growth Rate) (m^3)
2013	12,450	12,450	12,450	39	39	39	11,468	11,468	11,468
2014	12,550	12,699	13,073	40	40	42	11,529	11,619	11,847
2015	12,650	12,953	13,726	40	41	44	11,590	11,774	12,244
2016	12,751	13,212	14,412	40	42	46	11,651	11,931	12,661
2017	12,853	13,476	15,133	41	43	49	11,713	12,092	13,099
2018	12,956	13,746	15,890	41	44	52	11,776	12,256	13,559
2019	**13,060**	**14,021**	**16,684**	**41**	**45**	**55**	**11,839**	**12,423**	**14,042**
2020	13,164	14,301	17,518	42	46	58	11,902	12,594	14,550
2021	13,269	14,587	18,394	42	47	61	11,966	12,767	15,082
2022	13,376	14,879	19,314	43	48	65	12,031	12,945	15,641
2023	13,483	15,176	20,280	43	49	68	12,096	13,126	16,229
2024	13,590	15,480	21,294	43	50	72	12,161	13,310	16,845
2025	13,699	15,790	22,358	44	52	76	12,228	13,499	17,492
2026	13,809	16,105	23,476	44	53	80	12,294	13,691	18,172
2027	**13,919**	**16,428**	**24,650**	**45**	**54**	**84**	**12,361**	**13,886**	**18,886**
2028	14,031	16,756	25,883	45	55	89	12,429	14,086	19,635
2029	14,143	17,091	27,177	45	56	94	12,497	14,290	20,422
2030	14,256	17,433	28,536	46	58	99	12,566	14,498	21,248
2031	14,370	17,782	29,962	46	59	104	12,635	14,710	22,116
2032	14,485	18,137	31,461	47	60	110	12,705	14,926	23,026
2033	14,601	18,500	33,034	47	62	115	12,776	15,146	23,983
2034	14,718	18,870	34,685	48	63	122	12,847	15,371	24,987
2035	14,835	19,247	36,419	48	64	128	12,918	15,601	26,042
2036	14,954	19,632	38,240	48	66	135	12,991	15,835	27,149
2037	**15,074**	**20,025**	**40,152**	**49**	**67**	**142**	**13,063**	**16,074**	**28,311**

Year	Population (0.8% Growth Rate)	Population (2% Growth Rate)	Population (5% Growth Rate)	ADD Demand (0.8% Growth Rate) (L/s)	ADD Demand (2 % Growth Rate) (L/s)	ADD Demand (5 % Growth Rate) (L/s)	Total Storage Required (0.8% Growth Rate) (m^3)	Total Storage Required (2 % Growth Rate) (m^3)	Total Storage Required (5 % Growth Rate) (m^3)
2038	15,194	20,426	42,160	49	69	149	13,137	16,317	29,532
2039	15,316	20,834	44,268	50	70	157	13,211	16,566	30,813
2040	15,438	21,251	46,482	50	72	165	13,285	16,819	32,159
2041	15,562	21,676	48,806	51	73	174	13,360	17,077	33,572
2042	15,686	22,109	51,246	51	75	183	13,436	17,341	35,056
2043	15,812	22,551	53,808	52	77	192	13,512	17,610	36,614
2044	15,938	23,002	56,499	52	78	202	13,589	17,884	38,250
2045	16,066	23,463	59,324	53	80	213	13,667	18,164	39,967
2046	16,194	23,932	62,290	53	82	224	13,745	18,449	41,771
2047	**16,324**	**24,410**	**65,404**	**54**	**83**	**235**	**13,823**	**18,740**	**43,664**
2048	16,455	24,899	68,674	54	85	247	13,903	19,037	45,653
2049	16,586	25,397	72,108	55	87	260	13,983	19,340	47,740
2050	16,719	25,905	75,714	55	89	274	14,064	19,648	49,932
2051	16,853	26,423	79,499	56	91	288	14,145	19,963	52,234
2052	16,988	26,951	83,474	56	93	302	14,227	20,285	54,651
2053	17,123	27,490	87,648	57	95	318	14,310	20,612	57,188
2054	17,260	28,040	92,030	57	97	334	14,393	20,947	59,853
2055	17,398	28,601	96,632	58	99	351	14,477	21,288	62,651
2056	17,538	29,173	101,463	58	101	369	14,561	21,635	65,588
2057	**17,678**	**29,756**	**106,537**	**59**	**103**	**388**	**14,647**	**21,991**	**68,674**

Note:

1. Fire storage was calculated based on two pressure zones. Should additional pressure zone being added to the water system due to future annexation, additional fire storage should be incorporated to the above table.
2. ADD demands were calculated using 320 LPCD.

APPENDIX D

Joint Economic Area Servicing - Sensitivity Analysis

Stantec

Memo

To:	Terry Hager and Matthew Goudy	From:	Brad Vander Heyden
File:	1161104765	Date:	January 6, 2017

Reference: Lacombe IDP – Joint Economic Area
Interim Water and Wastewater Servicing Strategy Sensitivity Analysis - Updated

As part of our previous memos (dated November 7, 2016 and December 2, 2016), Stantec completed water and wastewater modeling to estimate the serviceable area within the Joint Economic Area from single point water and wastewater connections from the City of Lacombe, north of Highway 12. In those previous modeling exercises, water demand scenarios of 0.10 L/s/Ha and 0.05 L/s/Ha were used for the industrial and commercial land uses within the Joint Economic Area and Midway.

As requested, Stantec has completed additional modeling for sensitivity analysis purposes for additional scenarios using 0.04 L/s/Ha and 0.03 L/s/Ha. This updated high-level sensitivity analysis also included the servicing for the proposed Midway and adjacent developments to the north and east, which have a total of approximately 92 ha. The following table summarizes the maximum developable area based on the various industrial/commercial water consumption rates.

Table 1: Summary of Developable Areas in the Joint Economic Area

	Water					Waste Water
Scenario	Industrial / Commercial Water Consumption Rate	Average Daily Demand (L/s)	Maximum Daily Demand (L/s)	Peak Hour Demand (L/s)	Serviceable Area in Joint Economic Area (Ha)	Serviceable Area in Joint Economic Area (Ha)
A	0.10	20.7	41.4	82.8	207	254
B	0.05	16.2	32.3	64.6	323	340
C	0.04	13.9	27.8	55.5	347	355
D	0.03	11.7	23.4	46.8	390	371

Governing Area (shaded: 207, 323, 347, 371)

Figures 1 to 8 illustrate the water-serviceable areas and include the topography, residual pressure at peak hourly demands and available fire flows under maximum daily demand for the four scenarios. The boundary of serviceable areas shown are intended to be conceptual only. **Figures 9 to 11**

Reference: Lacombe IDP – Joint Economic Area
Interim Water and Wastewater Servicing Strategy Sensitivity Analysis - Updated

illustrate the wastewater-serviceable areas for Scenarios A, B, and D. For this wastewater modeling exercise, the serviceable area for Scenario C (0.04 L/s/Ha) was developed by interpolating Scenarios B and D.

It should also be noted that the water modeling analysis was conducted by allocating the future demands evenly across the future developments, which might bring a certain degree of uncertainty, given the industrial users are typically concentrated in one portion of the water network. As the future developments in the Joint Economic Area builds out, the water consumption rates should be monitored to ensure that sufficient flow and pressure can be provided to meet the future needs. Similarly, future sanitary sewer designs should be based on the users' requirements.

Summary

In summary, the serviceable areas increase as the consumption rate decreases. Due to uncertainties of the location of the future commercial/industrial users within the Joint Economic Area, it is recommended that the water consumption rates be monitored for commercial and industrial users to ensure that sufficient flow and pressure can be provided to meet the future needs. Should additional development take place in West Barnett, or other areas in West Lacombe, the servicing capacity for the Joint Economic Area could be reduced as well.

It is also recommended that as part of the monitoring, hydrant flow testing be completed during high demand periods so that the water model can continuously be calibrated and verified, so that the reliability of the model can be assured. The water model was only verified on the basis of the pressure reports provided in the City's current water models.

We trust that this will meet your requirements. If you have any further questions or comments, please feel free to contact us.

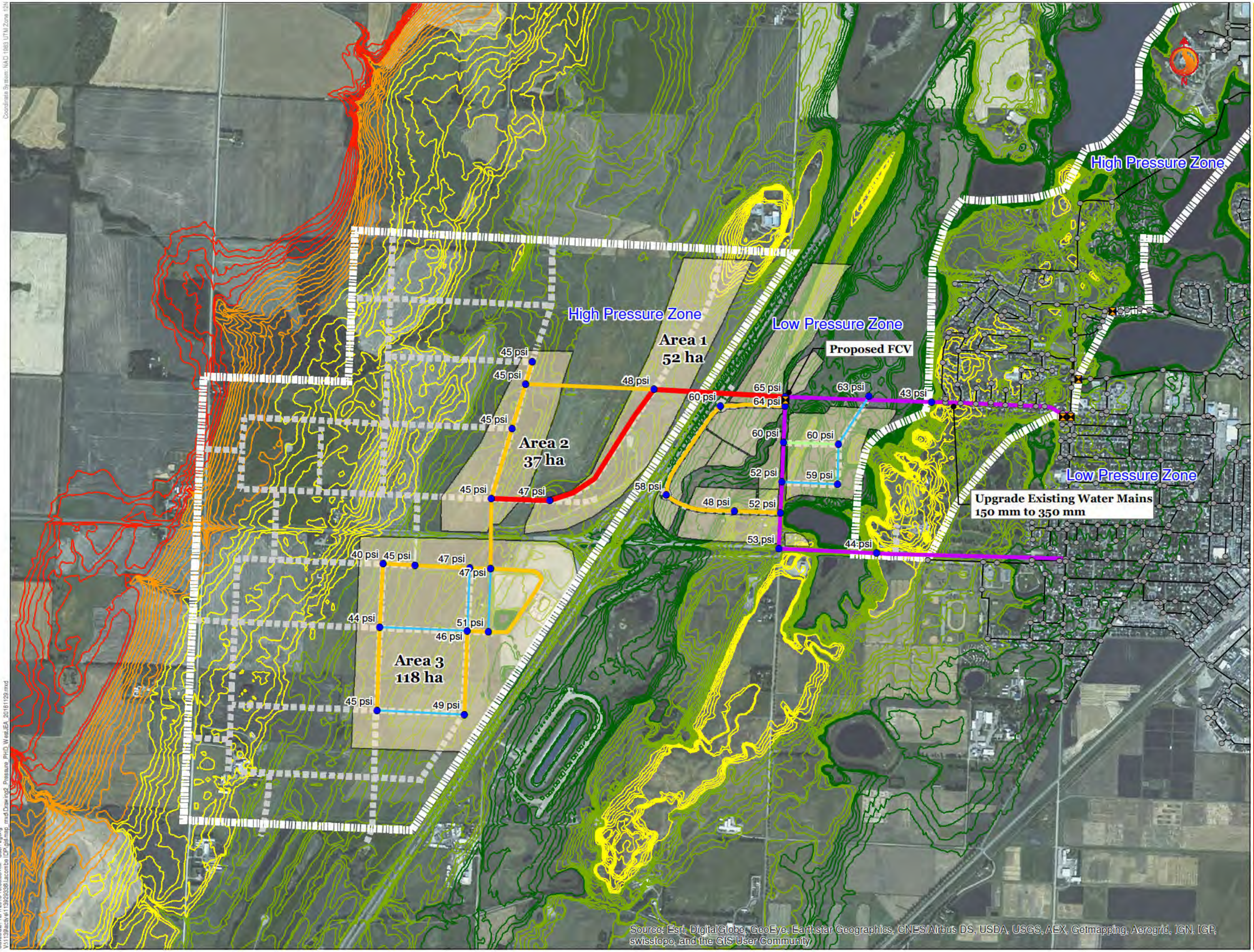
Sincerely,

STANTEC CONSULTING LTD.

Brad Vander Heyden, P.Eng.
Associate
Phone: 403-356-3309
Fax: 403-342-0969
brad.vanderheyden@stantec.com

Attachment: Figures 1-11

c. Todd Simenson, Johnny Ke, Zoe Gong



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Legend

- Nodes
- PRV

Pipe Diameter

- 200 mm
- 250 mm
- 300 mm
- 350 mm
- 400 mm
- Serviced Area

Elevation

- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m
- Pressure Zone Boundary
- Proposed Roadway

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial Consumption Rate
0.1 L/s/ha

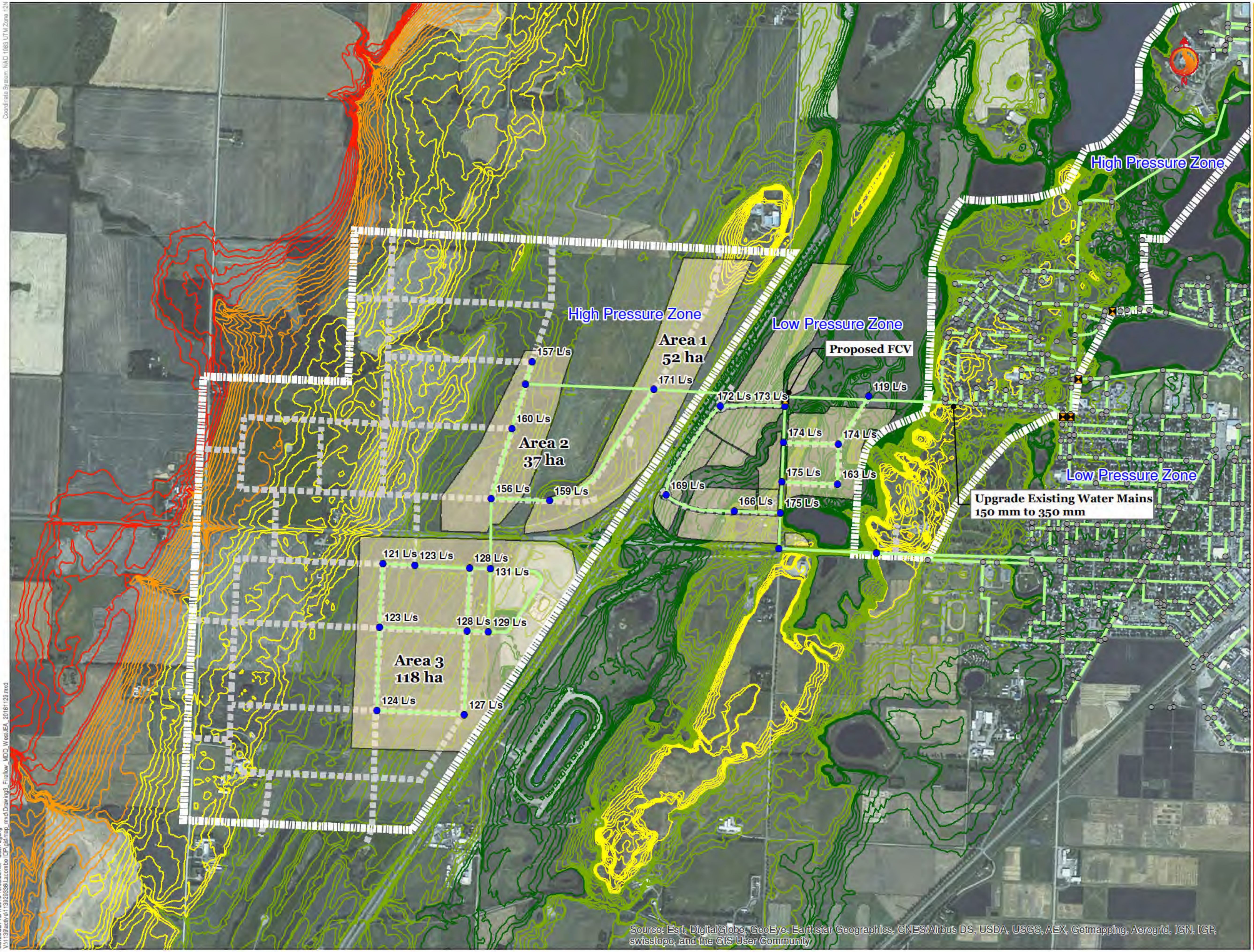
Client/Project

LACOMBE IDP
Red Deer, AB Canada

Title

PHD PRESSURE - SCENARIO A

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)
Figure No.	Issue/Revision
1	A/



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Legend

- Fire Flow Nodes
- PRV
- Pipes
- Serviced Area

Elevation

- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m
- Pressure Zone Boundary
- Proposed Roadway

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial
Consumption Rate
0.1 L/s/ha

Client/Project

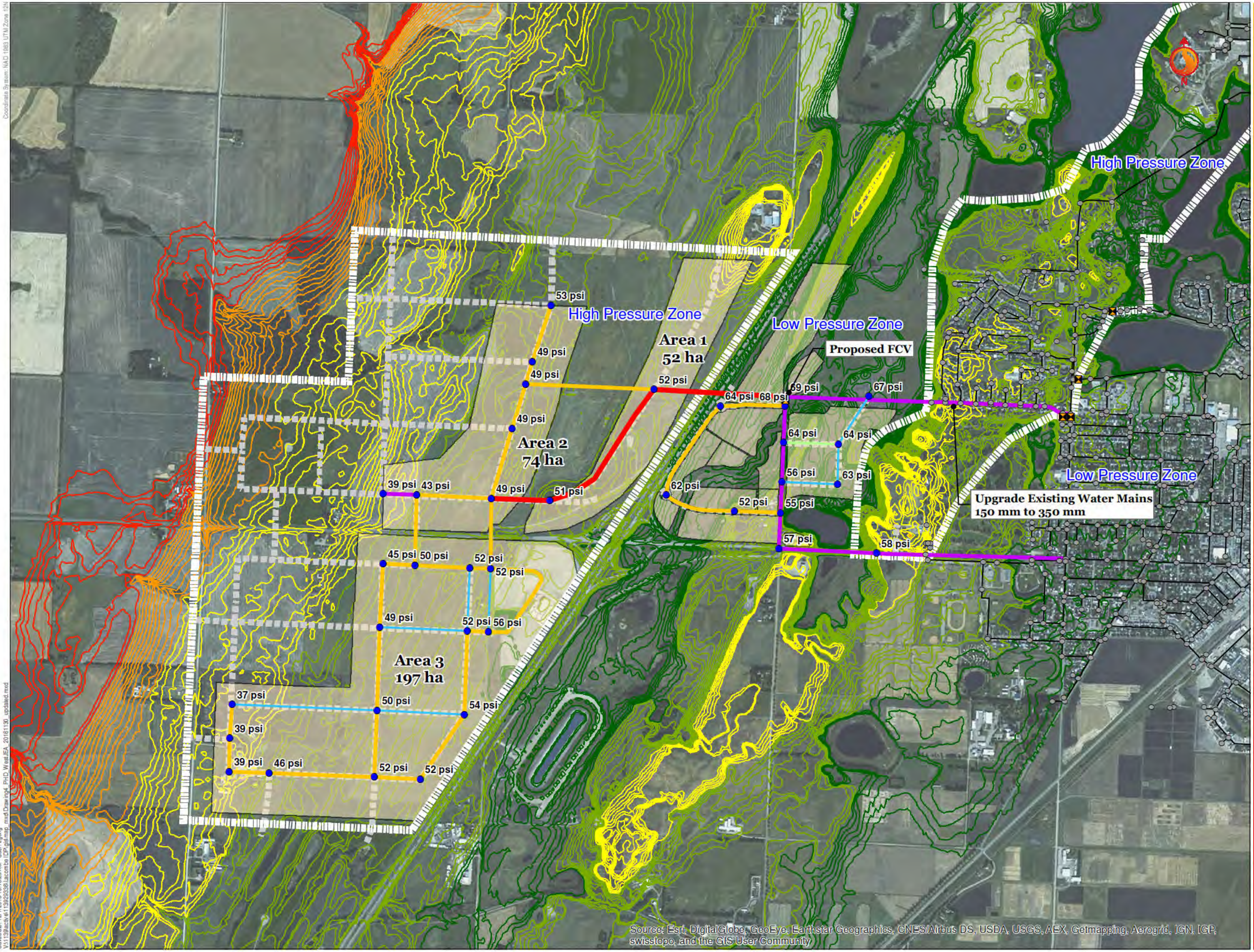
LACOMBE IDP
Red Deer, AB Canada

Title

AVAILABLE FIRE FLOW (MDD) - SCENARIO A

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)

Figure No.	Issue/Revision
2	A/



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Legend

- Nodes
- PRV

Pipe Diameter

- 200 mm
- 250 mm
- 300 mm
- 350 mm
- 400 mm
- Serviced Area

Elevation

- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m
- Pressure Zone Boundary
- Proposed Roadway

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial
Consumption Rate
0.05 L/s/ha

Client/Project

LACOMBE IDP
Red Deer, AB Canada

Title

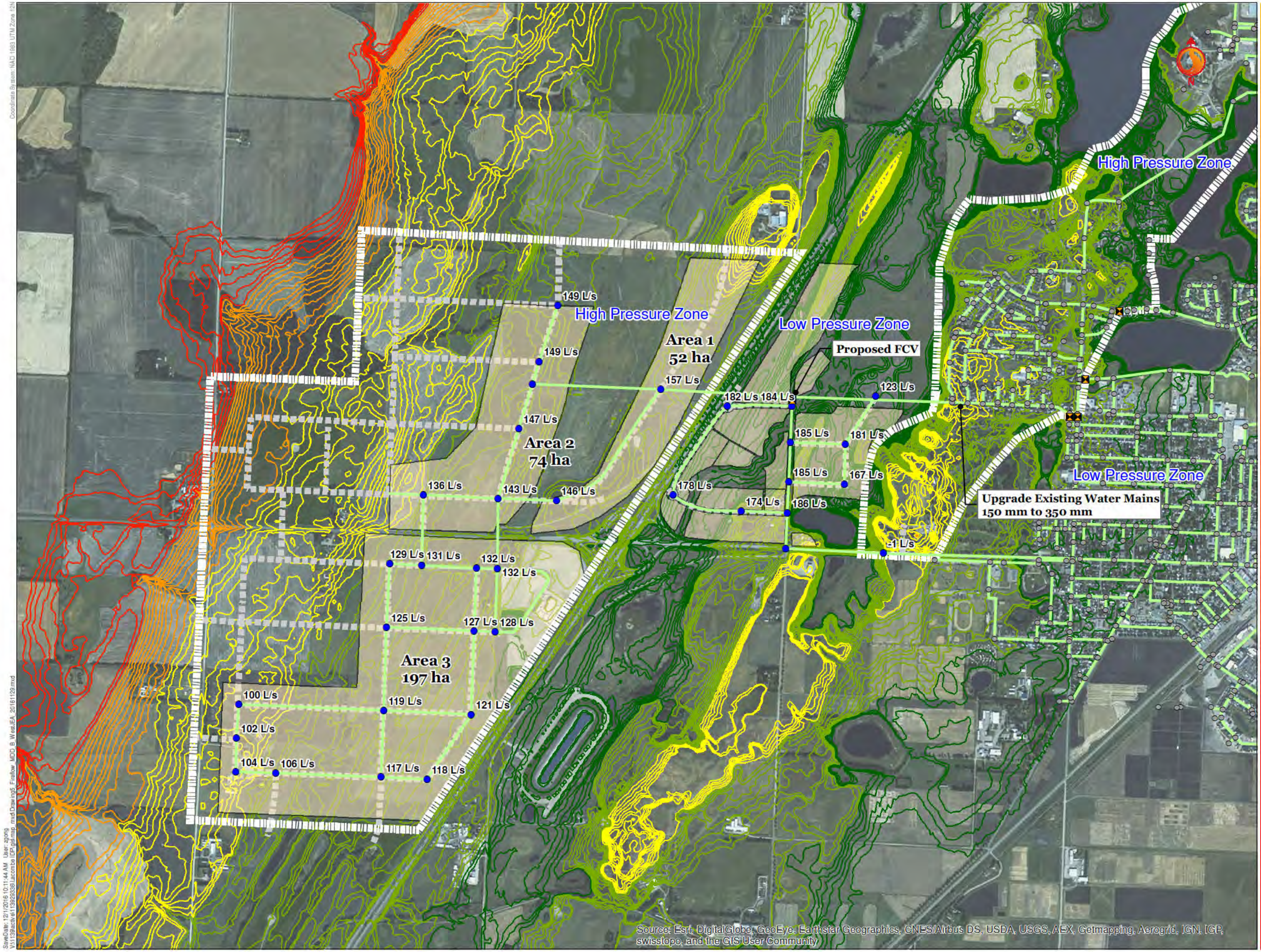
PHD PRESSURE - SCENARIO B

Project No.	Scale
1161104766	1:20,053

0 150 300 450 m

Figure No. 3

Issue/Revision A/



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Legend
- FFnodes
- PRV
- nodes
- pipes
- Serviced Area

Elevation
- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m

Pressure Zone Boundary
Proposed Roadway

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial
Consumption Rate
0.05 L/s/ha

Client/Project

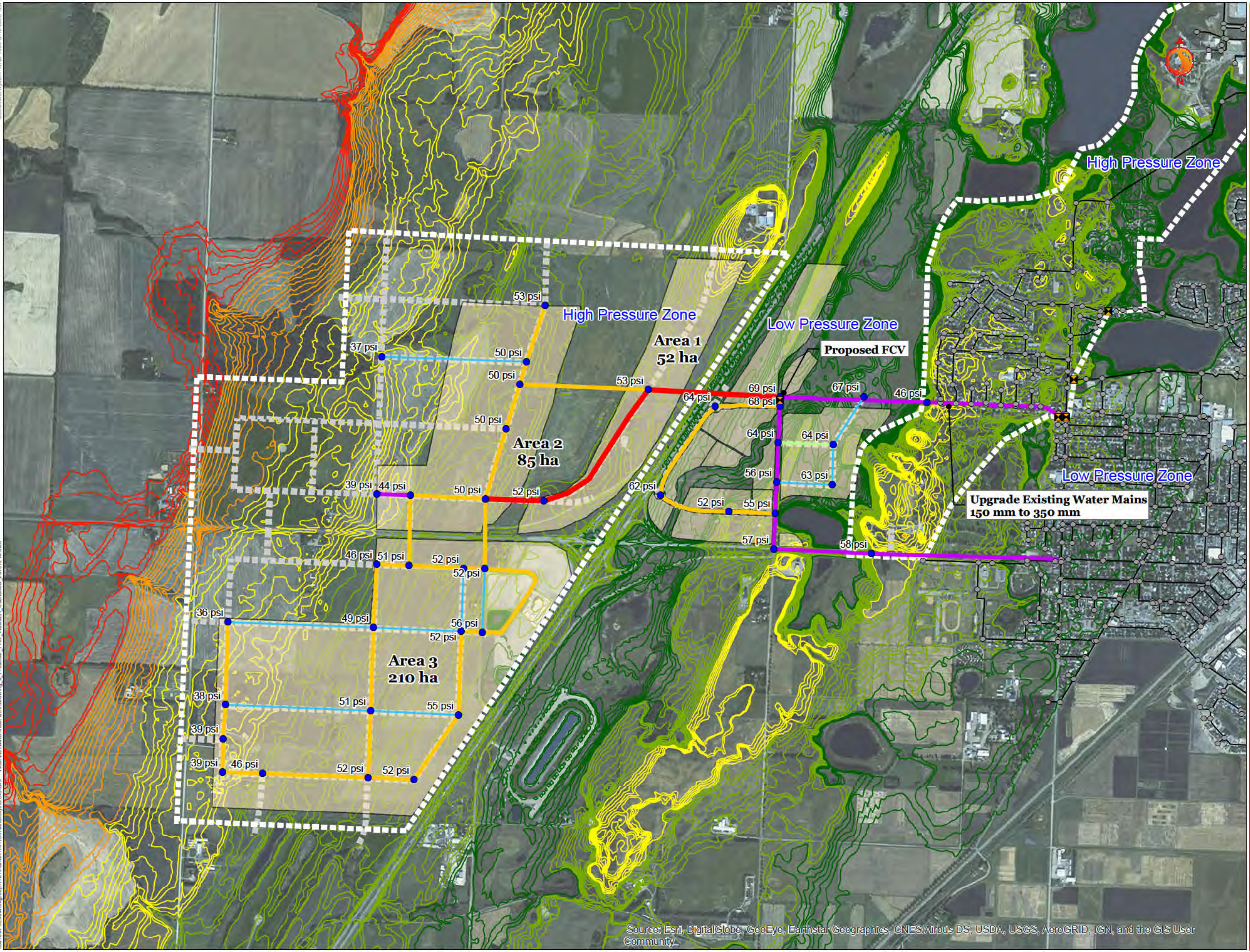
LACOMBE IDP
Red Deer, AB Canada

Title

AVAILABLE FIRE FLOW
(MDD) - SCENARIO B

Project No.	Scale
1161104766	1:20,053 0 150 300 450 m

Figure No.	Issue/Revision
4	A/



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Legend

- Nodes
- PRV

Pipe Diameter

- 200 mm
- 250 mm
- 300 mm
- 350 mm
- 400 mm
- Service Area
- Pressure Zone Boundary
- Proposed Roadway

Elevation

- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial
Consumption Rate
0.04 L/s/ha

Client/Project

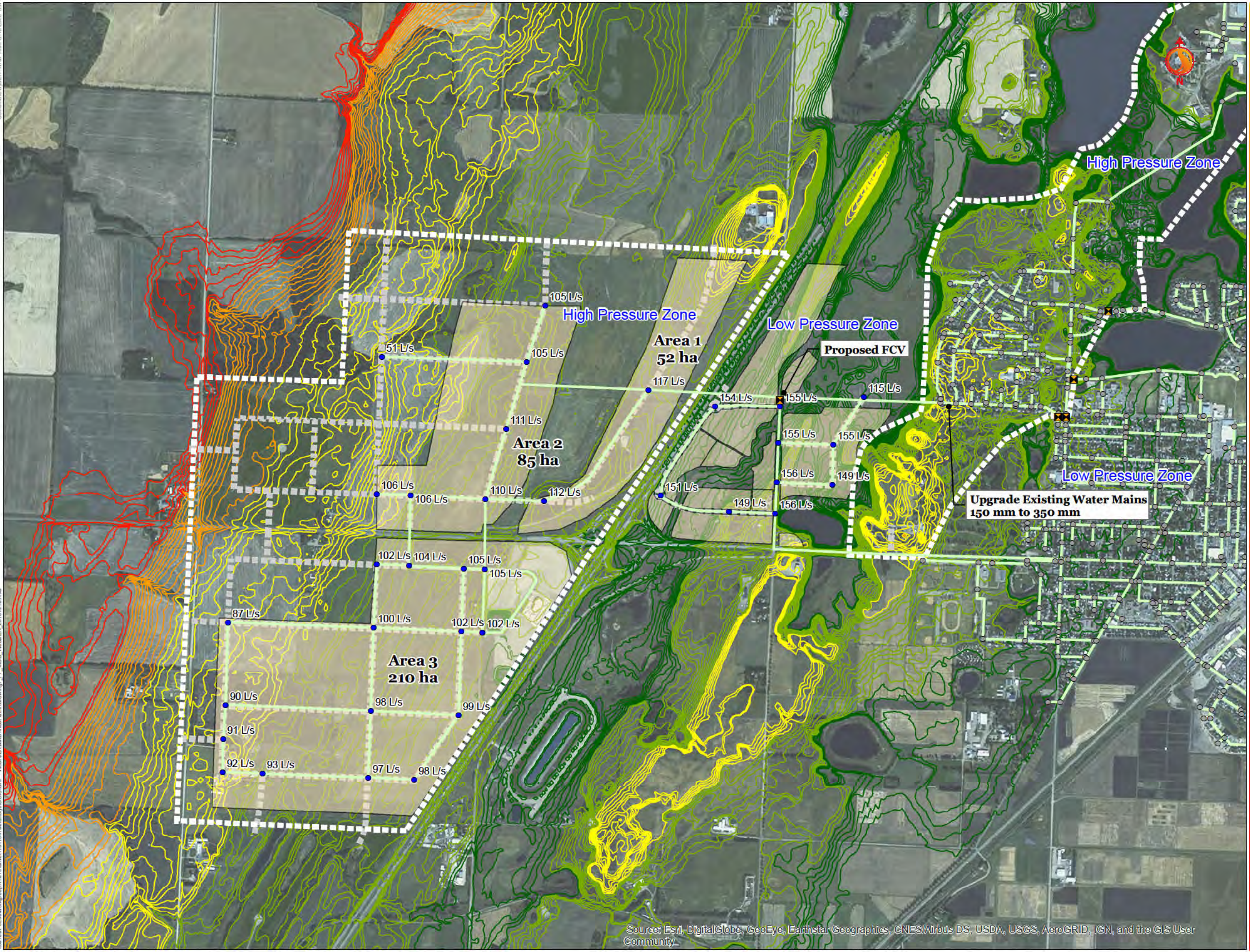
LACOMBE IDP
Red Deer, AB Canada

Title

PHD PRESSURE - SCENARIO C

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)

Figure No.	Issue/Revision
5	A/



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Legend
- PRV
- Pipes
- FFnodes
- Service Area
- Pressure Zone Boundary
- Proposed Roadway

Elevation
- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial
Consumption Rate
0.04 L/s/ha

Client/Project
LACOMBE IDP
Red Deer, AB Canada

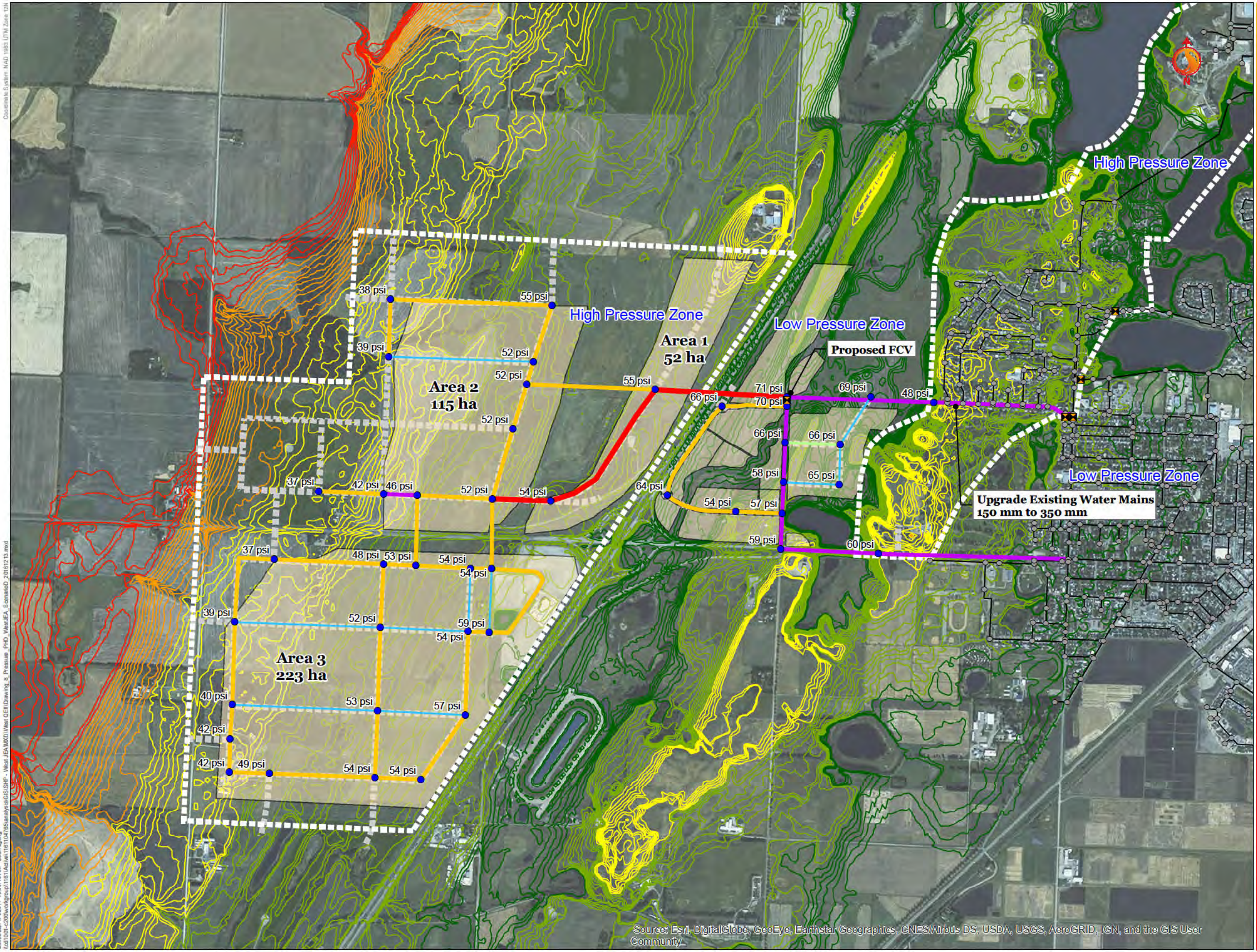
Title
AVAILABLE FIRE FLOW
(MDD) - SCENARIO C

Project No.
1161104766

Scale
1:20,053
0 150 300 450 m

Figure No.
6

Issue/Revision
A/



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Legend

- Nodes
- PRV

Pipe Diameter

- 200 mm
- 250 mm
- 300 mm
- 350 mm
- 400 mm
- Service Area
- Pressure Zone Boundary
- Proposed Roadway

Elevation

- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial
Consumption Rate
0.03 L/s/ha

Client/Project

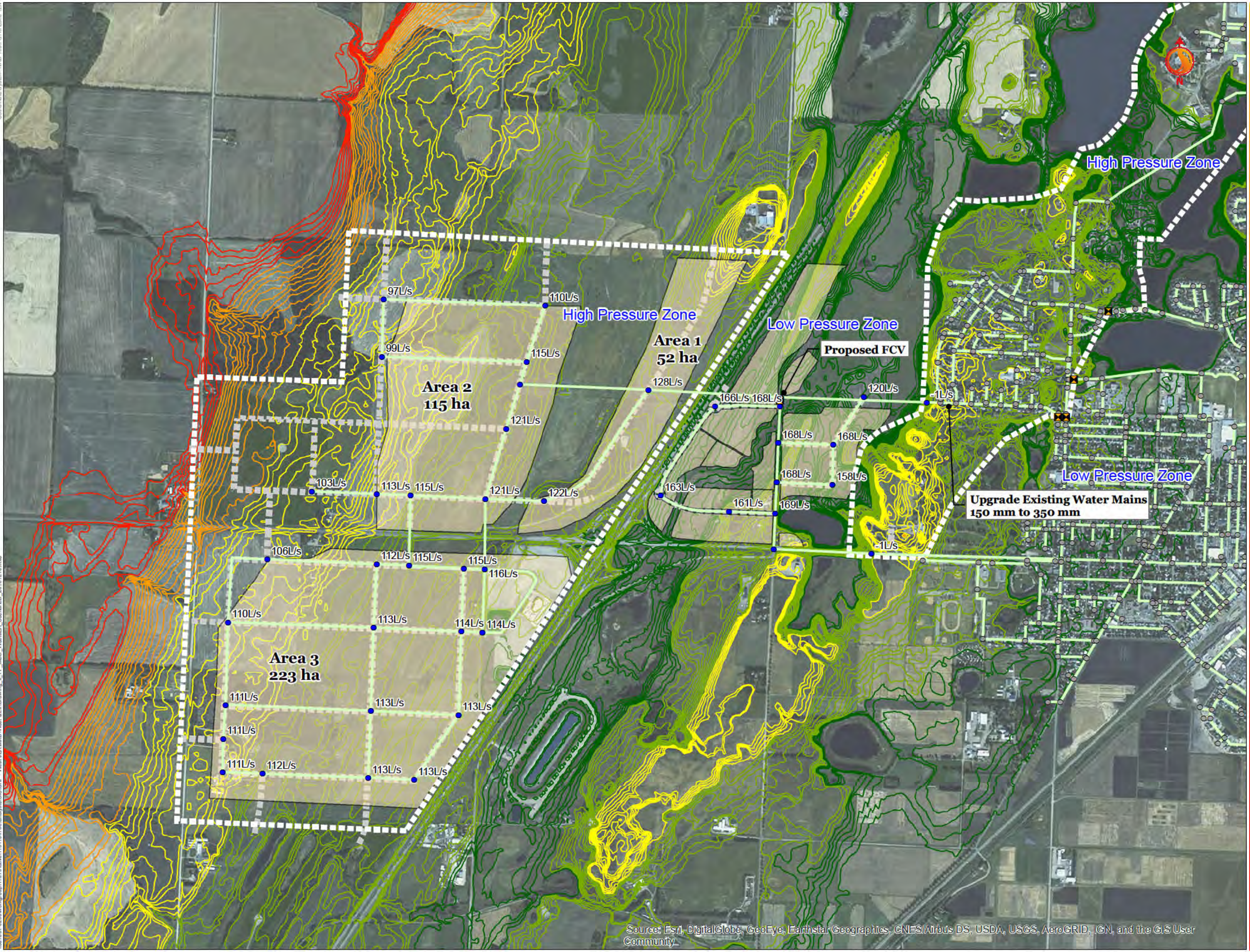
LACOMBE IDP
Red Deer, AB Canada

Title

PHD PRESSURE - SCENARIO D

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)

Figure No.	Issue/Revision
7	A/



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Legend

- PRV
- Pipes
- FFnodes
- Service Area
- Pressure Zone Boundary
- Proposed Roadway

Elevation

- 850 m - 860 m
- 860 m - 870 m
- 870 m - 880 m
- 880 m - 890 m
- 890 m - 896 m

Assumed Population Density:
35 People/ha
Residential Consumption Rate:
ADD: 320 LCPD
MDD: 640 LCPD
PHD: 1280 LCPD
Commercial/Industrial
Consumption Rate
0.03 L/s/ha

Client/Project

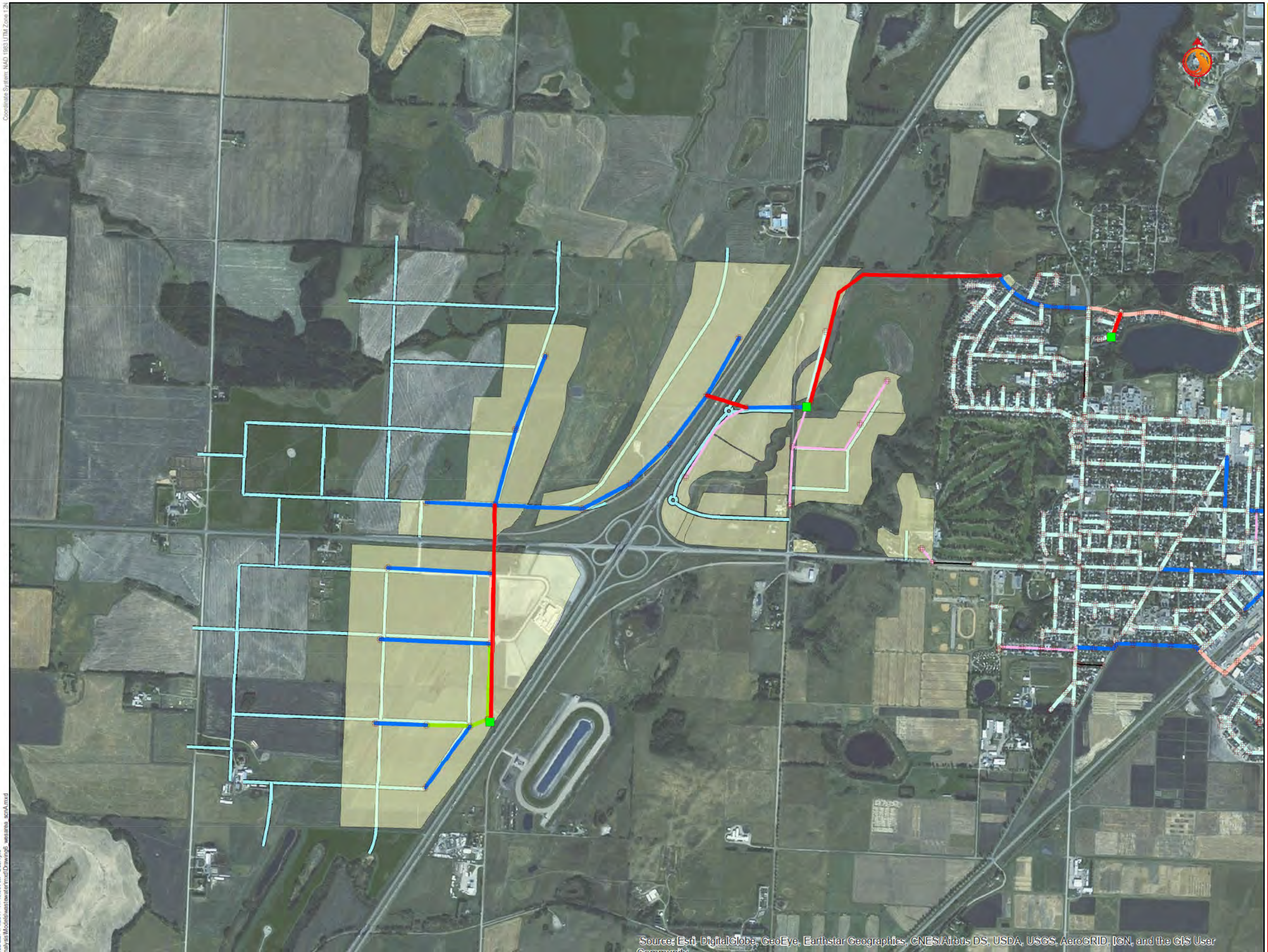
LACOMBE IDP
Red Deer, AB Canada

Title

AVAILABLE FIRE FLOW (MDD) - SCENARIO D

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)

Figure No.	Issue/Revision
8	A/



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Legend

Pipe Diameter

- 100-150 mm
- 200 mm
- 250 mm
- 300 mm
- 350 mm
- 375 mm
- 450 mm
- 525 mm
- 600 mm
- ForceMain/Crossing
- Manholes
- Lift Station
- Servicable Area
- Proposed Roadway

Assumed Population Density:
35 People/ha
Residential Wastewater Rate:
275 L per Capita
Commercial/Industrial
Wastewater Rate
0.1 L/s/ha
Total servicable area
in West Area: 254 ha

Client/Project

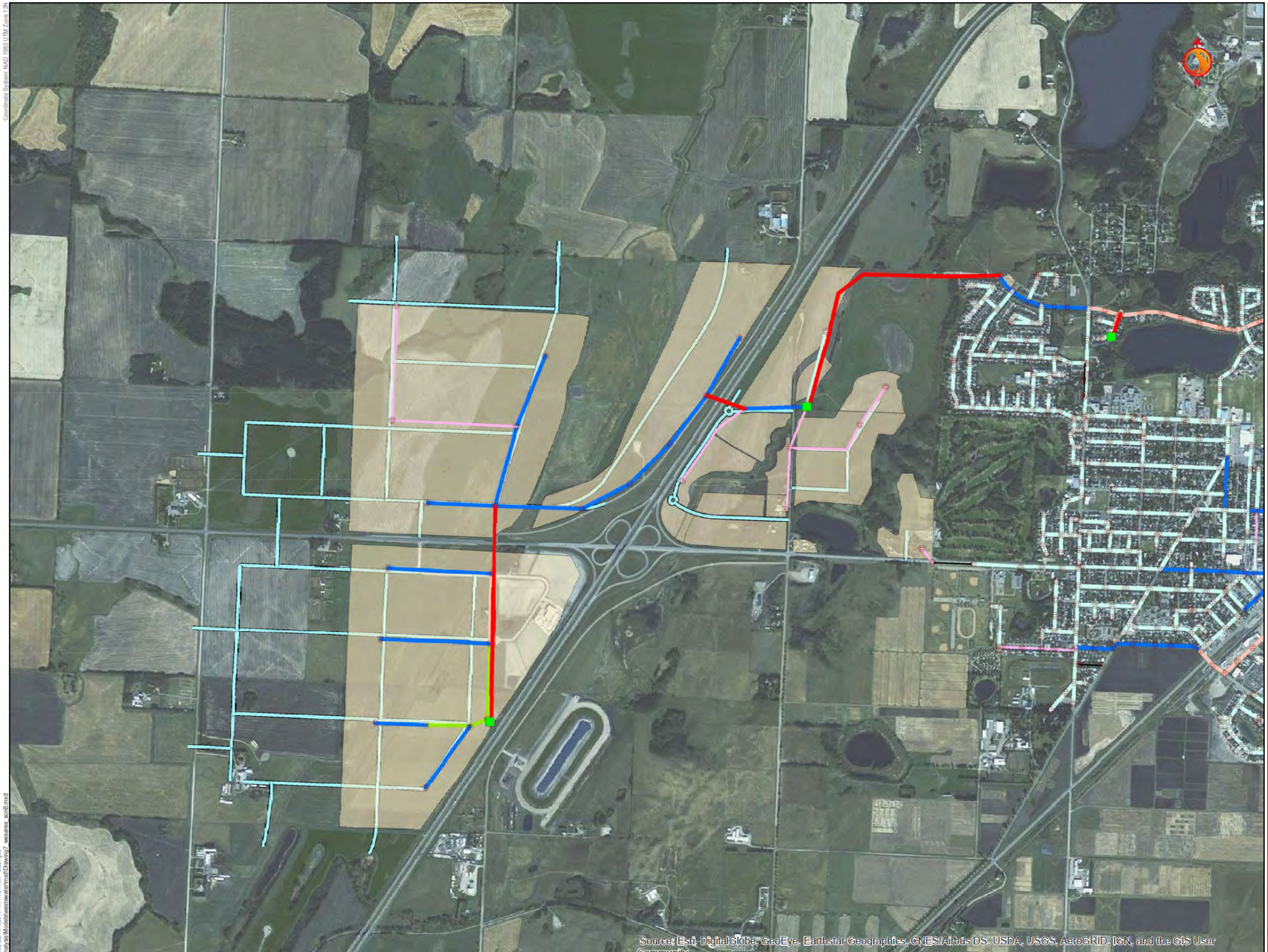
LACOMBE IDP
Red Deer, AB Canada

Title

SANITARY SERVICABLE AREA
WEST HWY II IDP AREA - SCENARIO A

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)

Figure No.	Issue/Revision
9	A/



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Legend

Pipe Diameter

- 100-150 mm
- 200 mm
- 250 mm
- 300 mm
- 350 mm
- 375 mm
- 450 mm
- 525 mm
- 600 mm
- ForceMain/Crossing
- Manholes
- Lift Station
- Servicable Area
- Proposed Roadway

Assumed Population Density: 35 People/ha
Residential Wastewater Rate: 275 L per Capita
Commercial/Industrial Wastewater Rate 0.05 L/s/ha
Total servicable are in West Area: 340

Client/Project

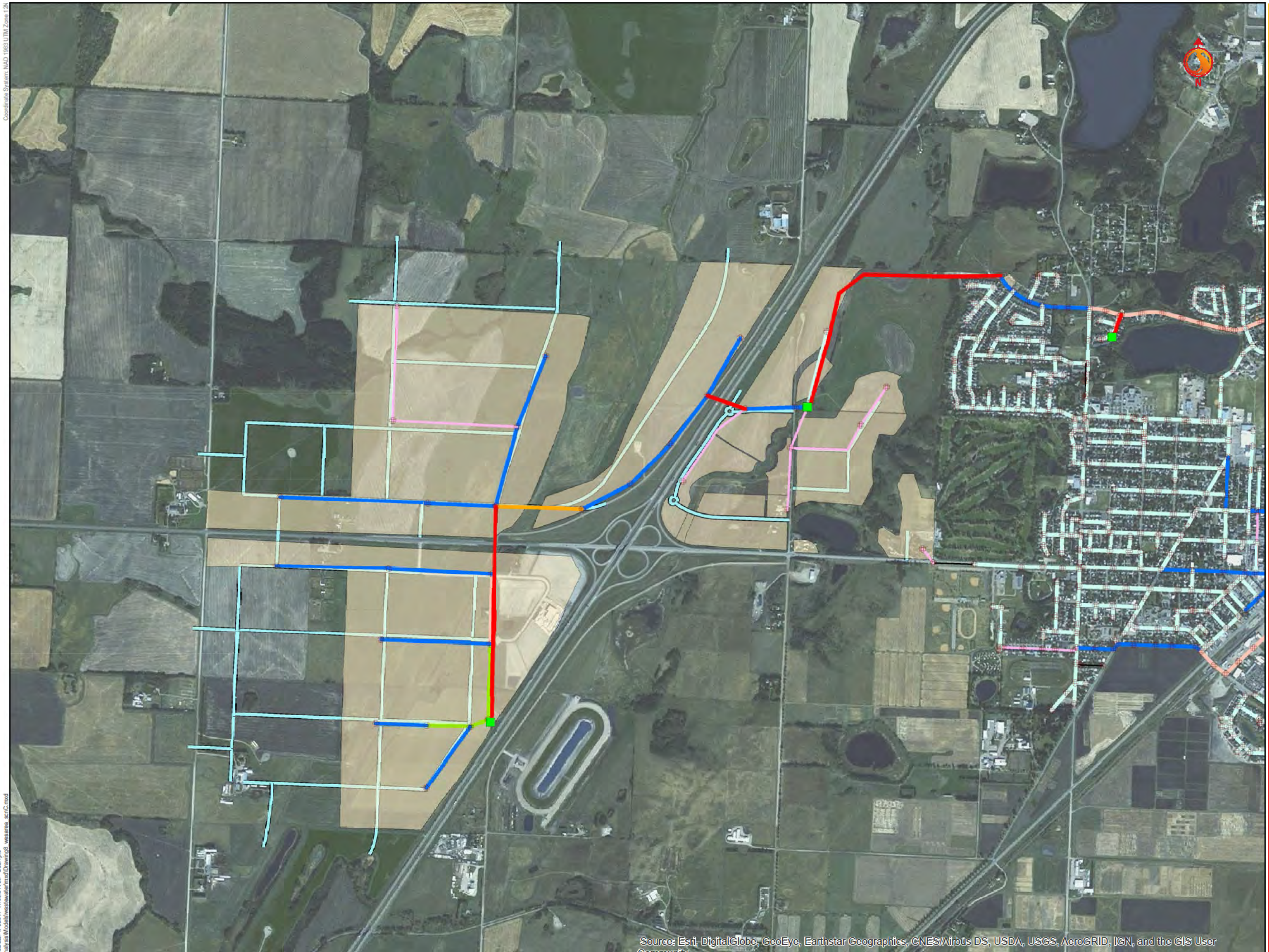
LACOMBE IDP
Red Deer, AB Canada

Title

SANITARY SERVICABLE AREA WEST HWY II IDP AREA - SCENARIO B

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)

Figure No.	Issue/Revision
10	A/



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Legend

Pipe Diameter

- 100-150 mm
- 200 mm
- 250 mm
- 300 mm
- 350 mm
- 375 mm
- 450 mm
- 525 mm
- 600 mm
- ForceMain/Crossing
- Manholes
- Lift Station
- Servicable Area
- Proposed Roadway

Assumed Population Density:
35 People/ha
Residential Wastewater Rate:
275 L per Capita
Commercial/Industrial
Wastewater Rate
0.03 L/s/ha
Total servicable area
in West Area: 371 ha

Client/Project

LACOMBE IDP
Red Deer, AB Canada

Title

SANITARY SERVICABLE AREA WEST HWY II IDP AREA - SCENARIO D

Project No.	Scale
1161104766	1:20,053 (0 150 300 450 m)

Figure No.	Issue/Revision
11	A/