Sturgeon County

Final Report

Sturgeon County Infrastructure Master Plan

July 2019

ISL Engineering and Land Services Ltd. is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

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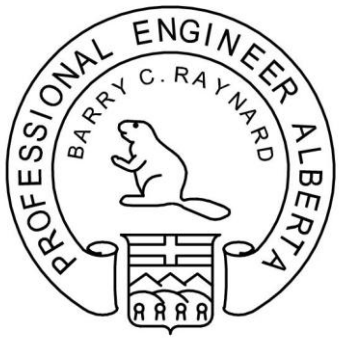

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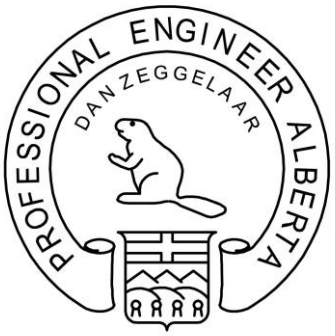

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PERMIT TO PRACTICE
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The Association of Professional Engineers and Geoscientists of Alberta

Council endorsed Sturgeon County's Infrastructure Master Plan to be used as a key infrastructure planning input for the community.

Motion 338/19 September 10th, 2019

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1.0
Introduction

1.1 Background

Sturgeon County is a vibrant and diverse municipality of over 20,000 residents, with a unique blend of land uses for agricultural, resource extraction, heavy and rural industrial, logistics, and residential development. With tremendous growth opportunity, an Infrastructure Master Plan (IMP) was required to support efficient and effective long-term planning.

The County also has several key planning tools in place. Its primary plan is the 2014 Municipal Development Plan (MDP), which identifies a focused growth strategy concept, and outlines distinctive roles and policies for each of its ten neighbourhoods. The County's 2018-2020 Corporate Business Plan also identifies strategies and initiatives to support its growth objectives, including this IMP and how it complements overall priorities.

The County's ten neighbourhoods are very distinctive with aspirations that range from those that seek to maintain current servicing and boundaries, to those that focus on transition from more intense urban built form to lower density rural land uses while ensuring that growth is supported by efficient municipal servicing, to those that focus on the economic growth associated with industrial development. The character, environmental stewardship, economic health, and infrastructure outcomes for each MDP neighbourhood provides an excellent basis for key drivers in the development of this IMP.

The County is also a member of the Edmonton Metropolitan Region Board (EMRB) and is therefore subject to the requirements of the Edmonton Metropolitan Region Growth Plan (EMRGP). For example, the EMRGP identifies major employment areas, Rural Area and Metropolitan Area policy tiers, growth hamlets, and special study area policies for the completion of the Sturgeon Valley. The County is committed to aligning its growth intentions to the requirements of the EMRGP and other regional requirements.

1.2 Study Purpose

This IMP is a planning study which integrates land use planning and infrastructure planning for transportation, water, wastewater, and stormwater. Its primary purpose is to identify conceptual long term infrastructure requirements and priorities for the County to undertake further analysis, rather than offer detailed solutions. This proactive approach will result in the effective use of resources and reduced infrastructure costs for the County. The municipality, potential investors, developers, and landowners will all benefit from a clear long-term infrastructure planning approach.

1.3 Terminology

The following terminology is used throughout this report.

Transportation

- **LOS** – Level of service - provides an indication of how well the intersection performs to service existing traffic volumes.
- **TAC** – Transportation Association of Canada
- **Roadway Classification System** – identifies roadway hierarchies used for planning maintenance activities, and priorities capital improvement projects
- **ITE** – Institute of Transportation Engineers

Water

- **CRNWSC** – Capital Region Northeast Water Services Commission
- **RWCG** – Regional Water Customers Group – purchases water from EPCOR
- **Reservoir** – potable water storage reservoir
- **Fire storage** – water that is stored for the purposes of fighting fires
- **Equalization storage** – water that is stored to meet periods of peak water demands
- **Emergency storage** – water that is stored for emergency use only such as a supply interruption
- **Pumphouse** – structure adjacent to water reservoir that contains distribution and fire pumps
- **Booster station** – structure containing booster pumps, typically on a long transmission line, and not connected to a water reservoir
- **Water transmission main** – water mains that are primarily used to convey water to reservoirs
- **Water distribution system** – water mains that connect the reservoir to individual customers

Wastewater

- **ACRWC** – Alberta Capital Region Wastewater Commission
- **Pump station** – pumping facility used to lift wastewater to a higher elevation and/or to pump through a pressurized forcemain to another typically higher location; synonymous to lift station; ACRWC uses term pump station
- **Lift Station** – synonymous to pump station; Sturgeon County uses term lift station
- **I/I** – Inflow / Infiltration
- **Inflow** – stormwater entering the wastewater collection system directly
- **Infiltration** – groundwater entering the wastewater collection system
- **NERTS** – ACRWC Northeast Regional Transmission System

Stormwater

- **SWMF** – Stormwater Management Facility – stormwater pond, wetland or dry pond used to store stormwater and treat runoff prior to release to downstream stormwater infrastructure or natural watercourses
- **Watershed** – A defined land area drained by a watercourse
- **LID** – Low Impact Development - development sites to mimic natural hydrologic conditions to the extent possible and protect the health and water quality in receiving streams
- **SWMF Discharge Rate** – allowable rate that SWMF can discharge stormwater to downstream systems

2.0
Methodology

2.1 Project Management Approach

The study was managed by the County's Planning and Regional Services department with primary support from Engineering Services, Economic Development, Transportation Services and Utility Services. The County's Planning and Regional Services staff also directed the stakeholder engagement portion of the study along with the development of the performance indicators.

2.2 Data Collection

The following items were provided by Sturgeon County:

- GIS data, including base mapping plus roadway, water, wastewater and stormwater infrastructure;
- Extensive background transportation, water, wastewater, stormwater, and land use planning reports completed on behalf of Sturgeon County and private developers;
- Record drawings, particularly for existing water reservoirs, lift stations and stormwater management facilities;
- Traffic volumes;
- Historic water use at each reservoir and truck fill facility; and
- Historic wastewater pumping information at lift stations.

2.3 Trends / Growth Projections

Rather than using historical growth as a predictor of future growth, the IMP assessed numerous factors that could affect the growth and upgrading requirements for the County's transportation, water, wastewater and stormwater infrastructure. Factors included economic changes, environmental influences, political dynamics, technology / innovation, and regional frameworks.

The County obtained input from a range of stakeholders, including:

- Industrial stakeholders;
- Residential developers;
- Others e.g. School Division, Edmonton Regional Airport Authority, Alberta's Industrial Heartland Association, University of Alberta, Councillors, etc.

This information was used to develop population and employment forecasts. These forecasts were then used as the basis for analyzing the future transportation, water, wastewater and stormwater infrastructure.

2.4 Existing Infrastructure Analysis

The existing infrastructure analysis examined the capacity constraints and opportunities associated with the existing transportation, water, wastewater and stormwater infrastructure. This task was conducted concurrently with the trends and growth projections to ensure for these constraints were considered in the development site specific growth projections.

For main roadway segments, traffic volumes, facility type and local network connectivity was reviewed against the roadway classifications as set by the County. Regional network connectivity also reflects classification; therefore, existing roadway classifications were reviewed for integration with the regional and provincial transportation network.

Existing water usage throughout the County was reviewed to determine the average per capita water use as well as the how water use fluctuates from month to month and year to year.

The existing water infrastructure was then compared to the existing water use to assess the capability of the existing infrastructure to meet current demands.

Monthly wastewater flows at County lift stations were reviewed and compared to the service area, in order to estimate per capita wastewater flows (residential) and unit non-residential flows per hectare. An assessment of wet weather flows could not be made for the existing system due to a lack of detailed rainfall and flow monitoring data.

The existing watercourses, creeks and rivers which drain the County were reviewed. Drainage patterns within or adjacent to existing developed areas were assessed in greater detail based on their potential impact on development.

2.5 Future Infrastructure Analysis

The future service delivery concept for transportation, water, wastewater and stormwater systems was developed based on an understanding of the County's existing infrastructure, as well as population and employment projections. The servicing concepts considered a range of technological innovations, such as modal shifts for transportation and climate change for water and stormwater systems.

Transportation travel demand forecasting used a four-step method. Including trip generation, trip distribution, mode split adjustment and trip assignment. Trip generation rates for retail land uses are readily available using the Institute of Transportation Engineers (ITE), Trip Generation Manual. Local industrial trip rates were used as ITE rates overestimate industrial traffic growth in Alberta. The County provided residential trip rates as these have been supplied to ISL for previous County projects.

The future residential water needs were estimated based on population projections, existing per capita water consumption, and anticipated future per capita water consumption which considered water conservation potential. The future non-residential water needs are estimated in a similar way, based on growth projections and potential future water use. The need for additional reservoir capacity and future water transmission system capacity (transmission mains, pumphouses) was determined based on the projected water demands.

The future wastewater analysis focused on the individual lift stations within the growth areas to determine their capacity to accommodate the projected growth. Where topography dictates, the need for new wastewater lift stations was noted and the lift station future service area was estimated.

Stormwater system upgrading and expansion to address the population and employment growth projections were estimated based on current allowable discharge rates. New or expanded ditches, channels, stormwater management facilities and outfalls to serve the growth projections were documented.

2.6 Implementation Strategy

An implementation strategy was developed for the IMP. The implementation strategy was based on three different growth thresholds/time periods and considered the following:

- Conceptual infrastructure projects/investments, based on growth projections;
- Potential timing of projects/investments, based on growth projections;
- Estimated project costs;
- Potential project funding mechanisms;
- Governance considerations;
- Corridor protection tools and infrastructure siting considerations; and
- Recommended supporting technical studies

2.7 Performance Indicators

Proposed performance indicators were developed for each infrastructure component (transportation, water, wastewater and stormwater). The indicators, along with associated targets, are to be refined by the County in order to assess the effectiveness of the IMP.

3.0
Trends and Growth Projections

3.1 Introduction

Infrastructure master plans typically reference historical growth as a predictor of future growth and assume that the drivers for future growth will be similar to historical ones. However, this study also applied numerous other factors that could affect the growth and upgrading requirements for the County's transportation, water, wastewater, and stormwater infrastructure. These include technical and environmental trends that can impact how infrastructure is planned, designed and operated. It also includes factors that influence growth, such as economics, political dynamics and regional frameworks, in addition to current development pressures.

These factors were considered in the development of residential and non-residential projections for the various growth nodes in the County. In addition, Sturgeon County worked with various stakeholder groups to identify or further refine projections within each growth node.

3.2 Technical/Environmental Trends

3.2.1 Environmental Influences

Increased Atmospheric Temperature Impacts on Transportation Infrastructure

The average temperature is expected to rise in the future. The American Association of State Highway and Transportation Officials (AASHTO) has found that increased temperatures causes infrastructure to deteriorate prematurely. Increased temperatures also cause buckling and rutting. Roadway damage can be mitigated by using a performance grade asphalt binder. Bridge joints will experience increased thermal expansion and stress as average temperatures rise. Increased temperatures mean longer construction seasons, but if temperatures become too extreme this may be offset with the cessation of daytime construction due to health concerns. As the average temperature rises, there may likely be reductions in snow and ice removal, reducing winter maintenance costs and the use of de-icing agents on roads.

Freeze Thaw Impacts on Asphalt

Water expands when it freezes, whereas asphalt contracts at temperatures below zero. Consequently, when water in a small crack or crevice in asphalt freezes it often creates larger cracks or potholes. During the transitional period between winter and spring, as the temperature hovers around zero degrees Celsius, water is entering cracks, freezing, creating larger cracks, this process (freeze thaw cycle) repeats, creating increasingly larger cracks. With increased environmental warming, there is a higher minimum temperature and this leads to increased number of these freeze-thaw cycles, lowering pavement life.

Damage from increased freeze thaw cycles can be mitigated by implementing a monitoring program and sealing cracks to prevent water penetration. Choosing a performance graded asphalt binder can be implemented to accommodate the projected minimum and maximum temperatures to lengthen the pavement's life. Freeze thaw cycles have a lesser impact on gravel roadways.

Increased Extreme Rainfall Events Impacts on Transportation Infrastructure

Many climate scientists believe there will be more extreme weather events in the future, including increased heavy precipitation events. This can result in several negative effects on transportation infrastructure, in addition to the consequences of flooding. Heavy rainfall increases soil moisture, causing reduced pavement subgrade stability as well as increased likelihood of slope erosion and slumping. Deeper ditches will help to ensure the subgrade does not get saturated. The integrity of roads constructed on expandable clay soils like many within the Edmonton Metropolitan Region may potentially be compromised. Retaining walls and abutments must withstand higher pressures due to increased soil saturation during intense periods of precipitation.

Drought Impacts on Water and Wastewater Infrastructure

Climate change is also resulting in an increase in the frequency and duration of droughts. This will impact the Edmonton Metropolitan Region with lower flows in the North Saskatchewan River and higher water demands from all municipalities that rely on EPCOR Water. The Regional Water Users Group (who purchase water from EPCOR) will continue to require that municipalities restrict their water use when reservoir storage levels across the region are low. Subject to major infrastructure upgrades, Sturgeon County could need to place water restrictions on residents (e.g. odd/even dates for lawn watering) more frequently and may need to ban all outside water use during extended droughts.

The impact on water infrastructure will likely be increases in storage reservoir requirements to maintain emergency and fire storage during periods of prolonged drought. This is expected to be offset by lower per capita water use from water conservation.

Lower water flows from water restrictions and/or water conservation will have a minor impact on wastewater infrastructure due to the lower velocities in the gravity sewer systems. This can increase maintenance costs for flushing sewer systems. There is a potential for this to lead to a change in sewer design standards, where slightly steeper sewers are required to minimize deposition of solids.

Increased Frequency of Extreme Rainfall Event Impacts on Stormwater Infrastructure

Climate change is also resulting in an increase in the frequency in extreme rainfall events. Several municipalities have adjusted to their design standards to reflect a larger rainfall depth during a 1:100 year event, based on analyses of rainfall records over the past 30 years. The City of Edmonton's recent revisions has required developers to provide more storage volumes in their storm water management facilities (SWMF) to reflect these changes in rainfall patterns. There is potential for climate change to require additional future changes in stormwater design standards, which could affect both storm pipe and SWMF sizing.

3.2.2 Technical Innovation

Unmanned Aerial Vehicles (drones) in Transportation Engineering

Unmanned Aerial Vehicles (UAV) have vast potential applications in the field of transportation engineering, particularly for traffic surveillance and monitoring. UAV can monitor larger areas and cost less to set up than traditional static cameras. Most UAVs can be airborne in a matter of minutes, making them particularly practical for emergency response. UAVs are also a cost-efficient alternative for routine road and rail monitoring, as opposed to in-person inspections.

Some recent examples of projects that utilized drone technology include:

- Intersection and pavement markings documentation: A drone was used to document changes to pavement markings at an intersection in Arizona (USA). Two hundred images were taken during a 20 minute flight time. The 10 hour process time produced 2-D maps and a 3-D model of the changes.
- Incident reconstruction: A drone was used to collect 130 images to produce a 3-D model depicting sight line limitations for an incident between recreational vehicles at a relatively isolated location.
- Construction zone documentation: Images of a unique piece of construction equipment were taken to produce a 3-D model, used for construction zone documentation.
- Traffic data collection: ISL Engineering, using drone technology, filmed the Flanders Interchange in Calgary, Alberta and the videos were used to observe traffic patterns through a system of several roundabouts. Collecting comparative data using manual traffic counts would have been challenging given the size of the area.
- Other uses, based on ISL's familiarity with drones includes,
  - Orthographic photos, being shot at lower elevation, providing more detailed pictures
  - Attaching Light Detection and Ranging (LIDAR) equipment to drones

- Using infrared cameras to collect photographs of agricultural areas to assess the health of the plants UAV technology is currently limited to 30 minutes of flight time unless a dedicated power source is tethered from the ground allowing longer flights. Costs for purchasing UAV technology varies, depending on quality, flight performance and flight duration. The following as a summary of current UAV technology, based on ISL's past experience:
  - **Consumer Level UAV:** Costs = <$1,000, similar features of higher end products, but less overall quality, including lower quality cameras, less flight performance features, shorter flight times (10 – 20 minutes)
  - **Budget Level UAV**: Costs = $1,000 – $2,000, similar features of higher end products, except slightly more challenging flight features, flight times are less than 30 minutes
  - **Performance Level UAV:** Costs = $2,000 - $4,000, 30 minute run time is standard, best features, including collision avoidance, automated flight modes, higher payloads, better cameras
  - **Performance Level UAV (Plus)** = $4,000 - $10,000 +, similar features of performance models, but higher payloads, providing more opportunities to attached accessory equipment, cost depends on payload size, types of sensors and external equipment

Intelligent Transportation Systems

As communities become more connected, Intelligent Transportation Systems (ITS) will play an ever-more important and central role. ITS includes smart transportation systems that use vehicle-to-infrastructure (V2I), vehicle-to-vehicle (V2V), and infrastructure-to-infrastructure (I2I) communications. An ITS example in the region includes the City of Edmonton's ACTIVE-AURORA project, which is connected vehicle testing. The project includes three V2I test-beds used to research impacts of the system to improve transportation safety, traffic demand management, and smooth out traffic flow during peak periods. Additionally, implementation of smart traffic signal networks, using I2I communication is actively being applied in many municipalities in the Edmonton Metropolitan Region. Optimizing traffic signal systems has the highest benefit/cost ratio compared to typical improvements, resulting in 20-30% reductions in vehicular congestion.

Vehicle-to-Vehicle Communication (Source: Delphi Automotive)

Vehicle to Infrastructure Technology (Source: Delph Automotive)

Autonomous and Connected Vehicles

The implications that autonomous vehicles (AV) will have on our transportation networks is not well understood, with often contradictory opinions of whether traffic congestion will increase or decrease. Even the timelines for full fleet implementation of AVs varies widely, with the City of Edmonton predicting full AV fleets by 2036, and the USA Transportation Secretary expecting AV market availability by 2021, although certain AV capabilities are already available in some vehicles. Although the future of AVs is not well understood, a few municipalities have begun to plan for them with the City of Toronto creating a new AV specific position in 2015, the first municipality to do so. It may be too early to tell how AVs will shape our transportation networks, but this could be better understood by modelling and testing different impact scenarios, including lower and higher congestion levels.

Integrating automated and connected vehicle technology into rural areas may help reduce fatal vehicle collisions. Studies have shown that the fatal motor vehicle collision density is two times higher in rural areas versus urban. This is due to several factors including less guardrails, driver fatigue, poor lighting, and increased speeds. AVs eliminate human error and would likely significantly reduce rural collisions, however detailed GPS mapping to guide AVs on rural roadways are often not available. Initial tests of AV in rural areas without detailed maps have been successful however much more research is required before AV on rural roads are viable.

Sharing Economy (Smart Phone Ride/Car Sharing Apps)

Ride or car sharing is an innovative approach to future congestion problems, which has been made increasingly easy to use due to the prevalence of smartphones. There are countless car sharing and carpool apps available today. These apps help reduce the number of vehicles on the road and consequently reduce the amount of noise and air pollution in cities. A study of Car Sharing Portland (CSP) users found that 26 percent of users sold their personal vehicle while 53 percent were able to avoid purchasing a vehicle altogether. While the potential reductions are attractive, there have already been several safety and liability issues surrounding these services. Municipalities may wish to create policy to protect users as car and ride sharing services become more widespread.

Integrating ride sharing into rural areas is challenging, due to low population densities. Rural ride sharing may be viable in areas within an hour's drive from a major metropolitan area where a sizable portion of the population commutes to the metropolitan area regularly for work. Opt-in ride sharing services coordinated through smart phone apps would help to organize ride sharing for more people, but the success depends on the number of people using the program, their schedule and availability of alternatives. Examples of ride sharing technology currently being tested are UberPOOL and Lyft Line. Both services match riders heading in the same direction so users can share the ride and the cost of the fare. Neither services are currently available in Alberta.

Ride Sharing (Source: Uber)

Big Data Applications in Transportation Planning

Origin/destination travel surveys are commonly done for transportation planning purposes, allowing practitioners to understand travel behaviors to plan new or expand existing transportation infrastructure. Traditional travel survey methods require extensive effort, involving manual license plate surveys or through individual interviews or questions. Emerging techniques for understanding travel patterns include collecting large amounts of data from smart phone applications and GPS devices. This data is collected by a third party and is readily available and more cost effective than manual methods. This data can be purchased directly from Google or mobile providers. Additionally, the vast amount of data collected, known as big data, comparatively dwarfs the sample size of the traditional manual methods, and as it is readily available allows more access for more applications.

Some examples of big data applications for transportation projects include:

- **Calibrating or verifying travel demand models:** Macro transportation models typically model travel patterns across a large municipal or regional transportation network. Allowing access to big data provides more sample points to compare the model travel patterns to actual travel patterns.
  - ISL Engineering used origin/destination data extracted from smart phones to verify a recent travel demand model in the Edmonton region. Collecting the information was more cost effective utilising big data than manual methods.
- **Identifying new active transportation infrastructure:** An example is the use of the cycling application Strava, which cyclists use to plan and track their route, including duration and speed. Using this cycling specific information provides insight into the utilization of existing bicycle facilities and an understanding of where new facilities could be located or where existing facilities could be expanded.
- **Locating park and ride sites:** Identifying where park and ride users originate allows practitioners to better choose locations for new park and ride sites.

Water Conservation

Water conservation is a known driver for reducing water demands and wastewater generation, and the impacts of water conservation initiatives are well documented. The typical metric for water conservation is residential per capita water demands in litres/capita/day (l/c/d). For example, the City of Edmonton, City of Calgary, and Strathcona County have developed water conservation strategies and have seen large drops in per capita water use. A significant portion of this reduction is due to new plumbing codes requiring low flow fixtures combined with high rates of new home construction.

Based on discussions with County officials, the largest opportunity for water conservation is expected to be in Sturgeon Valley for outside water use. The older and slower growing communities are expected to see a slight reduction in per capita water use over time through replacement of plumbing fixtures with low flow devices.

Wastewater Treatment Technology (Lagoons)

One of the key wastewater technology changes is in lagoon technology where the same lagoon footprint can service double the annual wastewater flows using aeration. In some cases additional technology needs to be utilized with aeration to address ammonia concentrations in the final effluent. These include Submerged Activated Growth Reactors (SAGR) or Moving Bed Biofilm Reactors (MBBR). This is expected to have a positive impact on wastewater servicing within the County, potentially for Villeneuve.

Low Impact Development

Low Impact Development (LID) is one of the current areas of innovation for stormwater servicing. It has been primarily applied to improving stormwater quality to mitigate stormwater discharges on downstream receiving waters. It has also been shown to reduce annual runoff volumes and peak flows. This may be very applicable to developments near the North Saskatchewan River based on the relationship between annual runoff volume and erosion.

3.3 Growth Projection Influences

3.3.1 Economic Influences or Opportunities

In discussion with Sturgeon County officials, numerous influences and opportunities exist or are emerging that could drive Sturgeon County's future growth and infrastructure needs. Significant items are listed below.

Cannabis Processing Potential

Induced by legislative changes at the federal level, the County is receiving numerous inquiries for the development of cannabis production facilities. Experience with cannabis production facilities elsewhere within the Edmonton Metropolitan Region (as opposed to cannabis processing) has found that they do not have a particularly high need for water servicing. They recycle their greywater for growing and are capable of relying on holding tanks for fire suppression precautions. These facilities do, however, have greater needs for electricity supply, land, and highway access. While lower dependence on municipal water servicing means these facilities could be located in more areas, many facilities seek rural or semi-rural settings where land is less expensive, but power and highway access is readily available.

Defense Clustering

Also at the federal level, government spending on national defense is dynamic over time and regularly affects the economy in Sturgeon County due to the location of Canadian Forces Base (CFB) Edmonton within its boundaries. CFB Edmonton has emerged as the military service centre for western and northern Canada. It currently employs approximately 6,100 people including 4,500 regular forces, 500 reserves, 500 deployment surge, and 600 civilians. CFB Edmonton houses an approximate population of 2,900. The potential for future development within and surrounding CFB Edmonton, including the Namao area, is a matter of ongoing discussion.

Provincial Infrastructure Improvements

Provincial infrastructure is critical to the success of Sturgeon County's growth areas. For example, the provincial commitment to improve Vinca Bridge (Highway 38 over the North Saskatchewan River) provides an opportunity for improved access for and attraction of heavy industrial investments. To the southwest, access improvements at the intersections of Highways 15, 37, and 825, coupled with the twinning of Highway 15 into Fort Saskatchewan may prove to be a boon for further industrial development in Sturgeon Industrial Park (SIP). These investments will improve the movement of goods and the labour force that may encourage projects within the SIP. These and other planned improvements will support growth and shared opportunity across the County.

Provincial Regulation Reviews

In 2019 the Government of Alberta committed to investigating the regulatory requirements and associated timeframes in relation to energy development in Alberta. This review is intended to assess what can be done to improve the attractiveness of Alberta to petrochemical and other related investment.

Targeted Industry Incentives

Another significant influence on Sturgeon County's growth relates to industrial incentives. For example, the Government of Alberta's Petrochemical Diversification Program (PDP) has announced two rounds of $500 million in royalty credits to date, targeting petrochemical manufacturing projects that offer to create downstream added value and jobs in Alberta. One of two selected first-round projects is sited in Sturgeon County: the $4 billion Canada Kuwait Petrochemical Corporation's complex that will produce polypropylene plastic from propane inputs.

Investment Attraction Focus

In 2018, Edmonton Global was formed, with Sturgeon County as a shareholder. Edmonton Global is a regional economic development company that serves to convene economic development agencies throughout the Edmonton Metropolitan Region and to support more efficient and effective global investment attraction. Of note, Edmonton Global and the Alberta's Industrial Heartland Association have mutually approved a terms of reference for a coordinated partnership.

Edmonton Global currently focuses on the attraction and expansion of 13 primary sectors within the Edmonton region including energy, agriculture, high technology, construction, retail, artificial intelligence, among others. Sturgeon County sees opportunities in most of these sectors through its involvement in Edmonton Global.

More locally, Sturgeon County relies and focuses on sectors including advanced energy, agriculture, and manufacturing, with tourism emerging as well. The County has interest in attracting more value-added agriculture and pursuing transportation/logistics for cold storage. The County is also benefitting from current pipeline developments including the Pembina Pipelines Fox Creek to Namao Junction Pipeline expansion. Major heavy industrial development remains focused in Alberta's Industrial Heartland.

3.3.2 Regional Planning Frameworks

Edmonton Metropolitan Region Growth Plan (EMRGP) and the Sturgeon Valley Special Study Area (SVSSA)

The most significant regional framework influencing Sturgeon County from an infrastructure perspective is the EMRGP, which places broad requirements upon Sturgeon County and also prescribes how growth areas, including the Sturgeon Valley, must be planned. EMRGP policy on the completion of the Sturgeon Valley, negotiated between Sturgeon County, the City of St. Albert, and the City of Edmonton and ultimately approved, establishes a framework to guide development in this area.

The vision for development within the SVSSA is to provide for a complete community with a residential built form that transitions from current densities in the heart of Sturgeon Valley to higher planned densities in St. Albert and Edmonton to the southwest and south respectively. Careful coordination in the planning of infrastructure and services is therefore necessary across the different jurisdictions. Sturgeon County has initiated primary area structure planning in this area and anticipates completion in 2020.

Edmonton Metropolitan Region Servicing Plan (EMRSP)

The Edmonton Metropolitan Region Servicing Plan may influence infrastructure planning investment in the County over time. The objectives of the EMRSP are:

- To identify the services required to support the goals of, and to implement, the Edmonton Metropolitan Region Growth Plan;
- To support the optimization of shared services to enhance use of ratepayer dollars;
- To facilitate orderly, economical, and environmentally responsible growth in the Edmonton Metropolitan Region; and
- To coordinate planning and decisions regarding services among member municipalities to ensure optimization of ratepayer dollars.

In general, the EMRSP is not expected to constrain Sturgeon County's existing municipal infrastructure systems.

Regional Agriculture Master Plan (RAMP)

The EMRB's Regional Agriculture Master Plan considers ways to grow the agricultural sector in the region, ensure clear application of land use policy, and reflect the influences of provincial and federal regulatory frameworks. The project is also reviewing the application of a Land Evaluation Site Assessment (LESA) tool, used to apply RAMP policies in specific potential growth areas.

One of the infrastructure influences of RAMP relates to potential constraints on future development activity, and more nuanced policy such as the abandonment of the use of well water to support agricultural activities in favour of municipally treated potable water. This could create a demand for extending a rural potable water infrastructure network, similar to a system that is in place near Calgary.

Integrated Regional Transportation Master Plan (IRTMP)

The EMRB's Integrated Regional Transportation Master Plan (IRTMP) is a regional framework that describes the region's transportation network, including elements that are regionally significant. Through its funding prioritization matrix, the IRTMP influences infrastructure investment in Sturgeon County.

The IRTMP specifically identifies major expressways within Sturgeon County, in addition to a future freeway (Ray Gibbon Drive) and a future arterial roadway (127 Street). While these future roads are contemplated, they remain uncertain from both need and prioritization perspectives. For example, a future 127 Street may function as either an arterial roadway or a regional collector that terminates at Sturgeon Road and does not cross Sturgeon River. The long-term need for this road and its ultimate form are expected to be further defined through area structure planning processes for the Sturgeon Valley and future regional transportation planning initiatives.

3.3.3 Current Development Pressures, Opportunities and Aspirations

Industrial

The greatest amount of industrial development pressure in Sturgeon County is focused in its portion of Alberta's Industrial Heartland and the Sturgeon Industrial Park. The preparation of an area structure plan for Neighbourhood I in the southeast portion of the County, which includes the Sturgeon Industrial Park, is contemplated by the County.

The Villeneuve area is a potential destination for future industrial development due to the presence of air (Villeneuve Airport), rail (Canadian National Sangudo Subdivision), and highway access (Highway 633 and Highway 44). The County is engaged in discussions with Edmonton Airports, the City of St. Albert, and other regional partners on the airport's potential. The greater Villeneuve-Calahoo area also has sand and gravel deposits where mining activities are anticipated to continue for the foreseeable future.

Elsewhere in Sturgeon County, the ProNorth Industrial Park, located northwest of St. Albert at the former St. Albert Airport, is nearing full build-out. A developer is currently preparing a development concept to expand the industrial park northward. At the Legal Crossroads Industrial Park, on the northeast corner of Highway 2 and Highway 651 west of the Town of Legal, there is limited industrial growth potential although the owner is currently working on a new development concept to build it out.

Residential

Sturgeon County estimates potential for 25 to 30 years of residential and supporting commercial growth within Sturgeon Valley. As per the EMRGP, the Sturgeon Valley could be completed with new residential development potential at an overall minimum density of 35 dwelling units per net hectare to the south and southwest of the existing residential community. Following approval of the special study area policies by the EMRB, the County has commenced work to review specific financial impacts of this development potential, with ultimate consideration for a primary area structure plan. Overall, the County anticipates the majority of its future population growth will be accommodated within the Sturgeon Valley.

Outside of the Sturgeon Valley, the County anticipates its remaining future population growth will be accommodated within its hamlets, with the most growth allocated to its previously identified growth hamlets of Cardiff and Villeneuve. Despite there being a growth moratorium in place for the Hamlet of Cardiff, developer interest persists adjacent to the community. In particular, an adjacent owner to the south of the hamlet is interested in subdividing for a higher density residential product (compared to existing products in the hamlet) with limited neighbourhood retail commercial.

In Villeneuve, the County has also witnessed past developer interest on adjacent lands to the west despite the hamlet's lagoon facility lacking some necessary capacity, which encumbers developability due to its legislated residential development setbacks. In the past, Villeneuve has attracted older demographics and the County sees a potential demand for aging in place and row housing in the future.

Other County hamlets are also anticipated to realize some growth. For example, a study was undertaken by Parkland County investigating the feasibility of extending sanitary lines from the Alberta Capital Region Wastewater Commission system (currently serving Stony Plain and Spruce Grove to the south) to the hamlets of Calahoo and Villeneuve. If this type of regional wastewater system was introduced, it could increase the development potential of both communities. The hamlet of Namao may also see developer interest emerge due to the existence of a lagoon (currently owned and operated by the Sturgeon Public School Division) and a water line (currently owned and operated by CFB Edmonton).

Beyond the Sturgeon Valley and the above hamlets, a small amount of the County's future population growth would be concentrated within country residential and farmstead acreage developments.

3.4 Growth Projections

3.4.1 Population Projections

Sturgeon County

Table 3.1 below presents a range of population projections for Sturgeon County to 2044. The range includes the projections within the County's 2014 Municipal Development Plan (MDP) to 2042. The range also includes the Low Case and High Case projections from the EMRGP to 2044 as well as an interpolated midpoint between the two cases.

Table 3.1: Annual Comparison of Sturgeon County Population Projections

Year	MDP	EMRGP Low	EMRGP Midpoint	EMRGP High
2011	19,578	—	—	—
2012	19,899	—	—	—
2013	20,226	—	—	—
2014	20,558	20,600	20,600	20,600
2015	20,896	20,883	20,969	21,047
2016	21,239	21,169	21,345	21,503
2017	21,588	21,459	21,728	21,969
2018	21,942	21,754	22,117	22,445
2019	22,303	22,052	22,513	22,932
2020	22,669	22,355	22,917	23,429
2021	23,041	22,661	23,328	23,937
2022	23,419	22,972	23,746	24,456
2023	23,804	23,287	24,171	24,986
2024	24,195	23,607	24,604	25,527
2025	24,592	23,930	25,045	26,081
2026	24,996	24,259	25,494	26,646
2027	25,406	24,591	25,951	27,224
2028	25,823	24,929	26,416	27,814
2029	26,247	25,271	26,890	28,417
2030	26,678	25,617	27,372	29,033
2031	27,117	25,969	27,862	29,662
2032	27,562	26,325	28,362	30,305
2033	28,014	26,686	28,870	30,962
2034	28,474	27,052	29,387	31,633
2035	28,942	27,423	29,914	32,319
2036	29,417	27,799	30,450	33,020
2037	29,900	28,180	30,996	33,736
2038	30,391	28,567	31,551	34,467
2039	30,890	28,959	32,117	35,214
2040	31,397	29,356	32,693	35,977
2041	31,913	29,759	33,278	36,757
2042	32,437	30,167	33,875	37,554
2043	—	30,581	34,482	38,368
2044	—	31,000	35,100	39,200
AAGR	**1.64%**	**1.37%**	**1.79%**	**2.17%**

The most conservative projection in Table 3.1 is the EMRGP Low Case, which estimates 31,000 residents in 2044 based on an average annual growth rate (AAGR) of 1.37%. The most aggressive projection is the EMRGP High Case that estimates a population of 39,200 in 2044 using an AAGR of 2.17%. Sturgeon County's MDP projection estimates a population of 32,437 in 2042 using an AAGR of 1.64%. This is lower than the interpolated EMRGP Midpoint Case projection in 2042, which estimates 33,875 residents in 2042 at an AAGR of 1.79%.

As visualized in Figure 3.1, the MDP projection estimate results in a population that is between the EMRGP Low Case and interpolated EMRGP Midpoint Case. Therefore, the MDP projection can be viewed as a hybrid between the EMRGP Low Case and the interpolated EMRGP Midpoint Case projections.

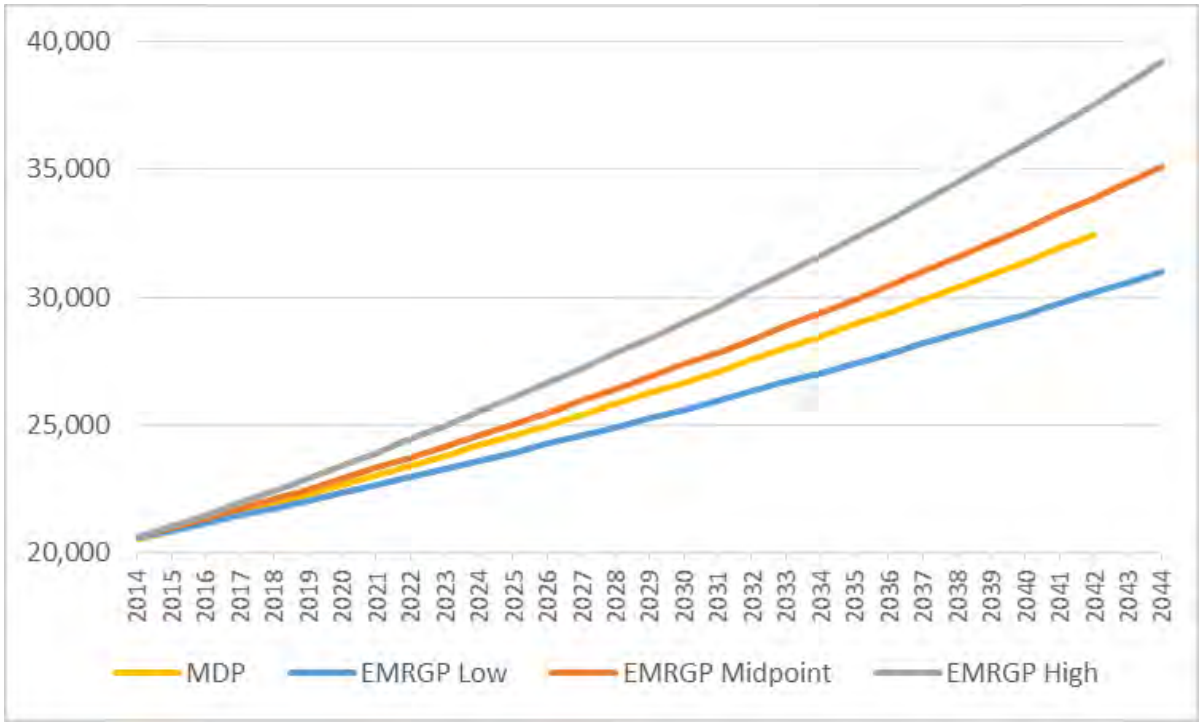

Figure 3.1: Comparison of Sturgeon County Population Projections to 2044

For the purposes of the IMP, an extrapolated 2044 MDP County population (25-year growth) was ultimately selected for analysis. The MDP figure was chosen as it remains current municipal policy direction and represents more of a balance between the high/low figures from the EMRB. Following the selection of this 25-year population target, the project team estimated the distribution of this future growth among the different residential growth areas. Table 3.2 provides a summary of this population growth distribution. Almost all of the future population is concentrated within three 'residential growth areas' – the Sturgeon Valley, Cardiff, and Villeneuve.

Table 3.2: Sturgeon County's Population Targets for Major Growth Nodes

Residential Growth Area	2011 Population	Growth Allocation	MDP Extrapolated 2044 Population
Sturgeon Valley	3,475	78%	14,202
Hamlets	1,955	17%	4,377
Cardiff	1,190	10%	2,574
Villeneuve	225	5%	917
Other Hamlets	540	2%	886
Rural Balance of County	14,148	5%	14,840
Total	**19,578**	**100%**	**33,419**

It was also determined that the growth distribution among the different residential areas also be estimated at various time periods/thresholds. Most long range plans typically consider short/medium/long-term horizons. For the purposes of the IMP, it was decided that these horizons would correspond with 5/15/25 years (2024/2034/2044). Table 3.3 illustrates populations at the 5/15/25-year intervals. It should be noted that it was assumed that population growth in the three 'residential growth areas' would be relatively low in the first 5 years. Greater planning certainty/clarity in terms of follow-up area structure planning and other planning tools is likely required in order to accelerate growth. It is anticipated that these initiatives would take place within five years and once completed provide the opportunity for an acceleration in growth.

Table 3.3 distributes the population figures within Table 3.2 to the three growth thresholds, and includes a breakdown of the growth in the other hamlets. The total future population is also shown.

Table 3.3: Population Projections for Thresholds 1, 2 and 3

		Future Population		
Residential Growth Area	2011 Population	Threshold 1 (2024)	Threshold 2 (2034)	Threshold 3 (2044)
Sturgeon Valley	**3,475**	**4,756**	**9,461**	**14,202**
Hamlets	**1,955**	**2,232**	**3,201**	**4,377**
Cardiff	1,190	1,328	1,882	2,574
Villeneuve	225	294	571	917
Other Hamlets	540	610	748	886
Calahoo	210	237	291	345
Alcomdale	50	56	69	82
Mearns	10	11	14	16
Pine Sands	30	34	42	49
Riviere Qui Barre	100	113	139	164
Carbondale	70	79	97	115
Namao	10	11	14	16
Lamoureux	60	68	83	98
Rural Balance of County	**14,148**	**14,287**	**14,563**	**14,840**
Total	**19,578**	**21,275**	**27,225**	**33,419**

3.4.2 Employment Projections

Sturgeon County

Table 3.4 presents two employment projections for Sturgeon County to 2044. The first scenario is the projection within the County's 2014 Municipal Development Plan (MDP) to 2044, which was drawn from the Capital Region Growth Plan (CRGP) December 2009 Addendum. This scenario assumed a total of seven 'upgrader scale' projects to be developed within Alberta's Industrial Heartland between 2009 and 2044. It estimated 10,793 jobs in its base year of 2009, growing to 18,888 jobs in the horizon year of 2044 – an AAGR of 1.61% over 35 years. The second is the EMRGP High projection scenario. It estimated 7,555 jobs in 2014, growing to 12,406 jobs in 2044 – an AAGR of 1.67% over 30 years. For the purposes of this study, the additional employment growth identified by the EMRB was utilized.

Table 3.4: Annual Comparison of Sturgeon County Employment Projections to 2044

Year	MDP (CRGP)	EMRGP High
2009	10,793	—
2010	11,400	—
2011	12,040	—
2012	12,717	—
2013	13,432	—
2014	14,187	7,555
2015	14,878	7,681
2016	15,603	7,809
2017	16,363	7,939
2018	17,160	8,071
2019	17,996	8,206
2020	17,503	8,343
2021	17,023	8,482
2022	16,557	8,623
2023	16,103	8,767
2024	15,662	8,913
2025	15,233	9,062
2026	14,816	9,213
2027	14,410	9,366
2028	14,015	9,523
2029	13,631	9,681
2030	13,931	9,843
2031	14,237	10,007
2032	14,550	10,174
2033	14,870	10,343
2034	15,197	10,516
2035	15,531	10,691
2036	15,872	10,869
2037	16,221	11,050
2038	16,578	11,234
2039	16,942	11,422
2040	17,315	11,612
2041	17,695	11,806
2042	18,084	12,003
2043	18,482	12,203
2044	18,888	12,406
AAGR	**1.61%**	**1.67%**

Figure 3.2 visualizes the employment projections presented in Table 3.5. The decline in jobs between 2019 and 2029 is due to the transitioning of the 'upgrader scale' projects from construction to operation.

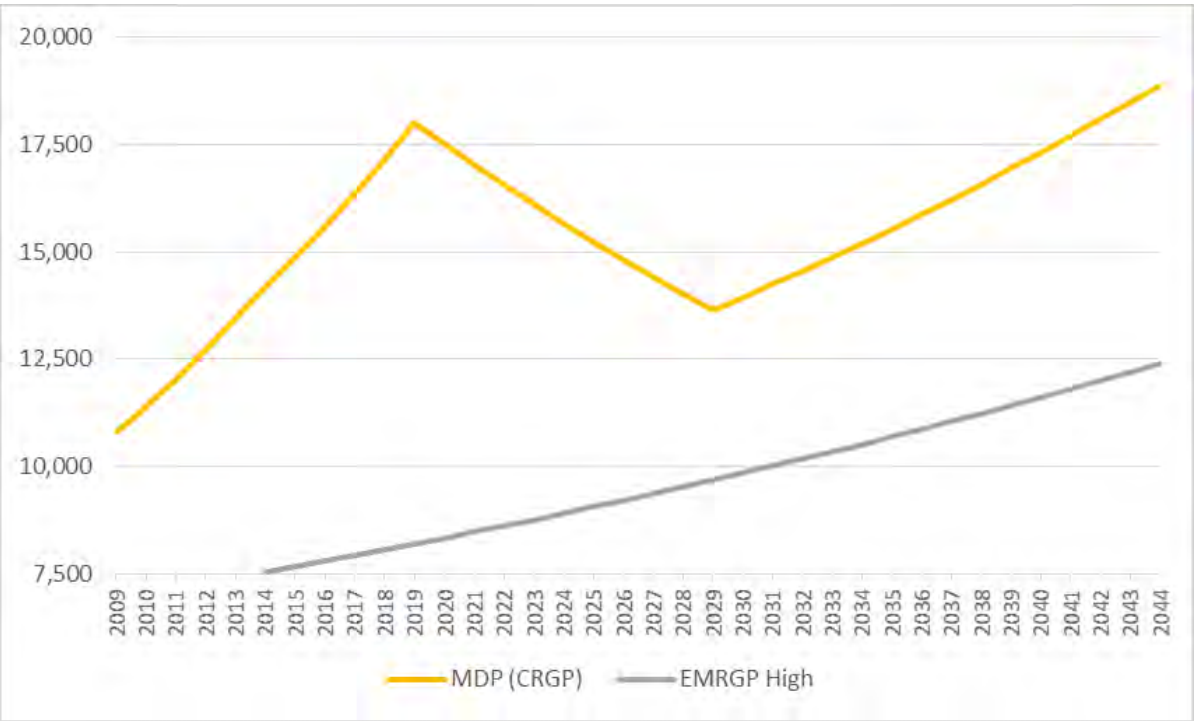

Figure 3.2: Comparison of Sturgeon County Employment Projections to 2044

Proposed Employment Allocations

The County provided estimated employment distributions for the IMP within Table 3.5.

Table 3.5: Employment Allocations

Employment Node	Additional New Employment (from 2019)		
	Threshold/Year		
	2024	2034	2044
Alberta's Industrial Heartland	379	1146	2079
Sturgeon Industrial Park	285	778	1563
Villeneuve Airport	26	236	321
ProNorth Industrial Park	17	150	237
Other*	70	230	420
Totals	**707**	**2310**	**4200**

* Other industrial development includes CFB Edmonton and other potential areas.

3.4.3 Proposed Growth Areas

The anticipated development locations within the growth nodes were identified by Sturgeon County and are shown in Figure 3.3. The gross and net developable areas were calculated by Sturgeon County based on the population and employment projections as well as input from key stakeholders. The areas shown in Figure 3.3 and later in the report are not intended to be prescriptive, but only a general indication of the most likely development location.

The non-residential areas are loosely based on employment projections, but the density of employment to non-residential development areas is highly variable. The non-residential areas are used to estimate water demands and wastewater generation. The non-residential areas are summarized in Table 3.6 at the key employment area.

Table 3.6: Non-Residential Growth Projections for Key Employment Areas

Employment Node	Existing Developed Area (ha)	Gross Hectares Added (ha)			Net Hectares Added (ha)			Total Net Area (ha)		
		Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Alberta's Industrial Heartland	988	322	784	776	258	627	621	1,246	1,873	2,494
Sturgeon Industrial Park	235	90	140	126	72	112	100	307	420	520
ProNorth Industrial Park	33	6	56	33	5	45	26	38	82	108
Namao	0	0	90	174	0	72	139	0	72	211
Villeneuve Airport	10	10	78	50	8	63	40	18	80	121

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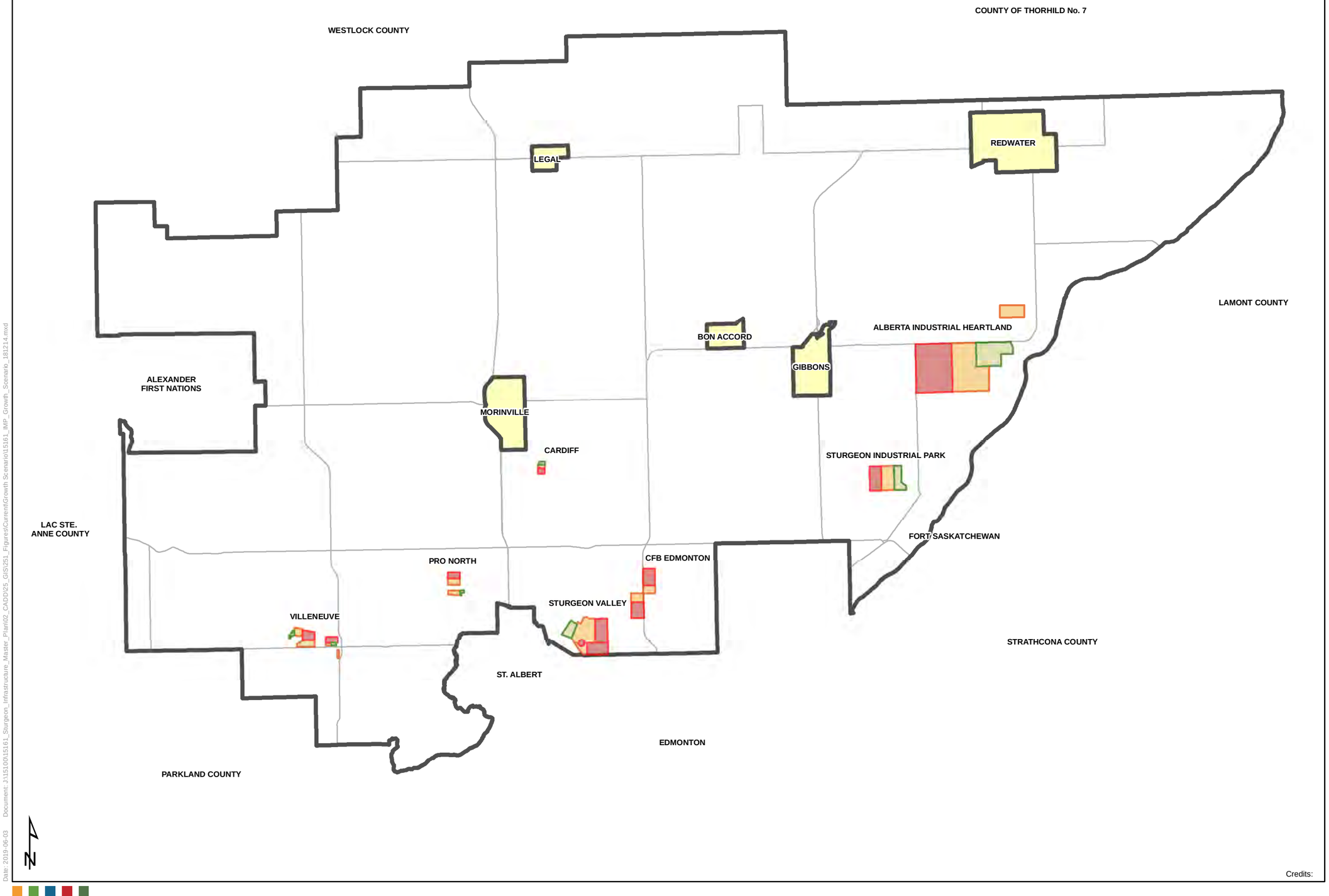
STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 3.3:

GROWTH THRESHOLDS



Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Neighbouring Municipality
- Sturgeon County
- Major Roads

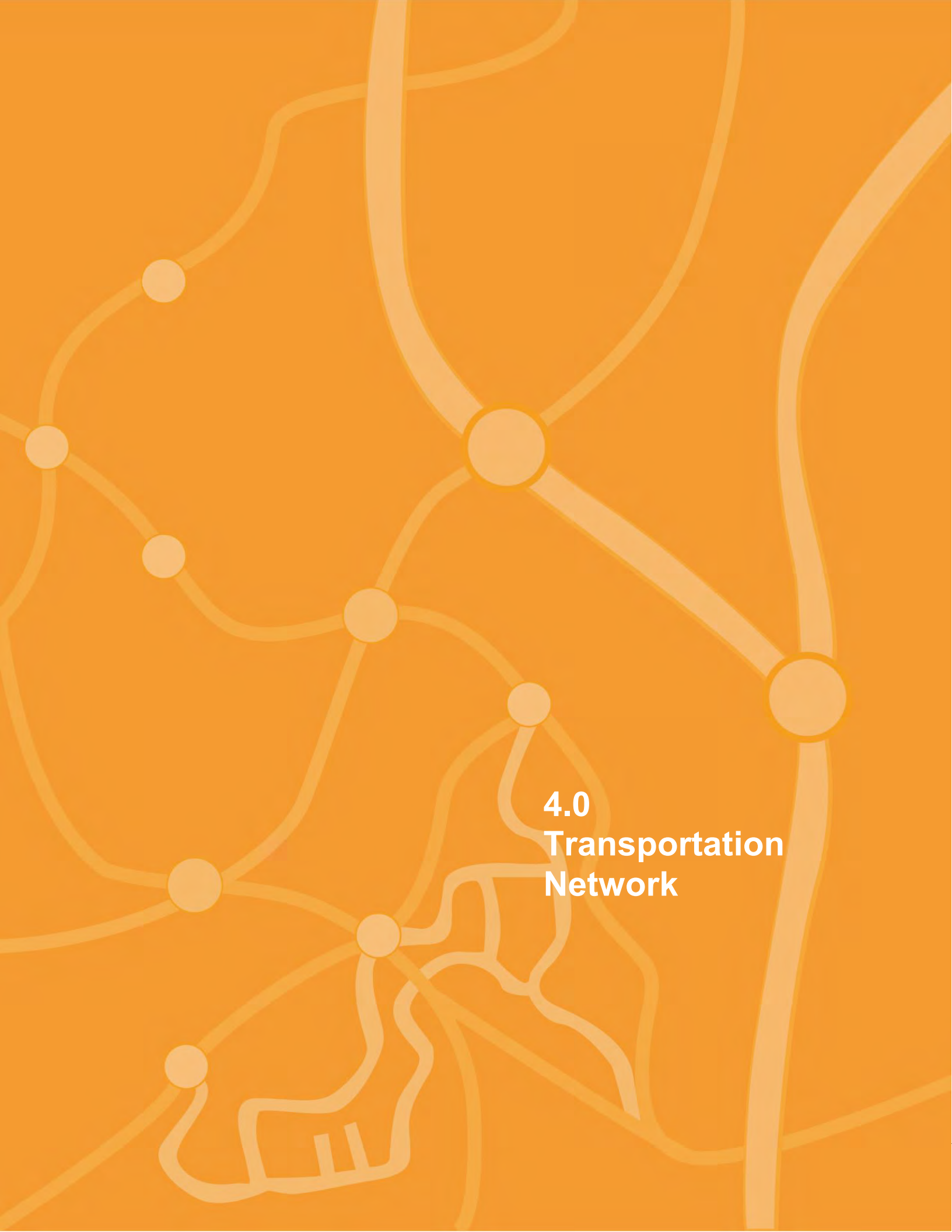
0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

ISL Engineering and Land Services

Sturgeon County



4.0 Transportation Network

4.1 Introduction

The transportation system includes roads, railways, bridges, air and goods movement networks. The focus of this report is on municipal road infrastructure that supports population and employment growth of the County. Railways and air transport are recognized as major transportation components to supporting the County's economy, however are not a focus of this study primarily as development and improvement of these modes are not within the County's control.

The following transportation review focuses on major intersections and main roadways in the County and major access points between existing County development and provincial Highways. This is a network level study, where localized roadways and intersections within existing and future development areas are not included. The main transportation component included within this study is the existing and future roadway conditions, which are assessed to identify opportunities where future growth can be absorbed or potentially constrained. This information will be used to identify future roadway improvement projects, studies, and other measures to accommodate growth. A preliminary functional classification review of the County's roadways is also undertaken in this study, although a more detailed review is recommended.

Study Intersections/Roadways: The intersections and roadways selected for analysis in this study are based on discussions between ISL and the County at the beginning of the project and are primarily those providing connections between the surrounding highway network and existing population and employment areas. It is noted that as the project evolved additional intersections providing key connections in expected growth areas were added providing traffic volume data was available. Intersections considered local in nature or where there is no traffic volume data available are noted for additional study, based on discussions between ISL and the County.

Traffic Analysis Horizons: Traffic analysis is conducted for the existing conditions (2018) and ultimate conditions for Phase 3 growth (2044). Traffic analysis of earlier Phases of development, including Phase 2 (2034) and Phase 1 (2024) are conducted, depending on the need to determine staging for implementation. For future phases, traffic forecasting is conducted based on land use projections for each horizon. The land use projections are detailed in an earlier section of this report.

4.2 Traffic Analysis Methodology

Traffic analysis includes traffic operations analysis at the intersection level. The Level of service (LOS) provides an indication of how well the intersection performs to service existing traffic volumes, and is determined based on the guidelines from the Institute of Transportation Engineers Traffic Engineering Manual. Level of service D is typically acceptable in most rural and urban areas. The amount of intersection delay for each level of service is provided below.

Table 4.1: Level of Service

	Average Delay Per Vehicle (s)	
LOS	Signalized	Unsignalized
A	< 10	< 10
B	10 – 20	10 – 15
C	20 – 35	15 – 25
D	35 – 55	25 – 35
E	55 – 80	35 – 50
F	> 80	> 50

Unsignalized intersections include all stop controlled and yield controlled intersections. Intersections have been modeled using Synchro 9 to determine each intersection's level of service (LOS) during the AM and PM peak hour. The intersection's overall LOS was recorded, as well as the intersection's worst LOS for an individual movement. The existing intersection level of service is provided in the following table reference Table 4.3.

- LOS A represents the highest level of service, or generally "free flowing conditions".
- LOS F generally represents a "breakdown" or "gridlock" condition in vehicular flow. At signalised intersections drivers will experience waits of two or more cycles.
- Levels of service B, C, D and E are intermediate levels of performance between each extreme.
- LOS D reflects "normal" peak hour congestion, generally accepted criterion for design analysis. Several municipalities apply LOS D as their design threshold for analysis and this is recommended for this study.

4.3 Analysis of Transportation Network (Existing)

For this review, traffic volumes, intersection geometry and traffic controls were compiled and analyzed. For major intersections and access points between County development and provincial Highways, Synchro9 was used to model the intersection's existing level of service. Sturgeon County's existing roadway system is provided in Figure 4.1.

4.3.1 Traffic Volumes (Existing)

Traffic volumes were provided by Sturgeon County and also extracted from Alberta Transportation's traffic volume database, previous traffic studies or estimated using trip generation rates. If not provided by Sturgeon County, the source of the data is denoted in the table. Daily two-way traffic volumes based on traffic data from Sturgeon County and Alberta Transportation are shown in Figure 4.2 and Table 4.2.

Table 4.2: Two Way Traffic Volumes (Existing)

Area	Year	Connecting Road, Leg	Daily Volumes	Major Roadway, Leg	Daily Volumes
Calahoo	2017	Ste. Anne Trail, S	80*	Highway 37, E	2320*
	2018	Range Road 274, S	670*	Highway 37, E	2610*
Cardiff	2017	Cardiff Road West, E	7580*	Highway 2, S	18050*
	2017	Cardiff Road East, W	1120*	Highway 28, S	8340*
Fedorah	2018	Range Road 232, W	331	Highway 28, S	3183*
Namao	2017	Range Road 244, S	680*	Highway 37, E	5170*
Riviere Qui Barre	2018	Township Road 554, W	237~	Highway 44, S	5090*
Sturgeon Valley	2017	Starkey Road, S	1820*	Highway 37, W	6740*
	2017	Sturgeon Road, W	3490*	Highway 28, S	13340*
Sturgeon County	2017	Range Road 240, S	1730*	Highway 28, E	6820*
	2017	Range Road 240, N	1950*	Highway 37, E	4970*
	2017	Range Road 224, N	1140*	Highway 28, E	6800*
	2018	Range Road 224, S	3220~	Township Road 570, E	1550~
Sturgeon Industrial Park	2012	Boysdale Road	860*	Highway 825, S	4640*
	2018	Range Road 231, N	180	Highway 37, E	5380*
	2017	Range Road 230, N	680*	Highway 37, E	5700*
Villeneuve Airport	2018	Range Road 270 A, N	140~	Highway 633	1690*
Villeneuve	2018	Range Road 265, N/S	330~	Highway 633, E	1690*

*Alberta Transportation Traffic Volumes, ~Estimated (Based on Trip Generation Rates), Without a notation volumes provided by Sturgeon County

Existing peak hour traffic volume diagrams are proved in Figure 4.3.

4.3.2 Traffic Operations Analysis (Existing)

The study intersections were modeled using Synchro 9, with the intersection's overall and worst lane movement level of service recorded. A summary of the existing intersection levels of service is provided in the table below.

Table 4.3: Intersection Levels of Service (Existing)

Area	Connecting Road	Major Road	Traffic Controls	AM LOS Overall (Worst Movement)	PM LOS Overall (Worst Movement)
Calahoo	Ste. Anne Trail	Highway 37	Unsignalized	A (A)	A (A)
	Range Road 274	Highway 37	Unsignalized	A (A)	A (B)
Cardiff	Cardiff Road West	Highway 2	Signalized	C (C)	B (C)
	Cardiff Road East	Highway 28	Unsignalized	A (C)	A (C)
Fedorah	Range 232	Highway 28	Unsignalized	~	A (B)
Namao	Range Road 244	Highway 37	Unsignalized	A (B)	A (B)
Riviere Qui Barre	Township Road Road 554	Highway 44	Unsignalized	A (B)	A (B)
Sturgeon Valley	Starkey Road	Highway 37	Unsignalized	A (D)	A (D)
	Sturgeon Road	Highway 28	Signalized	C (C)	B (C)
Sturgeon County	Range Road 240	Highway 28	Unsignalized	A (C)	A (C)
	Range Road 240	Highway 37	Unsignalized	A (B)	A (B)
	Range Road 224	Highway 28	Unsignalized	A (C)	A (C)
Sturgeon County	Range Road 224	Township Road 570	Unsignalized	~	A (B)
Sturgeon Industrial Park	Township Road 552	Highway 825	Unsignalized		
	Range Road 231	Highway 37	Unsignalized	A (B)	A (B)
	Range Road 230	Highway 37	Unsignalized	~	A (B)
Villeneuve Airport	Range Road 270 A	Highway 633	Unsignalized	A (B)	A (B)
Villeneuve	Range Road 265	Highway 633	Unsignalized	A (B)	A (B)

~Indicates PM analysis only
All unsignalized intersections are two-way stop controlled on the minor leg.

Based on the initial analysis there are no major operational concerns at the study intersections. The majority of the unsignalized intersections operate at a LOS of B. Signalized intersections are operating at a LOS of C in the AM and B in the PM. Notably, the peak LOS period for many intersections is mostly dependent on the orientation of the community to the regional highway systems. A high number of left turns onto the highways result in a higher AM LOS compared PM. For example, Cardiff Road West and Highway 2, Sturgeon Road/ Highway 28, and Range Road 240/Highway 37 have higher LOS during the AM peak due to left turning vehicles.

4.3.3 Proposed Traffic Operations Improvements (Existing)

The existing operations analysis shows that there are no intersection improvements required based on the existing conditions. It is noted that there are some intersections with movements operating at level of service C and/or D, with up to 35 seconds of delay on average during the AM or PM peak hours. These are the worst movements noted and are within the acceptable operating conditions, although will require ongoing monitoring in the near future. These intersections include: Starkey Road and Highway 37:

- Sturgeon Road and Highway 28
- Cardiff Road West and Highway 2
- Cardiff Road East and Highway 2
- Range Road 224 and Highway 28
- Range Road 240 and Highway 28

All other study intersections should still be monitored, but at a lower priority than those listed above.

4.4 Analysis Methodology of Future Transportation Network

To assess the future transportation network, traffic forecasts are estimated based on the land use projections and uses the industry standard, four-step method, including:

- **Trip forecasting:** Estimating new trips on the transportation network including:
  - Background traffic growth on provincial highways; and
  - Trip generation for new trips from land use projects.
- **Trip adjustments:** Adjusting trips forecasted for the following:
  - Reduced trips due to mode shift to transit; and
  - Impacts due to changes in transportation technology.
- **Trip distribution:** Forecasting trip distribution to the Edmonton region.
- **Trip assignment:** Assigning trips to the transportation network based on the shortest route.

The methodology is highlighted in the following sections.

4.4.1 Background Traffic Growth

The study area includes several provincial highways that will have growth outside of the specific growth areas within Sturgeon County's boundaries. Provincial highway traffic growth accounts for overall increases in population for the province in areas outside of the County. To account for background highway traffic growth, Alberta Transportation's standard linear growth rate of 2.5% per year is assumed. This is an increase of 2.5% per year from existing (2018) to Phase 3 (2044), applied only to through movements on provincial highways.

4.4.2 Trip Generation

Forecasting traffic volumes due to growth within the County is based on land use input (provided by the County), including projected residential dwelling units and employment. A trip generation rate is applied based on land use to determine the number of new trips generated by future growth within the study area. The Institute of Transportation Engineers (ITE), 10th Edition of the Trip Generation Manual rates govern in most cases, except where local information is available. The following trip generation rates will be used for this study:

- **Residential:** Sturgeon Valley Growth (2034, 2044 horizon), using ITE Rates as this is planned as a suburban growth node, which is consistent with the ITE rate description.
  - AM = 0.75 trips/dwelling, PM = 1.0 trips/dwelling.

- **Residential:** Sturgeon County Growth (outside of Sturgeon Valley). Growth is considered rural and ITE rates are for suburban/urban areas. The County has developed daily rates for these areas, which indicate 15 vehicle trips per day per dwelling, compared to 9.44 vehicle trips per day using ITE rates. AM and PM rates from ITE are increased by extrapolating the AM and PM peak rates proportionally.
  - AM = 1.19 trips/dwelling, PM = 1.59 trips/dwelling.
  - Rates apply to Sturgeon Valley 2024 horizon and Sturgeon County 2024, 2034 and 2044.
- **Employment:** Trip generation rates from the ITE 10th Edition for industrial and general aviation were used to forecast.
  - Industrial, AM = 0.44 trips/employee, PM = 0.42 trips/employee.
  - Aviation, AM = 1.18 trips/employee, PM = 1.18 trips/employee.
    - Note: the aviation trip rate from ITE is 14.24 trips per employee per day. As aviation activities can occur anytime throughout a 24-hour period, the peak AM and PM trip rate is assumed to be one twelfth of the daily trip rate, assuming an increase in staffing and trips during regular work hours.

Temporary Traffic Surges: The trip generation rates provide an estimate of 'normal' or typical daily peak hour traffic, excluding temporary surges in traffic flow. Temporary traffic peaks resulting from large construction projects, industrial operations (shut down), and industrial developments do not qualify as normal daily peak hour traffic. Designing this study for temporary traffic peaks is not practical or recommended, as it leads to overbuilding infrastructure. The practical approach is accommodating temporary traffic surges through implementing traffic accommodation plans to minimize the impacts of traffic surges. This includes temporary traffic controls, traffic control personnel, using transit/shuttle buses, scheduling shift outside of peak traffic and other traffic management strategies.

4.4.3 Trip Adjustment

Transportation trends and mode share are expected to shift as more transit, ride share, and intelligent transportation systems become available in Sturgeon County. Adjustment factors for each phase of this study have been developed to best represent the expected nature of transportation the County at these timelines. While these factors have been developed based on research into future mode share trends and discussion with the County, the fact remains that the adjustment factors have been developed at a specific point in time and the transportation trends captured in this study may change. It is therefore recommended that the following adjustment factors be re-evaluated for future transportation projects if more information is available to ensure the most likely scenarios are captured.

Mode Share Trip Adjustments

Increasing transit access to the Sturgeon Valley area is expected as the area builds out over the 5 year, 15 year and 25 year phases. In Phase 1 (2024), transit policies and plans are expected to still be developing, but by Phase 2 (2034), some form of basic bus service is expected, with increased access at Phase 3 (2044) as a transit center expected for the area. LRT access at 2044 is expected by way of an extension of the City of Edmonton's existing LRT network into NW Edmonton and eventually extending into the City of St. Albert, with LRT stations located along St. Albert Trail.

Adjusting the trip generation rates for increased mode share reduces the total vehicular trips generated.

For this purpose the following assumptions are made based on opportunities increasing transit accessibility as described, including:

- **Phase 1 (2024)** = 0% Transit Mode Share
- **Phase 2 (2034)** = 5% Transit Mode Share (Sturgeon Valley Only)
- **Phase 3 (2044)** = 15% Transit Mode Share (Sturgeon Valley Only)

Technological Tends Trip Adjustments

Changes in transportation technology include implementation of Intelligent Transportation Systems, Autonomous Vehicles and Smart Phone applications. These topics are extensively discussed previously in this report. How these trends impact the traffic forecasting is discussed in the following sections.

Intelligent Transportation Systems
Increases in system capacity is an acceptable assumption given the aspirations for this technology to improve flow, coordination of traffic control devices and improve efficiencies at intersections. This includes vehicle-vehicle technologies, vehicle-infrastructure technologies and infrastructure-infrastructure technologies. It is recognized that application of these technologies will have some level of impact, but it is challenging to predict exactly what implementation will be. Additionally, the impacts will be greater for later horizon years, but minimal at first.

A slightly higher roadway capacity increase percentage is used in Sturgeon Valley given there will be more opportunities for ITS to traffic signals, where Sturgeon County is not expected to have many traffic signals, based on engineering judgement.

For this study the following assumptions are applied accounting for ITS:

- **2024 Horizon =** 0% Increase in Roadway Capacity
- **2034 Horizon =** 5% Increase in Roadway Capacity (Sturgeon Valley Only)
- **2044 Horizon =** 10% Increase in Roadway Capacity (Sturgeon Valley, 5% Sturgeon County)

Autonomous Vehicles
Vehicle time headway is the time difference between when the front of a vehicle arrives at a point to the time the front of the next vehicle arrives at the same point, essentially, the typical following distance between vehicles represented in seconds. Vehicle headways for calculating ideal saturation vehicle flow rate, the number of vehicles a lane can accommodate under ideal conditions, are assumed at approximately two seconds for vehicles. The ideal saturation flow rate varies from 1800 – 1900 vehicles per hour per lane, depending on the governing municipality. Assuming that autonomous vehicles are able to travel in tighter groups, with smaller headways, an increase in the ideal saturation vehicle flow rate is reasonable. Applying smaller headways, for example 1 – 1.5 seconds per vehicle, increases the saturation flow rate to approximately 2,400 – 3,600 vehicles per hour per lane. While this adjustment is relatively transparent, it is challenging to justify the full extent of the change without understanding the timing and extent of autonomous vehicle implementation.

Improvements to capacity for autonomous vehicles are expected to apply County wide as these are related to transportation technologies for all vehicles. For this study, it is recommended that implications of autonomous vehicles be applied conservatively only at the 2044 horizon, outlined as follows:

- **2024 Horizon =** 0% Increase in Roadway Capacity
- **2034 Horizon =** 0% Increase in Roadway Capacity
- **2044 Horizon =** 5% Increase in Roadway Capacity (Sturgeon Valley and Sturgeon County)

Smart Phone Applications (car sharing and ride sharing)
Smart phone applications refer specifically to reducing vehicular demand by increasing the number of drivers sharing vehicles through a vehicle share service or ride sharing service. It is reasonable to assume that the majority of people currently own a smart phone and an increasing majority of people will own a smart phone in the future. While these services are slow to roll out locally, through the application of smart phone technology, it is assumed that more people will have access to car sharing and ride sharing services in the future.

While demand for ride sharing will be higher at first, in 2044 demand is expected to taper off for residents in Sturgeon Valley as they have increasing access to transit services. For this study, the following is recommended to account for car sharing and ride sharing services:

- **2024 Horizon =** 0% Reduction in Vehicular Trips
- **2034 Horizon =** 5% Reduction in Vehicular Trips (Sturgeon Valley and Sturgeon County)
- **2044 Horizon =** 5% Reduction in Vehicular Trips (Sturgeon County Only)

Ride sharing in Sturgeon Valley is assumed to be 0 percent in Phase 3 (2044) due to the higher level of transit (bus and/or LRT) offered in the region.

Summary of Mode Share and Technological Trends

Summarizing the trip demand adjustments accounting for increased transit and changes in transportation technologies is as follows:

Table 4.4: Summary of Trip Adjustments (Transit and Transportation Technology

		Sturgeon County	Sturgeon Valley
2024	Transit	0%	0%
	ITS		
	AVs		
	Sharing		
2034	Transit	0%	5% decrease in automobile trip demand, assumes a basic transit service.
	ITS		5% increase in roadway capacity accounting for opportunities to leverage traffic signal connectivity.
	AVs		0%
	Sharing	5% reduction in trip demand, accounting for ride sharing smart phone apps.	5% reduction in trip demand, accounting for ride sharing smart phone apps.
2044	Transit	0%	15% reduction in automobile trip demand assuming access a transit station and regional transit services
	ITS	5% increase in roadway capacity accounting for connected vehicle and vehicle-to-infrastructure technologies	10% increase in roadway capacity accounting for opportunities to leverage traffic signal connectivity.
	AVs	5% increase in roadway capacity accounting for tighter vehicle spacing on roadways	5% increase in roadway capacity accounting for tighter vehicle spacing on roadways
	Sharing	5% reduction in trip demand, accounting for ride sharing smart phone apps.	0% - ride sharing shifts to transit with improved transit access

4.4.4 Trip Distribution/Assignment

The trips generated were assigned to various movements based on several different criteria. The following section briefly summarized the trip distribution and assignment, with a detailed methodology provided in Appendix A.

Sturgeon Valley Trip Distribution/Assignment

Distribution of trips generated from the Sturgeon Valley area are based on origin/destination information from the City of Edmonton's regional travel model, based on their 2005 household travel survey - a robust data set that includes trip patterns across the entire Edmonton region. This is as follows:

- To/from Sturgeon County = 31%
- To/from St. Albert = 30%
- To/from West, South, East (other areas in Edmonton Region) = 39%

Traffic originating from the Sturgeon Valley area, destined for the County travels along internal roadways, including Starkey Road and Sturgeon Road, increasing the turning movements at the two related study intersections, Starkey Road/Highway 37 and Sturgeon Road/Highway 28. Traffic destined for other areas (St. Albert, others) are unlikely to use Starkey Road as this provides limited connectivity other than to areas within Sturgeon County. Sturgeon Road will provide some connectivity for traffic depending on the destination as this roadway connects to Highway 28 and Anthony Henday Drive to the south.

County Trip Distribution/Assignment

Distribution of trips generated from rural growth areas are based on using current traffic counts at the access/intersection to the growth area. For example, there is typically only one or two access points to most rural growth areas and the existing traffic counts are reflective of only trips originating from these areas. This is a reasonable approach and typically acceptable as traffic counts are reflective of local sources of trips with very little non-locally generated sources of trips.

4.4.5 Staged Analysis

The County's transportation network has been analyzed using a staged approach. Phase 3(2044) transportation network is analyzed first assuming no improvements have been made to the transportation network and the trip adjustment factors have been applied. By analyzing Phase 3 first, it is possible to reduce the overall amount of documentation. If an intersection operates at acceptable levels in Phase 3 when the traffic volumes are at their highest, it is reasonable to assume there will be no issues at the intersection at earlier phases. Further analysis is conducted only on intersections with operational issues in Phase 3 to determine the timing of required improvements. This staged approach to analysis allows ISL to provide insights on the County's future transportation network more efficiently than evaluating each intersection at every phase.

4.4.6 Potential Future Transportation Projects Phase 3 (2044)

Future major projects planned or otherwise (including Alberta Transportation and other regional roadway projects), have a high level of uncertainty in terms of scope and timeline. The Phase 3 (2044) "do nothing" analysis is intended to reflect the possible traffic operations if no significant change is made to the County's transportation network, and reflects the conservative approach for planning projects. It is acknowledged, however, that the construction of any roadway projects may impact the outcomes of this study and it is suggested that the County review the implications of any projects as needed and confirm/update the findings of this study.

4.5 "Do Nothing" Analysis of Future Transportation Network (2044)

The analysis for the Phase 3 (2044) future transportation systems assumes the existing transportation network as-is, with no improvements applied by the County and by other parties, including Alberta Transportation. This is considered the "do nothing" analysis for understanding the conditions in the case there are no changes made to the network and all of the projected growth is applied. Trip reductions and capacity increases were applied to the Phase 3 (2044) traffic analysis based on the trip adjustments discussed in Section 4.4.3 as the reductions represent expected future conditions.

4.5.1 Traffic Volumes (Phase 3 - 2044)

The daily traffic volumes based on the "do nothing" traffic forecasts are provided in the following table. A Phase 3 daily traffic volume map is provided in Figure 4.4. A Phase 3 peak hour traffic movements map is provided in Figure 4.5.

Table 4.5: Two Way Traffic Volumes (Phase 3 – 2044)

Area	Year	Connecting Road, Leg	Daily Volumes	Major Roadway, Leg	Daily Volumes
Calahoo	2017	Ste. Anne Trail, S	370	Highway 37, E	4,392
	2018	Range Road 274, S	1,050	Highway 37, E	4,565
Cardiff	2017	Cardiff Road West, E	12,122	Highway 2, S	29,247
	2017	Cardiff Road East, W	3858	Highway 28, S	15,309
Fedorah	2018	Range Road 232, W	331	Highway 28, S	9,766
Namao	2017	Range Road 244, S	583	Highway 37, E	8,959
Riviere Qui Barre	2018	Township Road 554, W	579	Highway 44, S	9,096
Sturgeon Valley	2017	Starkey Road, S	7,164	Highway 37, W	15162
	2017	Sturgeon Road, W	20,756	Highway 28, S	3542
Sturgeon County	2017	Range Road 240, S	1,900	Highway 28, E	11,096
	2017	Range Road 240, N	2,000	Highway 37, E	8,086
	2017	Range Road 224, N	1,100	Highway 28, E	11,501
	2017	Range Road 224, S	5,233	Township Road 570, E	2,519
Sturgeon Industrial Park	2012	Boysdale Road	5,220	Highway 825, S	8,590
	2018	Range Road 231, N	180	Highway 37, E	5,410
	2017	Range Road 230, N	3,330	Highway 37, E	6,240
Villeneuve Airport	2018	Range Road 270 A, N	3,860	Highway 633	7,431
Villeneuve	2018	Range Road 265, N	3,317	Highway 633, E	8,141

4.5.2 Future Traffic Operations Analysis (2044)

The “do nothing” scenario reflects the Phase 3 (2044) scenario using the existing transportation system. The following table outlines the preliminary results, unadjusted for mode split and future technologies. This was provided at the February 13, 2019 working group meeting.

Table 4.6: Preliminary Phase 3 (2044) LOS Analysis (“Do Nothing”)

Area	Connecting Road	Major Road	Traffic Controls	AM LOS Overall (Worst Movement)		PM LOS Overall (Worst Movement)	
				2018	2044	2018	2044
Calahoo	Ste. Anne Trail	Highway 37	Unsignalized	A (A)	A (B)	A (A)	A (B)
	Range Road 274	Highway 37	Unsignalized	A (A)	A (B)	A (B)	A (B)
Cardiff	Cardiff Road West	Highway 2	Signalized	C (C)	C (D)	B (C)	B (C)
	Cardiff Road East	Highway 28	Unsignalized	A (C)	F (F)	A (C)	E (F)
Fedorah	Range 232	Highway 28	Unsignalized	~	~	A (B)	A (C)
Namao	Range Road 244	Highway 37	Unsignalized	A (B)	A (C)	A (B)	A (B)
Riviere Qui Barre	Township Road 554	Highway 44	Unsignalized	A (B)	A (C)	A (B)	A (C)
Sturgeon Valley	Starkey Road	Highway 37	Unsignalized	A (D)	F (F)	A (D)	F (F)
	Sturgeon Road	Highway 28	Signalized	C (C)	E (F)	B (C)	E (F)
Sturgeon County	Range Road 240	Highway 28	Unsignalized	A (C)	A (E)	A (C)	A (C)
	Range Road 240	Highway 37	Unsignalized	A (B)	A (C)	A (B)	A (C)
	Range Road 224	Highway 28	Unsignalized	A (C)	A (D)	A (C)	A (D)
	Range Road 224	Township Road 570	Unsignalized	~	~	A (B)	A (C)
Sturgeon Industrial Park	Boysdale Road	Highway 825	Unsignalized	A (B)	F (F)	A (B)	F (F)
	Range Road 231	Highway 37	Unsignalized	~	~	A (B)	A (B)
	Range Road 230	Highway 37	Unsignalized	A (B)	A (E)	A (B)	A (E)
Villeneuve Airport	Range Road 270 A	Highway 633	Unsignalized	A (B)	A (C)	A (B)	A (C)
Villeneuve	Range Road 265	Highway 633	Unsignalized	A (B)	A (C)	A (B)	A (D)

Acceptable Intersection Operations

As shown in Table 4.6, there are a number of intersections that operate within the acceptable design criteria, with an overall LOS D or better and the worst movement at LOS D or better. These intersections can support the projected growth at Phase 3, without any improvements needed, noted as follows:

- **Calahoo:** The intersection of St. Anne Trail and Range Road 274 operates at LOS B or better with no improvements needed for existing or future Phase 3 conditions.
- **Fedorah:** The intersection of Range Road 232 and Highway 28 operates at LOS C or better with no improvements needed for existing or future Phase 3 conditions.
- **Namao:** The intersection of Range Road 244 and Highway 37 operates at LOS C or better with no improvements needed for existing or future Phase 3 conditions.
- **Riviere Qui Barre:** The intersection of Township Road 554 and Highway 44 operates at LOS C or better with no improvements needed for existing or future Phase 3 conditions.
- **County Intersections:** The intersection of Range Road 240 and Highway 37, Range Road 224 and Highway 28 and Range Road 224 and Township Road 570 operate at LOS D or better with no improvements needed for existing or future Phase 3 conditions.
- **Villeneuve (and airport):** The intersection of Range Road 270 and Highway 633 and Range Road 265 and Highway 633 operate at LOS D or better with no improvements needed for existing or future Phase 3 conditions.

The list of intersections detailed within the Acceptable Intersection Operations section can accommodate growth at the future Phase 3 horizon and do not require any additional analysis at earlier horizons as there is no need to understand staging for improvements.

Unacceptable Intersection Operations

Several intersections operate at unacceptable levels based on the Phase 3 (2044) analysis. Table 4.7 provides a summary of the issues at the intersections, with a detailed discussion to follow.

Table 4.7: Unacceptable Intersection Operations Summary

Intersection	Traffic Control	Phase 3 (2044) Operational Issues
Cardiff Road West and Highway 2	Signalized	High westbound left turning volumes result in an LOS D for that movement during the AM peak hour.
Cardiff Road East and Highway 28	Two-way stop on minor legs	Overall LOS of F during AM peak and E during PM peak due to high highway volumes and increased traffic to/from Cardiff Road.
Range Road 230 and Highway 37	Stop controlled on minor leg	Overall LOS A, with southbound left turn LOS E due to high traffic volumes on Highway 37 during AM and PM peak hour.
Range Road 240 and Highway 28	Stop controlled on minor leg	Overall LOS A, with southbound left turn LOS E due to high traffic volumes on Highway 28 during AM peak hour.
Highway 825 and Boysdale Road	Stop controlled on minor leg	Overall LOS of F during AM and PM peak.
Sturgeon Road and Highway 28	Signalized	LOS of E during the AM and PM peak hour due to a high demand of eastbound right and westbound left movements.
Starkey Road and Highway 37	Two-way stop on minor legs	Overall LOS of F during AM and PM peak.

Cardiff Road West and Highway 2: This intersection is currently signalized and as a result has sufficient spare capacity to accommodate the future traffic volumes at Phase 3. It is noted, that the westbound left turning volumes are relatively high, during both AM and PM peak hours, but these volumes are accommodated since there are very low volumes to/from the west leg of this intersection.

Cardiff Road East and Highway 28: This intersection is failing at Phase 3, based on its existing configuration as a two-way stop controlled intersection, due to the combination of highway volumes and volumes of traffic turning to/from Cardiff Road. To improve operations, a traffic signal is warranted, but as this is an Alberta Transportation controlled intersection a roundabout instead of a traffic signal may be required.[1] Traffic signals improve operations for LOS F to LOS B, with all movements operating at LOS C or better. The traffic signal warrant score is provided in Appendix B.

Range Road 230 and Highway 37, Range Road 240 and Highway 28: These operate at an overall LOS A, but failing operations for the southbound left turning movement, which operates at LOS E, due to the high volume of traffic on the highway. To improve both intersections, additional opportunities for the southbound left turning movement are needed and options include: creating a multi-way stop, traffic signal or roundabout. Of these improvements, a multi-way stop is not recommended as the Highway should have priority over the Range Roads and traffic volumes are significantly imbalanced between the two roadways. Traffic signals should be carefully considered, since the delay only occurs during peak hours and is only for a single movement. Traffic signal warrants show both intersections do not warrant a traffic signal. The traffic signal warrant score is provided in Appendix B.

Highway 825 and Boysdale Road: The County has a cost share agreement approved with Alberta Transportation to improve this intersection, with construction expected in 2020 or 2021.

Sturgeon Road and Highway 28: Significant increases in traffic volumes are expected at this intersection with build out of the Sturgeon Valley area. As a result, the intersection is failing during the AM and PM peaks. The major reason for failure is the high demand of eastbound right turning vehicles and northbound left turning vehicles, due to the number of trips destined to/from the Edmonton region.

Starkey Road and Highway 37: Significant increases in traffic volumes are expected at this intersection with build out of the Sturgeon Valley area. As a result, the intersection is failing during the AM and PM peaks. The major reason for failure is the high number of northbound left turning vehicles, combined with high volumes on Highway 37. To improve operations at this intersection traffic signals are warranted, with minimal changes to the geometry, if any. Since this is an Alberta Transportation controlled intersection they may require a roundabout instead of a traffic signal, based on their design bulletin #28/2010. Traffic signals improve operations for LOS F to LOS B, with all movements operating at LOS C or better. The traffic signal warrant score is provided in Appendix B.

4.5.3 127 Street Analysis

The Phase 3 (2044) analysis clearly indicates that the intersection of Sturgeon Road and Highway 28 will not be able to support expected increases in traffic demand with the intersection's current geometry and traffic operations. In order to accommodate expected traffic demand, the intersection will either need to undergo significant geometric changes including additional turning movements and lanes unless the County is able to reduce traffic demand at this location.

A possible method of reducing traffic demand on Sturgeon Road is to construct a 127 Street extension. 127 Street is currently a four-lane arterial within Edmonton that connects with the northwest Anthony Henday via an interchange. It then branches off into a two-lane roadway connecting into Range Road 250. While the current 127 Street does not provide an optimal link into the City of Edmonton, a functional alignment has been developed for the roadway to extend northward to ultimately connect with Highway 2. If a 127 Street extension were to be constructed, a significant amount of the traffic volumes assigned to Sturgeon Road would be redirected to the new connection, thus reducing demand at Sturgeon Road.

[1] Based on Alberta Transportation design bulletin #28/2010

The implications of Sturgeon County's roadway network with or without 127 Street is discussed in the following sub sections.

Option 1: No Extension of 127 Street

In the "do nothing" scenario, without 127 Street, several geometric improvements are required at the intersection of Sturgeon Road and Highway 28. Geometric improvements needed to accommodate the volumes include adding a second northbound left turn lane, a second northbound through lane and a second eastbound left turn lane. The number of improvements required result in creating a large intersection, similar in size to some in the City of Edmonton.

Improvements on Sturgeon Road are likely not isolated to the intersection of Sturgeon Road and Highway 28, as the roadway may need to be widened to accommodate the increased traffic volumes. The number of lanes required for a roadway segment can be calculated using the Federal Highway Administration's (FHWA) approach. The results of the lane analysis is provided in the following table, with details on the calculations provided in Appendix D.

Table 4.8: Sturgeon Road Lane Requirements – Without 127 Street Extension

Scenario	Phase	Peak Hour Volume	Number of Lanes
Option 1: Sturgeon Road (Without 127 Street)	1	710	2
	2	1,598	4
	3	2,404	4

Sturgeon Road requires four lanes across the Sturgeon Valley area, potentially between City of St. Albert limits to Highway 28 (6 – 7 km length) by Phase 2 (2034) if 127 Street is not constructed. Additional right of way is needed to protect for widening and the amount of right of way needed should assessed through a functional study. A transportation master plan should conduct a detailed assessment of whether Sturgeon Road widening is required across the entire Sturgeon Valley area.

Option 2: With 127 Street Extension

The construction of the 127 Street extension eliminates need for the twinning of / additional lanes for Sturgeon Road. However, Sturgeon Road still experiences growth from accommodating demand for trips to/from the County, which is 31% of trip generated in Sturgeon Valley. Traffic operations at Sturgeon Road and 127 Street operate at acceptable levels in Phase 3 due to a significant reduction in the number of eastbound right turn vehicles and northbound left turning vehicles. The only geometric improvement that may be required in Phase 3 is the possible addition of second eastbound left turn.

The lane requirements for Option 2, with 127 Street, are provided in Table 4.9.

Table 4.9: Sturgeon Road Lane Requirements - With 127 Street Extension

Scenario	Phase	Peak Hour Volume	Number of Lanes
Option 2: Sturgeon Road (With 127 Street)	3	1,106	2
Option 2: 127 Street	3	1,298	2

Neither Sturgeon Road nor 127 Street will require twinning / additional lanes to accommodate Sturgeon County's traffic demand in Phase 3 (2044).

Implementation of Option 1 or Option 2

- **Option 1:** For implementing option 1, Sturgeon Road is required to have four lanes by Phase 2; therefore planning should be done by phase 1 with construction occurring between Phase 1 and 2.
- **Option 2:** For implementing option 2, to avoid overloading Sturgeon Road (as shown in option 1 – without 127 Street), 127 Street should be constructed between Phases 1 and 2.
- Timing for both options depend on the pace of development, considering the gap between Phase 1 and Phase 2 is between 2024 and 2034.

4.5.4 Proposed Traffic Operations Improvements Phase 3 (2044)

The following improvements are to be considered:

- **Cardiff Road East and Highway 28:** Traffic signals or a roundabout are needed and the type of intersection requires collaboration with Alberta Transportation.
- **Range Road 230 and Highway 37, Range Road 240 and Highway 28:** Only the left turn from the minor road is experiencing long delays at both intersections, but there is no improvement that is warranted (signals or four-way stop) to resolve this issue. There are other parallel routes available for traffic to use to avoid this delay, but is flagged for the County to complete future monitoring.
- **Highway 825 and Boysdale Road:** Improvements planned already by the County and Alberta Transportation to realign this intersection.
- **Sturgeon Road and Highway 28:** To improve operations at this intersection the volume of traffic needs to be reduced by provided an alternative outlet or significant geometric improvements are needed. These are discussed further as follows:
  - **Option 1 (No Extension of 127 Street):** Assuming a 127 Street extension is not constructed; Sturgeon Road geometric improvements needed to accommodate the volumes include adding a second northbound left turn lane, a second northbound through lane and a second eastbound left turn lane. The number of improvements required result in creating a large intersection, similar in size to some in the City of Edmonton. In addition, expected volumes warrant widening Sturgeon Road to four lanes.
  - **Option 2 (With 127 Street Extension)**: 127 Street is constructed from City of Edmonton limits to Sturgeon Road (stage 1 of 127 Street functional study). 127 Street substantially reduces the traffic demand on this intersection and reducing volumes reduces the number of eastbound right turn vehicles and northbound left turning vehicles significantly and results in acceptable operations at this intersection, with minimal geometric improvements needed, if any (possible addition of second eastbound left turn).
- **Starkey Road and Highway 37:** Traffic signals or a roundabout are needed and the type of intersection requires collaboration with Alberta Transportation

Staging Analysis (Phase 2 and Phase 1)

A sensitivity analysis was conducted to determine the timing of future intersection improvements. Only intersections identified as having unacceptable operations in Phase 3 have been considered by the sensitivity analysis. Intersections with acceptable traffic operations in Phase 3 do not require improvements and thus do not need to be included in the sensitivity analysis. Once again, a staged analysis approach was taken. Intersections with operations issues in Phase 3 were first modeled using traffic volumes for the Phase 2 (2034) scenario. If an intersection had no operational concerns based on the Phase 2 (2034) traffic, this indicated that intersection improvements will be required by Phase 3 (2044) and no additional analysis was performed. Only intersections with failing movements in the Phase 2 (2034) were subsequently remodeled using Phase 1 (2024) traffic volumes.

Traffic volumes were calculated using the same methods outlined within this report and provided in Appendix A. Reductions for Phase 1 and Phase 2 were applied based on the mode share adjustments discussed in Section 4.4. The sensitivity results are as follows:

- Highway 28 and Range Road 240
  - Phase 2: Acceptable operations in the AM and PM peak. No further analysis required.
- Highway 28 and Township Road 554 (Cardiff)
  - Phase 2: AM westbound LOS F, PM eastbound through left and westbound through left LOS F. Overall intersection LOS B for both peak hours.
  - Phase 1: Acceptable operations in the AM and PM peak.
- Highway 37 and Range Road 230 (Sturgeon Industrial)
  - Phase 2: Acceptable LOS for all movements. No further analysis required.
- Highway 28 and Sturgeon Road (Sturgeon Valley)
  - Phase 2: LOS E for several movements during the PM peak hour with an overall intersection LOD D. Acceptable operations in the AM peak.
  - Phase 1: Acceptable operations in the AM and PM peak.
- Highway 37 and Starkey Road (Sturgeon Valley)
  - Phase 2: AM and PM northbound LOS F. Overall intersection LOS C for AM and PM.
  - Phase 1: Acceptable operations in the AM and PM peak.

Based on the sensitivity analysis undertaken, no intersection improvements are required before Phase 1 (2024) according to the sensitivity analysis.

4.6 Roadway Classifications Assessment

Sturgeon County's roadway classification system identifies roadway hierarchies used for planning maintenance activities, and priorities capital improvement projects. The county's baseline functional classification system is the general municipal services standards document developed for the county in 2011. The following proposed roadway classification system is based on the Transportation Association of Canada's (TAC) Geometric Design guide for Canadian Roads. The classifications are separated into rural (County-wide, except highways and larger population areas) and suburban/highway (highways and roadways serving larger population areas).

Table 4.10: Rural Roadway Classifications

	Rural Local	Rural Collector
Traffic Volumes	0 – 1000 vehicles per day	>1000 vehicles per day
Connectivity	Limited connectivity to any substantial development areas. Providing access to local acreages, farmsteads and small subdivisions.	Providing dedicated access between several local roadways connecting to a substantial built up area.
Description	Narrow, unimproved gravel surface with one lane per direction. Shoulder widening is required @ 200 vehicles per day with dust abatement. Hard surfacing is required at 500 vehicles per day.	Hard surfaced, with additional widening. roadway structure and width depends on the volume and type of traffic.

Table 4.11: Suburban/Highway Roadway Classifications

	Local	Collector	Arterial
Traffic Volumes	0 – 2000 vehicles per day	2000 – 10,000 vehicles per day	2 lanes <15,000 vehicles per day* 4 lanes <25,000 vehicles per day*
Connectivity	Main access road to a built up area with a high number of residential or business accesses.	Connectivity between local roadways and arterials.	Regional connectivity. Provincial Highway network, but may have some links with lower volumes.
Description	Hard surfaced, once development occurs. May include sidewalks, streetlights, landscaping and other urban elements.	Hard surfaced. May include sidewalks, streetlights, landscaping and other urban elements.	Improved/Paved, urban standard (streetlights, underground stormwater), two lanes per direction.

*Number of lanes depend on Albert Transportation Design Guidelines

The roadway classifications are provided to expand on the County's existing classification system and to use the expanded descriptions to assess the current state of the roadway classifications system. For main roadways, traffic volumes, facility and network connectivity were reviewed for roadway classifications. This is a high-level assessment to understand current practices and set priorities at the network level. This excludes reviewing cross-section details for each roadway including lane widths, boulevard widths, lighting requirements, utility locations, landscaping, median, bikes lanes, design speeds, access management, right of way requirements and other items.

The proposed roadway classification provided in Table 4.10 and 4.11 may conflict with other County documents, including their general municipal service standards (GMSS), sustainable roads infrastructure study (SRIS) and other implementation practices. Thus, the information provided in Table 4.10 and 4.11 and any assessment provided using the proposed classifications are provided for information only, and for interpretation by the County against their existing processes. Since the classification systems are used for prioritizing capital improvements, in addition to define the type of roadway constructed (cross section features), a thorough review of roadway classifications is recommended. A consolidated functional classification would incorporate the best practices of the different classifications being used, ensuring practical application at the network level and implementation at the roadway level. A thorough functional classification review would provide the County with the opportunity to develop standards for access management, road form design, and traffic calming, all of which require a level of consistency to ensure sustainable growth.

4.6.2 Existing Transportation Network Classification Review

Proposed Existing Roadways Classifications

Sturgeon County's existing roadway network has been re-classified based on the proposed roadway classification in the previous section. A map of the proposed existing roadway classifications is provided in Figure 4.6.

The existing traffic volumes and adjacent land uses were used to determine a roadway's proposed classification under the new system. In general, roadways outside of Sturgeon Valley that are classified as major or minor collectors in the current system become rural collectors with the proposed classification. Similarly, roadways classified as local currently are generally considered rural local road. Only roadways within Sturgeon Valley qualify as urban in the existing (2018) scenario. Roadway segments with traffic volumes or adjacent land used indicating a more significant classification change, for example going from minor collector in the existing system to a proposed rural local, have been listed in Table 4.12.

Table 4.12: Existing Roadway Classification System Review

Roadway	Classification		Segment	Comments
	Current	Suggested		
Range Road 10	Minor Collector	Rural Local	From Highway 37 to 55230 Range Road 10	Traffic volumes and the low number of residence the segment serves suggest changing this segment to rural local.
Range Road 212	Minor Collector	Rural Local	Highway 644 to Highway 38	Change from minor collector to rural local, maintaining the existing minor collector classifications may result in upgrades that accommodate highway volumes rather than serving the county
Range Road 220	Minor Collector	Rural Local	Redwater to Township Road 570	Volumes suggest changing this to a rural local roadway. In reality the main roadway that connects to Redwater is Highway 643
Range Road 225	Major Collector	Rural Local	Township Road 554 to Highway 37	Traffic volumes suggest changing this section to a rural local roadway. This segment provides access to Sturgeon Industrial Park, however traffic volumes indicate highway 825 and Boysdale Road is the primary access.
Range Road 230	Major/ Minor Collector	Rural Local	Vista Road to Highway 37	Traffic volumes suggest re-designating this section to a rural local roadway. This segment provides access to Sturgeon Industrial Park, however traffic volumes indicate highway 825 and Boysdale Road is the primary access. Similarly, this segment provides access to the Vista residential area; however traffic volumes are low.
Range Road 231	Minor Collector	Rural Local	Township Road 570 to Township Road 564	This can be re-classified as rural local. Traffic volumes suggest it should be hard-surfaced.
Range Road 231	Minor Collector	Rural Local	Highway 643 to Township Road 560	Traffic volumes suggest this section of Range Road 231 be re-designated as a rural local. Additionally, this road segment serves less than 5 residences.
Range Road 234	Minor Collector	Rural Local	Highway 28 to Highway 37	Traffic volumes on this segment suggest changing this segment to a local roadway.
Range Road 251	Major Collector	Rural Local	Legal to Highway 37	Traffic volumes suggest this section be designated a local collector. It is likely the majority of drivers destined for Legal use Highway 2.
Township Road 545A	Local Road	Rural Collector	Range Road 273 to Range Road 274	Located in Calahoo adjacent to Riverbend Road, the nature of adjacent residential suggest designating this roadway to rural collector.
Township Road 544	Local Road	Rural Collector	Future Highway 2 to Northview Crescent	Several roadways around the ProNorth Industrial Park could be re-designated from local roads to rural collector based on traffic volumes, likely associated with the industrial park.
Township Road 552	Major Collector	Rural Local	Highway 825 to Range Road 230	The connection of the Sturgeon Industrial Park from Highway 825 to Range Road 230, suggest a need to designate the entire segment as a local.
Township Road 552	Minor Collector	Rural Local	Range Road 230 to Highway 28A	This segment includes very few accesses, could be classified as a rural local with a gravel surface.
Township Road 554	Minor Collector	Rural Local	Sturgeon Road to Highway 825	Provides access to a subdivision, should be designated as a hard-surfaced rural local.

Roadway	Classification		Segment	Comments
	Current	Suggested		
Township Road 554	Major Collector	Rural Local	Highway 825 to Highway 28A	Traffic volumes do not support maintaining the current major collector classification. Additionally, there are no community connections using this roadway.
Township Road 554	Local	Rural Local	Highway 28A to Range Road 240	Provides very infrequent access to properties, should be designated as rural local.
Township Road 554	Minor Collector	Rural Local	Highway 2 to Highway 44	The section between Highway 2 and Highway 44 is currently designated as a minor collector, but does not connect through any developed land, with very low traffic volumes suggest this could be designated as a rural local.
Township Road 560	Local Road	Rural Local	Range Road 230 to Highway 28A	The traffic volumes between Range Road 230 Highway 28A suggest this road be re-designated as a rural local. Additionally, it provides a convenient connection to the Sturgeon Industrial Park.
Township Road 564	Major Collector	Rural Local	Range Road 224 to Range Road 231	Traffic volumes from Range Road 224 to Range Road 231 suggest this roadway is a rural local with a gravel surface. The main roadways that connects Bon Accord and Gibbons are Highway 28 and Highway 643.
Township Road 564	Major Collector	Rural Local	Range Road 231 to Highway 28	Traffic volumes suggest it can be accommodated with a rural local roadway that is hard-surfaced.
Township Road 564	Major Collector	Rural Local	Highway 28 to Range Road 235	Traffic volumes from Highway 28 to Range Road 235 suggest this roadway is a rural local with a gravel surface. The main roadways that connects Bon Accord and Gibbons are Highway 28 and Highway 643.
Township Road 564	Major Collector	Rural Local	West of Range Road 235	Traffic volumes west of Range Road 235 are less than 250 vpd, suggesting it is a rural local.
Township Road 570	Major Collector	Rural Local	Highway 44 to Range Road 12	There is a small section around the Hamlet of Alcomdale with higher traffic volumes, but the majority of this roadway could be changed from a major collector to a rural local.
Township Road 574	Minor Collector	Rural Local	Range Road 202 to Highway 829	Traffic Volumes east of Highway 829 suggest that this is a local roadway. Additionally, while Township Road 574 continues east to the North Saskatchewan River there is no connection across, indicating that this roadway primarily serves local traffic.

Proposed Improvements (Based on Proposed Existing Classifications)

The proposed roadway classification system in Tables 4.10 and 4.11 identify several improvement thresholds for roadway improvements within each roadway class. The proposed roadway upgrades by class are summarized in Table 4.13.

Table 4.13: Proposed Roadway Standard by Class

Roadway Class	Daily Volume Criteria	Roadway Standard
Rural Local	> 200	Shoulder widening and dust abatement.
	> 500	Hard surfacing.
Rural Collector	All	Hard Surfacing, with additional widening depending on traffic volumes.
Local	All	Hard surfacing once development occurs. May include urban elements.
Collector	All	Hard surfacing. May include urban elements.
Arterial	0 – 15,000	2-lanes, improved/paved. Urban standard (streetlights, underground stormwater).
	15,000 – 25,000	4 lanes, improved/paved. Urban standard (streetlights, underground stormwater).

Based on the existing roadway classification review, several roadways require upgrades to meet the proposed standard of the roadway's proposed classification. Table 4.14 summarizes the proposed roadway upgrades required to meet its proposed roadway classification. Note the current roadway description is based on available aerial imagery that may not reflect the most recent roadway conditions.

Table 4.14: Proposed Roadway Improvements (Existing)

Roadway	Segment	Daily Traffic Volume	Proposed Classification	Current Roadway Description	Proposed Upgrade
Range Road 220	Redwater to Township Road 570	204	Rural Local	Gravel	Shoulder widening and dust abatement
Range Road 225	Township Road 554 to Highway 37	279	Rural Local	Gravel	Shoulder widening and dust abatement
Range Road 230	Township Road 554 to Highway 37	680	Rural Local	Partially paved or gravel.	Hard surfacing
Range Road 231	Township Road 570 to Township Road 564	577	Rural Local	Paved / gravel	Hard surfacing
Range Road 251	Cardiff to Highway 37	396	Rural Local	Gravel	Shoulder widening and dust abatement
Township Road 545A	Range Road 573 to Range Road 574	1169	Rural Collector	Gravel	Hard surfacing
Township Road 552	Range Road 225 to Range Road 230	283	Rural Local	Gravel	Shoulder widening and dust abatement
Township Road 560	Range Road 230 to Highway 28A	416	Rural Local	Gravel	Shoulder widening and dust abatement
Township Road 564	Range Road 224 to Range Road 231	254	Rural Local	Gravel	Shoulder widening and dust abatement

Improvements were included for roadways listed in Table 4.14 only as they have the highest potential to impact current capital plans and funding. Additional analysis is required to determine the full extent of roadway improvements required based on the proposed classification system.

4.6.3 Phase 3 (2044) Transportation Network Classification Review

The Phase 3 traffic volumes and known land uses were used to review the 2018 suggested classifications to identify changes. A map of the proposed roadway classification changes is provided in Figure 4.7. Table 4.15 summarizes the suggested roadway classification changes for Phase 3.

Table 4.15: Roadway Classification System Review (Phase 3 – 2044)

Roadway	Classification		Segment	Comments
	2018 Suggested	Phase 3 Update		
Township Road 554	Collector	Arterial	Highway 28 to Highway 2	Increased traffic volumes due to growth in Cardiff suggest designating this roadway as an arterial.
Starkey Road	Collector	Arterial	Whole segment	Increased traffic volumes from Phase three Sturgeon Valley growth indicate Starkey Road will be an arterial.
Range Road 230	Rural Local	Rural Collector	Township Road 554 to Highway 37	Phase 3 traffic volume increases due to expanding industrial activities suggest this segment be re-classified as a rural collector.

4.6.4 Proposed Improvements (Based on Phase 3 Classifications)

The roadways surfaces identified in Table 4.15 were reviewed in order to determine if upgrades would be required to meet the Phase 3 suggested classification. Only improvements that are additional to or not included in the existing proposed roadway improvements (Table 4.14) are listed in Table 4.16, it is assumed the 2018 suggested upgrades will have been completed by Phase 3.

Table 4.16: Proposed Roadway Improvements (Phase 3 - 2044)

Roadway	Segment	Daily Traffic Volume	Proposed Phase 3 Classification	Current Roadway Description	Proposed Upgrade
Range Road 230	Township Road 554 to Highway 37	680	Rural Collector	Partially paved or gravel.	Shoulder widening
Township Road 554	Highway 28 to Highway 2	12122 (west)	Arterial	Paved two-lane	Shoulder widening
Township Road 570	Range Road 224 to Highway 28	650	Rural Local	Gravel	Hard Surfacing
Sturgeon Road	Whole Segment	20756 (west)	Arterial	Paved	Urbanization and twinning to four-lanes
Starkey Road	Whole Segment	14493 (west)	Arterial	Paved	Urbanization

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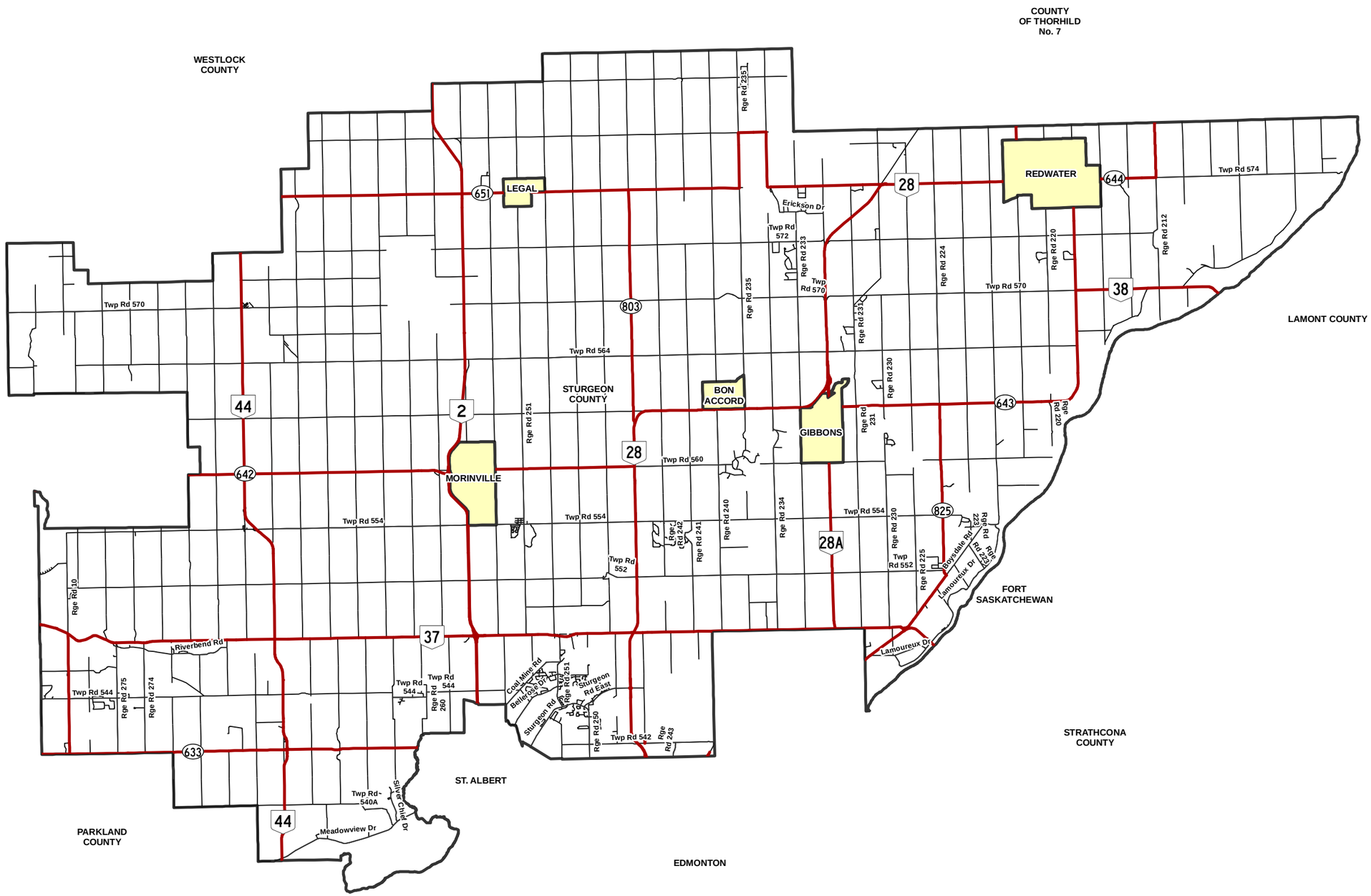
STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 4.1:

EXISTING TRANSPORTATION NETWORK



- Provincial Highways
- Existing Road Network
- Municipality Boundaries
- Sturgeon County

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

ISL Engineering and Land Services

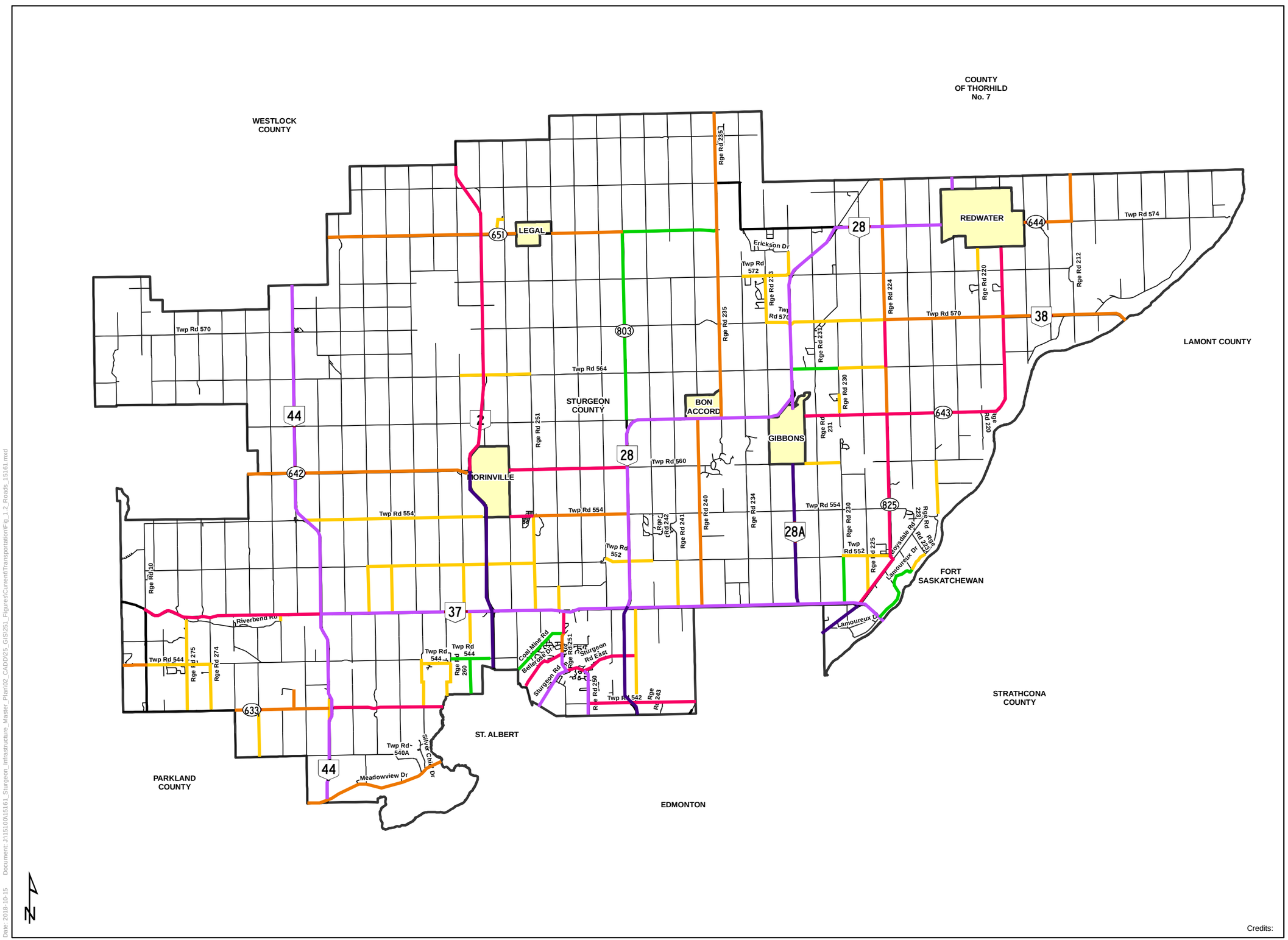
Sturgeon County

Date: 2018-10-15 Document: J:\15100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Transportation\Fig_1.1_Roads_15161.mxd

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 4.2:

EXISTING DAILY TRAFFIC VOLUMES



Existing Daily Traffic Volumes

- 0 - 200
- 200 - 500
- 500 - 1000
- 1000 - 2000
- 2000 - 4000
- 4000 - 8000
- > 8000
- Municipality Boundaries
- Sturgeon County

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

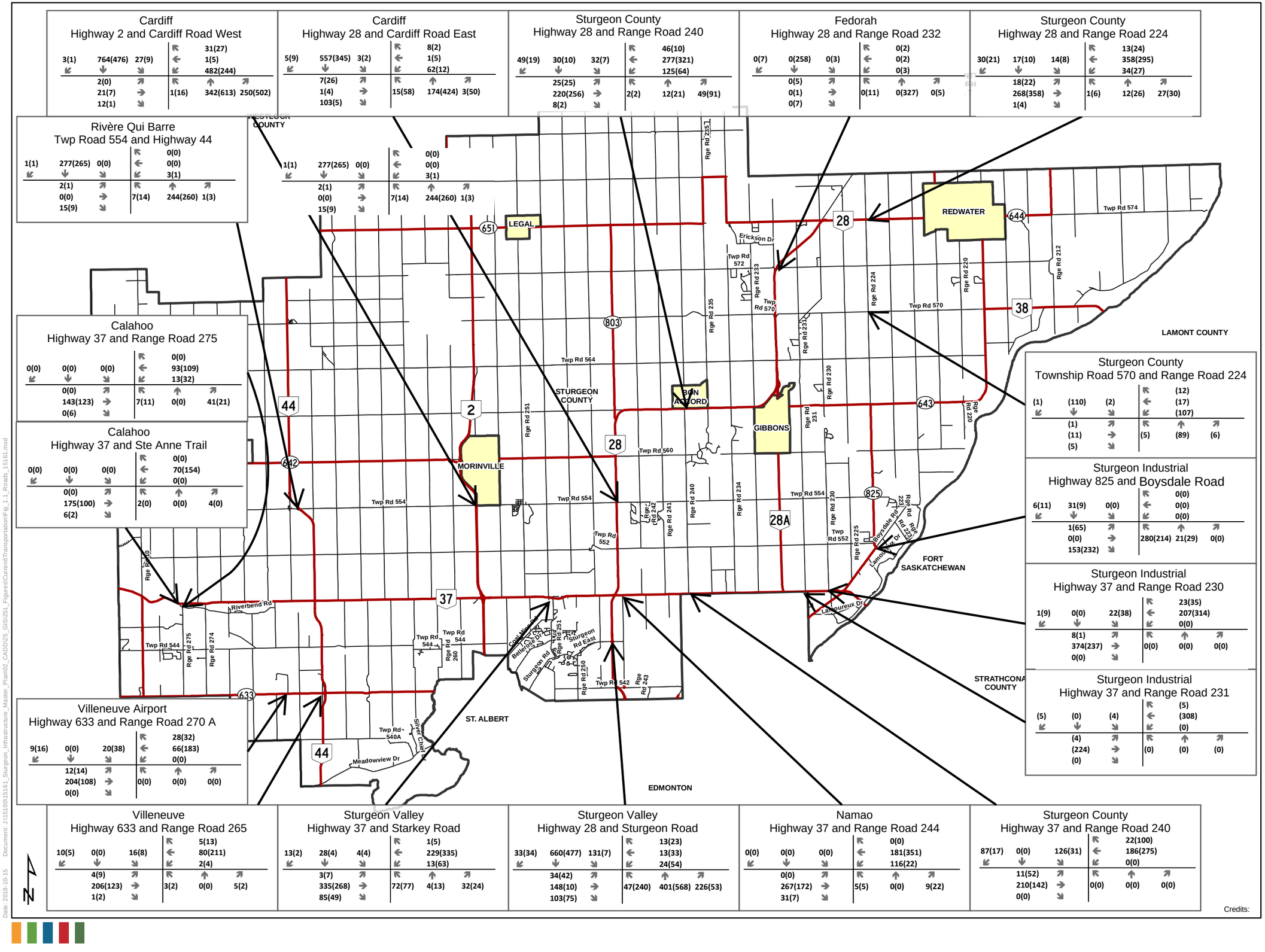
ISL Engineering and Land Services

Sturgeon County

Date: 2018-10-15 Document: J:\15100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Transportation\Fig_1-2_Roads_15161.mxd

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

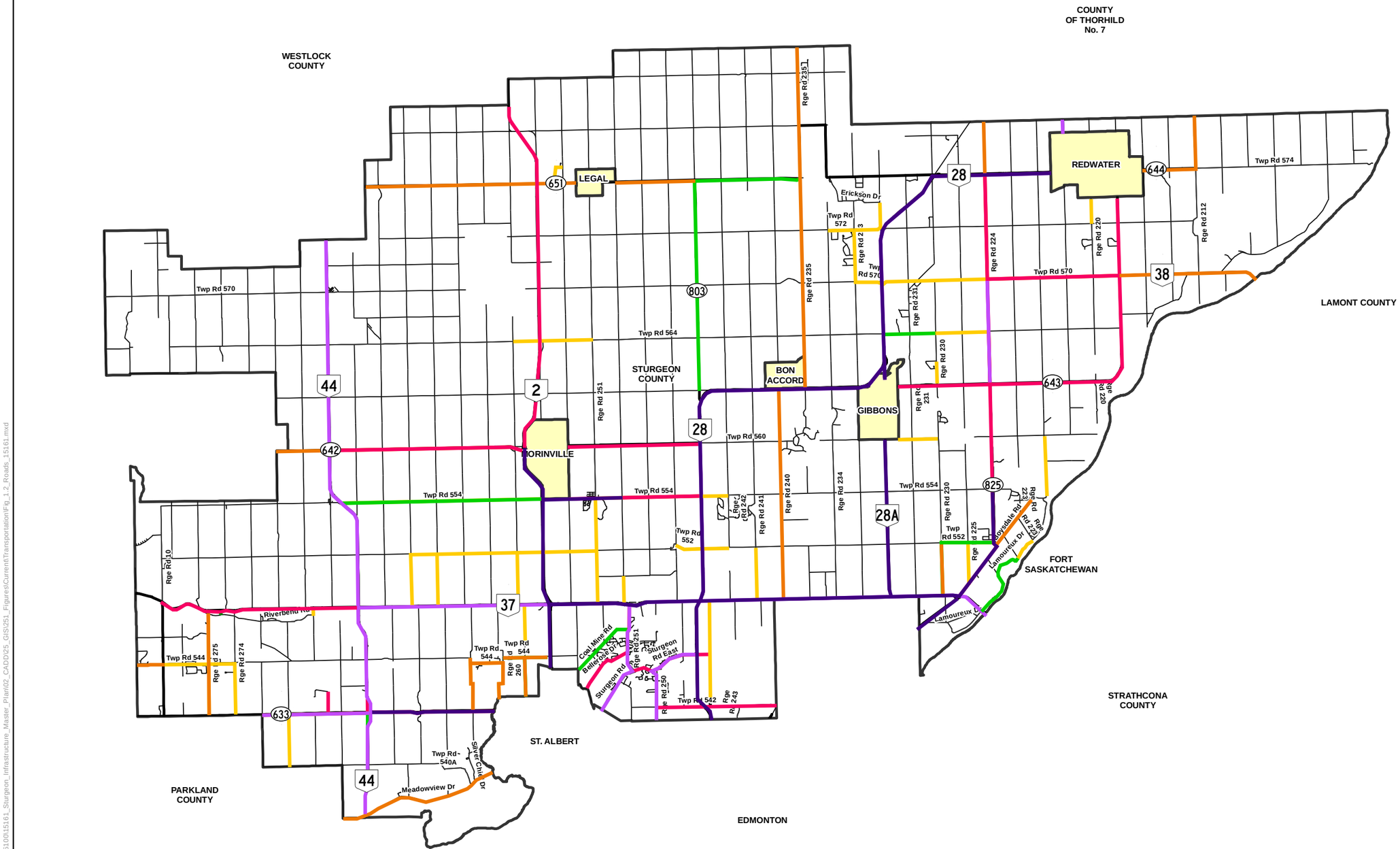
FIGURE 4.3:
EXISTING PEAK HOUR TRAFFIC MOVEMENTS



STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 4.4:

PHASE 3 (2044) DAILY TRAFFIC VOLUMES



2044 Daily Traffic Volumes

- 0 - 200
- 200 - 500
- 500 - 1000
- 1000 - 2000
- 2000 - 4000
- 4000 - 8000
- > 8000
- Municipality Boundaries
- Sturgeon County

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

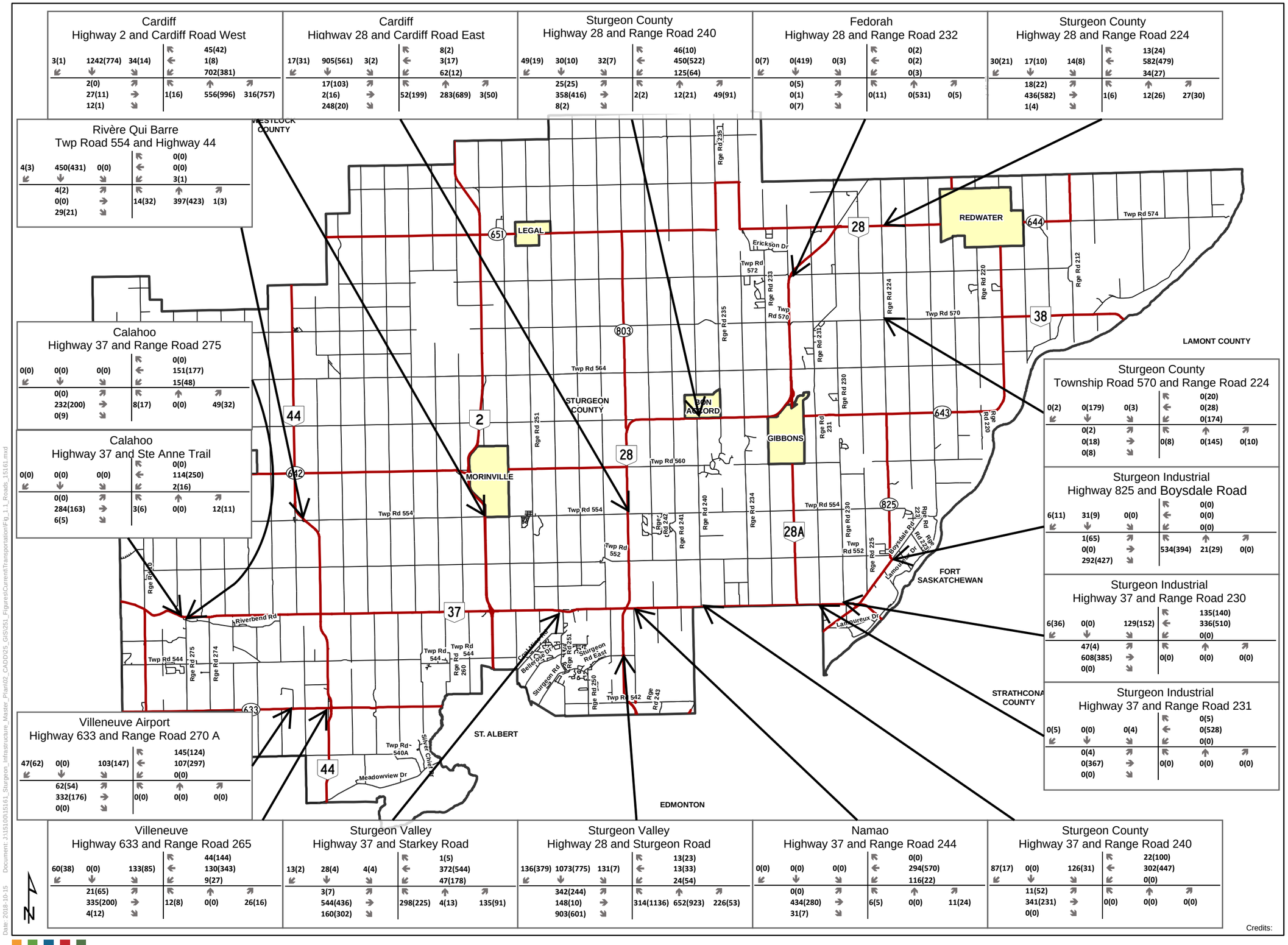
ISL Engineering and Land Services

Sturgeon County

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 4.5:

PHASE 3 (2044) PEAK HOUR TRAFFIC MOVEMENTS



Credits:

ISL Engineering and Land Services

Sturgeon County

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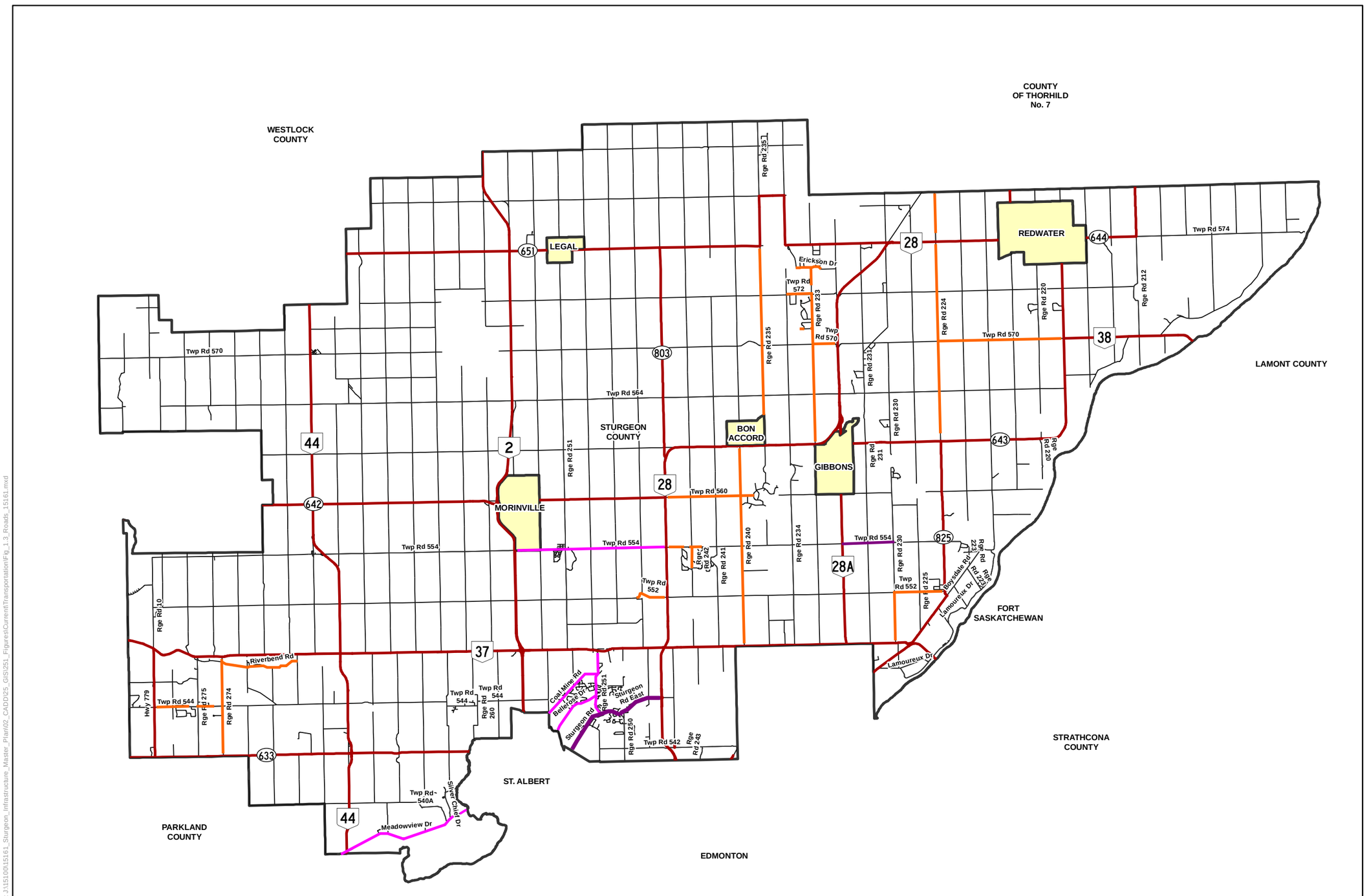
STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 4.6:
PROPOSED EXISTING TRANSPORTATION NETWORK BY CLASS



Classification

- Arterial
- Collector
- Rural Collector
- Local Road
- Rural Local Road
- Provincial Highways
- Existing Road Network
- Municipality Boundaries
- Sturgeon County

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

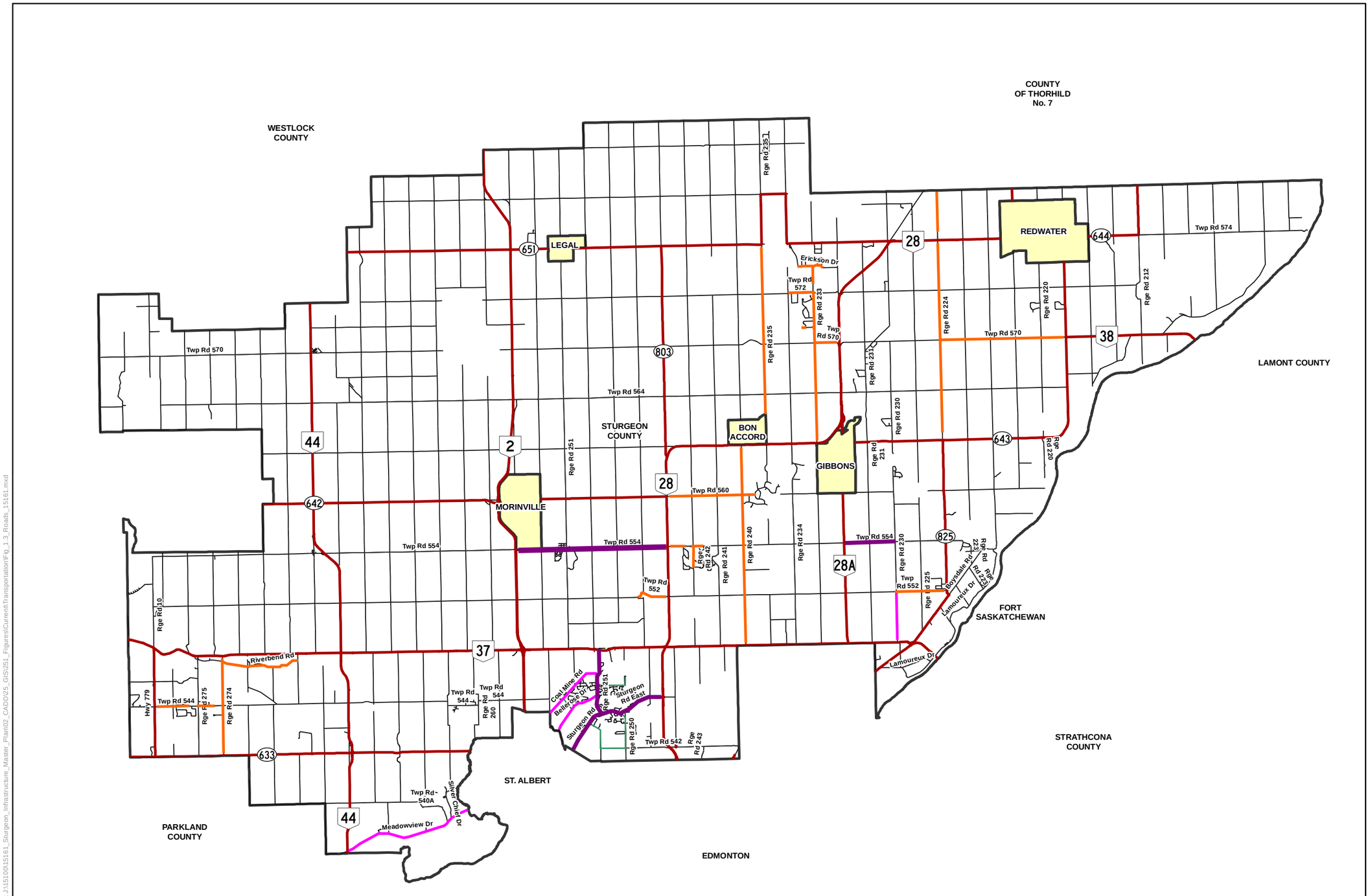
ISL Engineering and Land Services

Sturgeon County

Date: 2018-10-15 Document: J:\15100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Transportation\Fig_1_3_Roads_15161.mxd

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 4.7: PROPOSED PHASE 3 (2044) TRANSPORTATION NETWORK BY CLASS



5.0
Water Infrastructure

5.1 Overview

Sturgeon County receives almost all of its treated water primarily from EPCOR Water Services (EPCOR), either directly or through connection to regional water systems. These transmission systems are shown in Figure 5.1, color coded by owner. These include:

- Direct connection to EPCOR at 127 Street south of 195 Avenue;
- Several connections to the "Morinville Water Line" which is supplied from a booster station at the Oakmont Reservoir in St. Albert.
- Connections to the Capital Region Northeast Water Services Commission (CRNWSC) system near Fort Saskatchewan.

Water is then conveyed to numerous hamlets, country residential areas and industrial areas in the County through these County owned local transmission lines. The transmission mains are shown in Figure 5.2, and are color coded by pipe size. The Morinville Water Line and CRNWSC transmission system are the primary water transmission systems for the County. Each hamlet has its own water reservoir and water distribution pumps to provide potable water servicing to residents and commercial/industrial customers.

Calahoo, Mearns, Pine Sands and Carbondale are the only hamlets that do not receive their water from EPCOR. They rely on wells for their water supply. Alcomdale was on wells but was connected to the County transmission system in the fall of 2018.

Several industries in the Alberta's Industrial Heartland receive both potable (drinking) water from the CRNWSC and raw (untreated) water from the North Saskatchewan River. The raw water is used exclusively for industrial process water.

5.2 Existing Potable Water Use

5.2.1 Residential Water Use

The annual water use for each County owned water reservoir is shown in Table 5.1 below for 2014 to 2017. These service the residential areas of the County with the exception of the Sturgeon Industrial Park reservoir which services primarily industrial development.

Table 5.1: Historic Water Use at County Water Reservoirs

Community/Reservoir	Annual Water Use (m^3/year)[1]				
	2014	2015	2016	2017	Average
Alcomdale	4,545	5,103	5,515	4,691	4,964
Cardiff	88,934	89,963	86,807	78,105	85,952
Casa Vista	13,056	11,765	10,787	10,727	11,584
Hewitt	21,963	24,173	21,451	25,087	23,169
Landing Trail	16,346	16,784	14,794	16,374	16,075
Villeneuve	15,329	31,283	51,577	61,241	39,858
Northern Lights / ProNorth (excluding Villeneuve)[2]	29,266	19,347	5,734	6,259	15,152
Northern Lights Reservoir Total	44,595	50,630	57,311	67,500	55,009
Riverside	19,509	23,157	17,153	16,447	19,067
Rivière Qui Barre Total	87,876	94,823	107,294	106,014	99,002
Alexander First Nation (AFN)	62,498	73,932	72,638	71,114	70,046
Rivière Qui Barre (RQB) excluding AFN[3]	25,378	20,891	34,656	34,900	28,956
Sturgeon Industrial Park (W4)	80,308	95,645	281,769	174,359	158,020

Community/Reservoir	Annual Water Use (m^3/year)[1]				
	2014	2015	2016	2017	Average
Sturgeon Valley – Allin Ridge	336,379	347,932	316,432	332,515	333,315
Sturgeon Valley – Summerbrook	71,171	76,633	105,805	82,177	83,947
Grandview Heights / Namao Ridge	37,518	37,906	29,707	31,291	34,106

Note:

1. Based on historical annual water reports.
2. Based on Northern Lights Reservoir data minus Villeneuve Reservoir data.
3. Based on RQB Reservoir data minus AFN reservoir data.

The Rivière Qui Barre (RQB) Reservoir includes water that is re-pumped to Alexander First Nation, so the net RQB volumes are also shown in Table 5.1. The AFN water use was obtained from Sturgeon County. Similarly, the Northern Lights Reservoir total includes water that is re-pumped to Villeneuve. The net Northern Lights / ProNorth water use is estimated by subtracting the Villeneuve water use. This data from Table 5.1 is also summarized in Chart 5.1.

Table 5.2 shows the average annual water use for each of the residential reservoirs from 2017 and based on population estimates, shows average and peak use per capita.

Table 5.2: Residential Per Capita Water Use

Community[1]	Population (2017)[4]	2017 Annual Use (m^3/year)	2017 Per Capita Use (L/c/d)	2017 Peak Day Use (m^3/day)[5]	2017 Peak Per Capita Use (L/c/d)
Alcomdale	53	4,691	244	36	682
Cardiff	1,254	78,105	171	319	254
Casa Vista	193	10,727	152	95	492
Hewitt	399	25,087	172	170	426
Landing Trail	49	16,374	916	116	2,367
Northern Lights[2]	51	6,259	-	642	-
Riverside	305	16,447	148	139	456
Rivière Qui Barre[3]	106	34,900	902	378	-
Sturgeon Valley – Allin Ridge	2,549	332,515	-	1,848	-
Sturgeon Valley – Summerbrook	1,700	82,177	-	579	-
Sturgeon Valley – Total/Average	4,249	414,692	267	2,427	571
Villeneuve	257	61,241	653	82	319
Grandview Heights / Namao Ridge	10	31,291	8195	-	-

Notes:

1. Water use includes local commercial / industrial / institutional.
2. Northern Lights includes ProNorth usage.
3. Riviere Qui Barre usage excluding AFN.
4. Based on 2017_Annual_Reports_ISB.xlsx. This data comes from the amount of water accounts, last updated Dec 2015. Population data interpolated for Alcomdale, Cardiff, RQB, Villeneuve and Namao Ridge / Grandview Heights.
5. Peak day use based on 2017 actual values interpolated from monitored data (2017 annual water reports).

The Allin Ridge Reservoir is reported to have high water consumption. County staff have indicated that there are a number of residents that water their lawns very heavily in spite of the current block pricing (higher water rates after 60 m^3/month). This has led to the County placing watering restrictions on all residents when the Allin Ridge Reservoir volume is low.

The high per capita water use at the Allin Ridge and Summerbrook Reservoirs (and possibly others) may also be due to truck fill operations. The truck fill historical annual demands are shown below in Table 5.3.

Table 5.3: Historical Truck Fill Demands.

Truck Fill Data	Annual Demand (m^3/yr)						
Reservoir	2012	2013	2014	2015	2016	2017	Average 2012-17
Cardiff	9,567	10,146	11,256	10,914	14,237	10,654	11,129
Riviere Qui Barre	16,336	17,517	17,649	21,198	22,840	20,845	19,398
Villeneuve	19,541	21,304	5,892	29,258	34,569	28,090	23,109
Summerbrook	69,934	67,106	70,060	82,397	71,097	85,485	74,347
Allin Ridge	25,457	28,904	34,756	36,174	22,608	33,390	30,215
SIP	-	-	56,408	43,438	255,156	128,054	120,764

Note:

1. 2012 to 2016 truck fill volumes are actual volumes and 2017 data is projected (data provided by County).
2. Source: Morinville Water Line Demand Analysis, January 2018.

Table 5.4 shows the breakdown in water use at each reservoir with a truck fill, including the percentage of water use that can be attributed to the truck fill.

Table 5.4: Breakdown of Annual Water Use For Truck Fill Locations.

Community / Reservoir	Annual Water Use (m^3/year)					
	Year	2014	2015	2016	2017	Average (2014-17)
Cardiff	**Total**	**88,934**	**89,963**	**86,807**	**78,105**	**85,952**
	Truck Fill	11,256	10,914	14,237	10,654	11,765
	Distribution System	77,678	79,049	72,570	67,451	74,187
	% Truck Fill	13%	12%	16%	14%	14%
Rivière Qui Barre excluding AFN	**Total**	**25,378**	**20,891**	**34,656**	**34,900**	**28,956**
	Truck Fill	17,649	21,198	22,840	20,845	20,633
	Distribution System	7,729	-307	11,816	14,055	8,323
	% Truck Fill	70%	101%	66%	60%	71%
Sturgeon Industrial Park (W4)	**Total**	**80,308**	**95,645**	**281,769**	**174,359**	**158,020**
	Truck Fill	23,900	52,207	26,613	46,305	37,256
	Distribution System	56,408	43,438	255,156	128,054	120,764
	% Truck Fill	30%	55%	9%	27%	24%
Allin Ridge	**Total**	**336,379**	**347,932**	**316,432**	**332,515**	**333,315**
	Truck Fill	34,756	36,174	22,608	33,390	31,732
	Distribution System	301,623	311,758	293,824	299,125	301,583
	% Truck Fill	10%	10%	7%	10%	10%
Summerbrook	**Total**	**71,171**	**76,633**	**105,805**	**82,177**	**83,947**
	Truck Fill	70,060	82,397	71,097	85,485	77,260
	Distribution System	1,111	-5,764	34,708	-3,308	6,687
	% Truck Fill	98%	108%	67%	104%	92%

Community / Reservoir	Annual Water Use (m^3/year)					
	Year	2014	2015	2016	2017	Average (2014-17)
Villeneuve	Total	15,329	31,283	51,577	61,241	39,858
	Truck Fill	5,892	29,258	34,569	28,090	24,452
	Distribution System	9,437	2,025	17,008	33,151	15,405
	% Truck Fill	38%	94%	67%	46%	61%

The reported Summerbrook Reservoir Truck Fill volumes are higher than the total reported reservoir volumes for two years which is not possible. Based on discussions with Sturgeon County, it was agreed to use the 2016 data for predicting future Summerbrook distribution system water demand.

Accounting for truck fill volumes, Table 5.5 shows updated average and peak day usage per capita.

Table 5.5: Residential Per Capita Water Use Excluding Truck Fill Demands

Community	Population	2017 Avg. Annual Use (m^3/year)	2017 Average Annual Use (L/s)	2017 Average Per Capita Use (L/c/d)	2017 Peak Day Use (m^3/day)[6]	2017 Peak Use (L/s)	2017 Peak Per Capita Use (L/c/d)
Alcomdale	53	4,691	0.15	244	36	0.42	682
Cardiff	1,254	67,451	2.14	147	319	3.69	254
Casa Vista	193	10,727	0.34	152	95	1.10	492
Hewitt	399	25,087	0.80	172	170	1.97	426
Landing Trail[1]	49	16,374	0.52	916	116	1.34	2,367
Northern Lights[2]	51	6,259	0.20	-	642	7.43	-
Riverside	305	16,447	0.52	148	139	1.61	456
Rivière Qui Barre[3]	106	14,055	0.45	363	378	4.38	n/a
Allin Ridge	2,549	299,125	9.49	322	1,848	21.38	725
Summerbrook[4]	1,700	34,708	1.10	56	233	2.70	137
Total - Sturgeon Valley[5]	4,249	333,833	10.59	215	2,081	24.08	490
Villeneuve	257	33,151	1.05	354	315	3.65	1,226
Grandview Heights / Namao Ridge	10	31,291	0.99	8195	-	-	-

Notes:

1. Landing Trail includes only residential domestic users.
2. Northern Lights values includes the ProNorth Industrial Park (excludes Villeneuve contributions). Population is estimated based on discussions with the utility.
3. RQB excludes truck fill and AFN contributions. Peak values are not separated, however.
4. Summerbrook values derived from 2016 annual water reports. 2016 peak data measured from distribution line.
5. Total Sturgeon Valley peak day use assumed to be the sum of Allin Ridge & Summerbrook despite occurring on different days.
6. Peak values are from 2017 annual water reports which include truck fill (non-separable).

The high per capita water use for Northern Lights is due to industrial use (ProNorth). The high per capita water use in Villeneuve was thought to be due to the demands from the West Country Hearth continuing care facility, but County records indicate that the annual withdrawal is only about 7,000 m^3 of the approximate 33,000 m^3 total distribution system. The high per capita water use in RQB was thought to be due to the Camilla School or the RQB Arena, but their reported annual water use was just over 1,000 m^3 of the approximate 35,000 m^3 total annual water use. A detailed water use analysis should be carried out prior to, or as part of, future master plans.

5.2.2 Industrial Water Use

Table 5.6 below shows historical annual water use for the key industrial areas within Sturgeon County from 2014 to 2017. The dramatic increase in annual water use in the Sturgeon Industrial Park (SIP) is due to major industries (Bunge Canada, etc.) being connected to a new 400 mm waterline connected to the SIP Reservoir. This waterline is owned by the CRNWSC line as part of the Commission's transmission system but is currently operating as a County distribution main to address chlorine residual issues in the SIP reservoir when it was expanded from 1,310 m^3 to 4,956 m^3 in 2013-14. Prior to this these industries were drawing water directly from the CRNWSC transmission line and thus the 2014 and 2015 volumes do not represent all the water users in the Sturgeon Industrial Park, and only the industries that were connected to the SIP Reservoir.

Table 5.6: Historic Industrial Water Use

Community / Reservoir	Annual Water Use (m^3/year)				
	2014	2015	2016	2017	Average
Sturgeon Industrial Park[1]	80,308	95,645	281,769	174,359	158,020
Alberta's Industrial Heartland[1]	515,000	515,000	610,000	650,000	572,500
ProNorth Industrial Park (estimated)[2]	23,309	13,390	-223	302	9,195

Note:

1. Data from Sturgeon County Utility Services (Monthly Water Bill Accounts).
2. Calculated as ProNorth = Northern Lights Reservoir - Villeneuve Reservoir - Northern Lights Residential. This assumes 51 people living in Northern Lights at 320 L/c/d.

The AIH historic water use was provided directly from the County and not part of the reservoir data analysis, as it does not have a dedicated water reservoir. Each industry gets its water directly from the CRNWSC and is required to provide its own storage.

Table 5.7 estimates the per hectare water use for both the SIP and AIH industrial areas in 2017.

Table 5.7: Industrial Water Use per Hectare.

Industrial Area	Developed Industrial Area (ha)	2017 Annual Use (m^3/year)	2017 Annual Use (L/ha/d)	2017 Peak Day Use (m^3/day)	2017 Peak Day Use (L/ha/d)
Sturgeon Industrial Park	235	174,359	2,033	1,233	5,247
Alberta's Industrial Heartland	988	650,000	1,802	3,562	3,605

Note:

1. AIH / ProNorth Area taken from Google Earth as an estimate. Peak day values from adjusted factor of 1.8 from CRNWSC Master Plan (2016).
2. Agrium - 368 Ha, 42 L/ha/d 2017 annual use & 65 L/ha/d 2017 peak day use [Source: North West Redwater Partnership (NWRP) Sturgeon Upgrader Potable Water Connection Application Report, 2011 (sameng inc)].

5.3 Analysis of Existing Water System & Existing Demands

5.3.1 Water Transmission Mains

There are two primary water transmission systems and several local transmission mains servicing Sturgeon County, as described below. These transmission systems are shown in Figure 5.1, color coded by owner, and in Figure 5.2 which is color coded by pipe size.

Morinville Water Line

The Morinville Water Line is jointly owned between Sturgeon County (23.3%), the Town of Morinville (64.7%) and the Village of Legal (12%). The County has the following connections off the Morinville Line:

- Sturgeon Valley's Summerbrook Reservoir to the east
- Northern Lights / Villeneuve to the west;
- Riviere Qui Barre / Alexander First Nation / new Alcomdale to the west;
- Cardiff to the east;
- Crossroads Industrial Park west of Legal

This water line originates at EPCOR transmission system near Campbell Road and Anthony Henday Drive. The section between EPCOR and the Oakmont Reservoir in St. Albert is shared with the City of St. Albert, however, it is understood that the City of St. Albert will be constructing its own line to the Oakmont Reservoir in the near future.

The Morinville Line then connects to the Morinville Booster Station located within the Oakmount Reservoir Pumphouse. The booster pumps are currently bypassed and thus the system is operating under EPCOR pressure. Without the booster pumps in operation, the system has a total capacity of about 100 L/s (actual capacity varies depending on EPCOR pressure). The current plan is to activate the Morinville Booster Station when the peak demands from Morinville / Sturgeon / Legal exceed the 100 L/s capacity. The City of St. Albert currently maintain the booster station through an agreement with the Town of Morinville.

The Morinville Line has a 550mm diameter from the Oakmont Reservoir through the Sturgeon Valley where it reduces to 500 mm. Based on discussions with the Town of Morinville, the transmission main is in good condition.

After the Town of Morinville connection, water is boosted at the Legal Booster Station for supply to the Village of Legal and the County Crossroads Industrial Park. The Legal Booster Station and the transmission main from Morinville to Legal are owned by the Village of Legal.

Based on the available data, the estimated breakdown in the water demands along the Morinville line are shown in Table 5.8. The average annual and maximum day demands for Sturgeon County and Alexander First Nation are based on 2017 data provided by the County. The Morinville and Legal demands are based on data provided by the Town of Morinville.

The estimated flows connecting to each location on the Morinville Line are shown in Figure 5.3. Based on this preliminary assessment, it appears that the County is withdrawing more than its allocated percentage of the overall capacity of the Morinville Line (based on MDD).

Table 5.8: Current Water Use along Morinville Line

Reservoir / Community	Average Annual Demand (L/s)[2]	Average Annual Demand Percent of Capacity (%)[1]	Max Day Demand (L/s)	Max Day Demand Percent of Capacity (%)	Allocated Percent (%)[6]
Summerbrook/Sturgeon Valley	2.6	2.6	6.7	6.7	--
Villeneuve	1.9	1.9	3.6	3.6	--
Rivière Qui Barre[3]	1.1	1.1	4.4	4.4	--
Northern Lights/ProNorth	3.8	3.8	6.9	6.9	--
Cardiff	2.5	2.5	3.7	3.7	--
Alexander First Nation[3]	2.6	2.6	5.2	5.2	--
Sturgeon County Total	13.2	13.2	30.5	30.5	23.3
Town of Morinville[4 5]	30.3	30.3	54.5	54.5	64.7
Village of Legal[4]	5.2	5.2	9.3	9.3	12.0
Total	**48.7**	**48.7**	**94.3**	**94.3**	**100.0**

Notes:

1. Table is based on an overall pipe capacity of 100 L/s.
2. Data is based off 2017 annual water reports unless otherwise specified.
3. RQB and AFN are inconsistent with Alcomdale Preliminary Design Report demands, 2017. RQB demands minus AFN are ADD = 1.1 L/s, not 3.5 L/s. 3.5 L/s from report is close to total RQB reservoir amount.
4. Morinville and Legal flows were provided by the Town of Morinville.
5. Town of Morinville max day demand sourced from Town of Morinville: Municipal Utility Servicing Plan Update (2016).
6. Percent allocations based on Morinville Waterline Agreement (2013).

CRNWSC Transmission System

The CRNWSC system supplies water to Sturgeon County at the following locations:

- To the Sturgeon Industrial Park (SIP) reservoir from the CRNWSC north side transmission main;
- To Casa Vista, Hewitt Estates and Sturgeon Valley Vista Estates country residential areas via the CRNWSC Gibbons / Bon Accord transmission line;
- To Alberta's Industrial Heartland (AIH) industrial private reservoirs via the CRNWSC Redwater transmission mains.

The CRNWSC system is able to supply water to these Sturgeon County connection locations under both existing and near-term future demand conditions. The Northside transmission main is a 900 mm line connecting to EPCOR's Clareview Reservoir. It has a 6.8 ML on-line storage reservoir that is used as an emergency storage facility. The CRNWSC Redwater transmission line was recently twinned to increase supply to the AIH, Redwater and the Highway 28/63 Regional Water Service Commission. The 2016 CRNWSC Master Plan Update indicated that it will be necessary to twin parts of the Southside transmission system between Sherwood Park and Fort Saskatchewan if the proposed Bremner development area is to be serviced by the CRNWSC.

Local Water Transmission Mains

Local water transmission mains are summarized in Table 5.9 and described below.

Table 5.9: Local Water Transmission Main Capacity Analysis

Transmission Main	From	To	Size (mm)	Length (km)	Estimated Capacity (L/s)	Average Flow (L/s)	Peak Flow (L/s)
Northern Lights / Villeneuve[1]	Morinville Line	Northern Lights	300	5	70	0.2	7.4
Villeneuve[2]	Northern Lights	Villeneuve	200	11	40	1.9	0.9
Summerbrook Supply[3]	Morinville Line	Summerbrook	150	1	20	2.6	6.7
Cardiff Supply[1]	Morinville Line	Cardiff	200	2	30	2.5	3.7
RQB Supply[1]	Morinville Line	RQB	200	14	30	3.5	4.8
Alcomdale Supply[4]	RQB	Alcomdale	150	14	15	0.1	0.4
EPCOR 127 St Allin Ridge Supply[3]	EPCOR	Allin Ridge	300	4	65	10.5	21.4

Notes:

1. Northern Lights, RQB & Cardiff supply capacity estimated based on pipe size at 1.0 m/s; need hydraulic analysis to determine capacity.
2. Villeneuve supply capacity from Villeneuve Utilities Servicing Plan (2010, Sameng).
3. Allin Ridge & Summerbrook supply capacity from Sturgeon Valley Fire Study (2016 Update, Sameng).
4. Alcomdale Transmission Main length and capacity from Alcomdale Waterline Feasibility Report (AE 2014).
5. Booster Pump quote for RQB / Cardiff Booster Station listed at 12.7 L/s (202 usgpm).

There is no information available on the current hydraulic capacity of the Northern Lights, RQB or Cardiff supply lines, other than the reported booster station pump capacity of 12.7 L/s (source: Sturgeon County Utility Services). The values in Table 5.9 represent the potential pipe capacities based on a velocity of 1.0 m/s. Comparing the current peak flows and these pipe capacities, it is expected that the current pumping capacity in these pipes are much lower. The table does provide a useful estimate of the pipe capacity that can be provided by upgrading the pumping capacity or installing an on-line booster station.

ProNorth/Northern Lights/Villeneuve

Water is supplied to the ProNorth/Northern Lights/Villeneuve local transmission system from the Morinville Line. The first section is a 300mm main extending to the Northern Lights Reservoir. Water is then pumped from the Northern Lights pump house to Villeneuve via a 200mm main.

No data is available on the capacity of the 5km long 300mm transmission main connecting the Morinville Line to Northern Lights/ProNorth. Its capacity depends on the hydraulic grade line at the connection to the Morinville Line and the elevation of Northern Lights Reservoir. The maximum possible capacity is in the order of 100 L/s based on the 300mm size, but the current capacity (without an on-line booster) is likely in the range of 20 L/s to 50 L/s. The total average annual flows in the 300 mm main is about 4 L/s based on the Northern Lights and Villeneuve Reservoir inflow data (Table 1). The maximum day inflow rates are approximately 11 L/s. This does not include the Villeneuve Airport which could be connected at a later time.

The 11 km long, 200 mm diameter transmission main from Northern Lights to Villeneuve is reported to have a capacity of 40 L/s (Hamlet of Villeneuve Utility Servicing Plan, 2011). The average and maximum day demands are about 2 L/s and 4 L/s, respectively, based on the Villeneuve Reservoir inflow data.

Cardiff

Cardiff is supplied by a 200 mm transmission main connecting to the Morinville Line about a half mile (800 m) north of Cardiff Road on the west side of East Boundary Road (Range Road 252) in Morinville. A Cardiff / Riviere Que Barre Booster Station has a capacity of 12.7 L/s. This booster also supplies Riviere Que Barre, Alexander First Nation and now Alcomdale, and a hydraulic analysis will be needed to determine the capacity of the 200 mm supply to Cardiff.

The average 2017 annual fill rate to the Cardiff Reservoir is approximately 2.5 L/s and the maximum fill rate is about 4 L/s.

Riviere Que Barre / Alexander First Nation / Alcomdale

Riviere Que Barre is supplied by a 200 mm transmission main connecting to the Cardiff / RQB Booster Station off the Morinville Line. The Alexander First Nation is supplied from the RQB Reservoir and Pumphouse through a 150 mm main. Alcomdale will also be supplied from the RQB Reservoir via a new 150 mm transmission main east of Highway 44.

The Alcomdale Water Pipeline Preliminary Design Report reports that the RQB has a maximum capacity of 18.16 L/s which is to be split equally between RQB and AFN. The preliminary design report also indicated that total new demand from Alcomdale, Morinville Colony and other rural customers was estimated to be 1.4 L/s and 2.6 L/s for average and maximum day demand, respectively. Future 2042 average and maximum day demands were projected to be 1.6 L/s and 3.3 L/s, respectively (Alcomdale Water Pipeline Preliminary Design Report, draft 2017). The Alcomdale transmission main was designed for the above demands, so it would have a minimum capacity of 3.3 L/s.

The total average and maximum day demands for Riviere Que Barre / Alexander First Nation / Alcomdale are about 3.5 L/s and 5 L/s, respectively, based on the RQB and Alcomdale Reservoir inflow data.

Sturgeon Valley – Allin Ridge

The Allin Ridge Reservoir supply line from the EPCOR transmission main on 127 Street is proposed to be twinned in the future to accommodate growth in Sturgeon Valley. The Allin Ridge Reservoir is proposed to be the primary source of supply to Sturgeon Valley. The current fill rate is 13 L/s which is adequate for domestic needs but the reservoir has experienced peak draws of 40 L/s for lawn watering (source: Utility Services).

Country Residential Connections to CRNWSC

Based on discussions with the CRNWSC, it is understood that the Commission will be taking over ownership of the local transmission main between the CRNWSC transmission main and several country residential reservoirs. These include Hewitt & SV Vista Estates, Casa Vista, Hu Haven, Riverside Park and Fort Augustus Park. The rationale for this is that the CRNWSC is currently managing the operation of these local transmission systems. The County would remain responsible for operation of the reservoir and local distribution systems.

The local transmission mains being transferred from the County to the CRNWSC is shown in Figure 5.4.

5.3.2 Potable Water Reservoirs and Pumphouses

There are 12 storage reservoirs in Sturgeon County that obtain their water from EPCOR that are used to service residential and/or industrial areas. These reservoirs are listed in Table 5.10, along with their current available storage and calculated required storage volumes. As several of the pump houses do not have fire pumps and the distribution systems do not have fire hydrants, the estimates of fire storage do not apply for the smaller reservoirs. The calculations were based on Sturgeon County storage requirement guidelines and the Fire Underwriter's Survey (1999). The 1999 Fire Underwriter's Survey is the most current version of this document, and it is used by several municipalities to calculate fire storage requirements.

In Table 5.10 below, equalization storage refers to 25% of the maximum day demand, emergency storage refers to a 2 day supply of average day demand, and fire storage is calculated via the formula below:

$$F = 220C\sqrt{A} \text{ in L/min}$$

Where,
F = Fire storage in L/min.
C = coefficient based on critical building type:
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = plan area of building in m^2.

Table 5.10: Existing Water Reservoir Storage Volumes and Design Requirements

Reservoir Name	Current Active Storage Volume (m^3)[5]	Calculated Storage Requirements				
		Equalization Storage (m^3)	Fire Storage (m^3)	Emergency Storage (m^3)	Total With Fire Storage (m^3)	Total Without Fire Storage (m^3)
Alcomdale	136	9	430	26	465	35
Cardiff	1,290	80	723	428	1,231	508
Casa Vista	167	24	360	59	443	83
Hewitt	527	43	360	137	540	180
Landing Trail	76	29	723	91	843	120
Northern Lights	385	161	360	370	890	530
Riverside	194	35	360	90	485	125
Rivière Qui Barre	486	94	1,026	581	1,702	676
Sturgeon Industrial Park (W4)	4,956	308	4,096	955	5,360	n/a
Allin Ridge	5,000	462	952	1,821	3,234	2,283
Summerbrook	2,276	145	360	450	955	595
Villeneuve	1,036	79	4,832	335	5,246	414

Notes:
1. Total storage without fire storage is shown for comparison purposes only for communities that do not have full fire storage available.
2. Equalization Storage = 25 % of Max Day Demand.
3. Emergency Storage = 15 % of Average Day Demand OR 2-day supply, whichever is larger.
4. Fire Storage based off of methodology presented in Fire Underwriter's Survey, 1999.

5. Reservoir storage based on the following sources:
   - Alcomdale - Approval 334-01-00,1999, AEP
   - Cardiff - Cardiff Echoes SOP, 2011
   - Casa Vista - Casa Vista SOP, 2011
   - Hewitt - Hewitt Estates SOP, 2011
   - Landing Trail - Landing Trail SOP, 2011
   - Northern Lights - Existing as of 2014, there were recommendations for an upgrade of an additional 800 m3 (not sure if this has been implemented). This reservoir is intended to meet the demands of Northern Lights, ProNorth, and Villeneuve downstream. Sturgeon County Industrial Development Servicing Standards: ProNorth Industrial Area, 2014 (sameng inc).
   - Riverside - Riverside Park SOP, 2011
   - Rivière Qui Barre - Rivière Qui Barre SOP, 2011
   - Sturgeon Industrial Park (W4) - Sturgeon Industrial Park - 2015 Water Servicing Update, 2015 (sameng inc).
   - Allin Ridge - Sturgeon Valley Area Servicing, 2013 (sameng inc).
   - Summerbrook - Sturgeon Valley Area Servicing, 2013 (sameng inc).
   - Villeneuve - Villeneuve Utility Servicing Plan, 2011 (sameng inc).

With recent expansion of the Allin Ridge Reservoir, it currently meets the design storage requirements on the south side of Sturgeon Valley. Based on a 2013 memo (Sameng, 2013), the proposed reservoir volume at Allin Ridge for ultimate development in Sturgeon Valley is 60,000 m^3.

The Summerbrook Reservoir currently meets its storage requirements. It is scheduled to be upgraded with new distribution pumps and a fire pump to improve its pumping capacity.

The remainder of the reservoirs do not have adequate fire storage to meet the Fire Underwriters Survey requirements. This is to be expected as these reservoirs are generally not equipped with fire pumps to meet the design fire flows and the developments were not designed to provide an urban level of fire protection.

Available pumping capacity at the County's reservoirs is shown in Table 5.11 below. The SIP and Villeneuve Reservoirs are the only reservoirs that have fire pumps installed. The Allin Ridge Reservoir will need the future fire pump installed to increase the available fire flows in Sturgeon Valley.

Table 5.11: Existing Pumping Capacity at Water Reservoirs

Reservoir Name	Distribution Pumps		Fire Pump Capacity (L/s)	Total Pumping Capacity (L/s)[1]
	# Pumps	Capacity (L/s)		
Alcomdale	No information available			
Cardiff[3]	2	24.2	n/a	48.5
Casa Vista	No information available			
Hewitt	2	4.4	n/a	8.8
Landing Trail	No information available			
Northern Lights	2	10.2	n/a	20.4
Riverside	No information available			
Rivière Qui Barre	No information available			
Sturgeon Industrial Park (W4)	3	15	115	160
Allin Ridge	3	36	190	298
Summerbrook	2	22.9	n/a	45.8
Villeneuve	2	12.6	60.6	85.8

Notes:
1. Total pumping capacity is approximate only and depends on pumping head.
2. Truck fill pumps are not included.

3. Pump Information Sources:
   - Cardiff: TS Catalog - Section C - 1150 RPM Vertical Turbine Pump Curves, Crane-Deming Pumps, Crane Co. Salem, Ohio.
   - Hewitt: Sturgeon County Hewitt Estates and Valley Vista Water Servicing - 2005, Existing and Removals Drawing, DCL Siemens.
   - Northern Lights: Sturgeon County Industrial Development Servicing Standards - ProNorth Industrial Area, sameng. Inc., 2014.
   - SIP: Sturgeon Industrial Park - 2015 Water Servicing Update, sameng inc., 2015.
   - Allin Ridge: Sturgeon Valley Fire Protection Study (2017 Update), sameng inc., 2019. Truckfill pump has a capacity of 25.2 L/s which is not included.
   - Summerbrook: Sturgeon Valley Fire Protection Study (2017 Update), sameng inc., 2019.
   - Villeneuve: Hamlet of Villeneuve Utility Servicing Plan, sameng inc., 2010. The truck fill pump has a capacity of 5 L/s which isn't included.

5.3.3 Water Distribution Systems

Sturgeon County has a total of 12 communities (hamlets, country residential, industrial areas) with water distribution systems that were reviewed as part of this study. These systems are shown in Figure 5.5 and listed in Table 5.12. The larger distribution systems are described below.

Table 5.12: Summary of Existing Water Distribution Systems

Community	Water Distribution System	Fire Hydrants?
Alcomdale	Line extended from Rivière Qui Barre.	Yes
Cardiff	Cardiff is supplied by a 200 mm transmission main connecting to the Morinville Line. The Cardiff / RQB Booster Station uses a 15 Hp Peerless Pump.	Yes
Casa Vista	150mm system branching off from CRNWSC transmission main.	Yes
Hewitt	150mm and 75mm system branching off from CRNWSC transmission main.	Yes
Landing Trail	50-100mm system of double looping pipes branching off of CRNWSC main transmission line.	No
Northern Lights	200 mm system that branches out from the Morinville - Villeneuve connection.	Yes
Riverside	100 – 150mm pipes that branch off of the CRNWSC transmission main.	Yes
Rivière Qui Barre	150mm system. Demand will increase due to school upgrades. Also, Sandy Beach and Sunrise Beach are requesting water via truckfill (2” line).	Yes
Sturgeon Industrial Park (W4)	250 – 300mm system branching off of CRNSWC transmission main.	Yes
Sturgeon Valley – Allin Ridge	Connected to Sturgeon Valley system via two 250 and 300 mm pipes. Allin Ridge is considered for reservoir expansion as it may be used for future growth.	Yes
Sturgeon Valley – Summerbrook	Connected to Sturgeon Valley system via 150 – 200mm pipes. Branches off of the Morinville Line.	Yes
Villeneuve	150 – 200mm system from Northern Lights Reservoir and Pump Station (capacity 40 L/s). Currently the airport is trucking water from Devon.	Yes

Notes:
1. Landing Trail – Sturgeon Industrial Park and Landing Trail Co-op Servicing Report, 2010 (DCL Siemens Engineering Ltd).
2. Villeneuve – Villeneuve Utility Servicing Plan, 2011 (sameng inc).
3. The remainder of the data was mined from the GIS database.

Alcomdale

Alcomdale is fed from a 150 mm line extended north of the 200 mm Rivière Qui Barre line along Range Road 262. It feeds into the Alcomdale reservoir near the NE side of the hamlet, as well as a number of a number of local service connections.

The Alcomdale system is owned by a local co-op and does not feature any hydrants.

Cardiff

Cardiff has water supplied via a 200 mm line branching off of the Morinville line. The Cardiff system is primarily 150 mm water distribution mains.

Casa Vista

The Casa Vista system branches off of the CRNWSC transmission main along the line heading northwest, known as the Gibbons Line, which is 250 mm in diameter. The Casa Vista system is a 150 mm pipe system.

Hewitt & Sturgeon Valley Vista Estates

Along the Gibbons Line heading towards Bon Accord, the Hewitt Estates and SV Vista Estates country residential neighborhoods are serviced by a 150 mm line heading south from the existing 200 mm CRNWSC line. The network is made up of 50 – 150 mm pipes. Hewitt Estates makes up the northern section of the network, while Sturgeon Valley Vista Estates makes up the southern section. The ownership of the local transmission lines to the reservoir will be changing to the CRNWSC in the future.

Landing Trail

50 – 100mm system of double looping pipes branching from the 900 mm CRNWSC main transmission line. This system does not have capacity for new connections and the County is currently considering connecting it to the Sturgeon Industrial Park system.

Northern Lights

Northern Lights is a country residential area just north of St. Albert and southwest of the Pro North industrial area. It is serviced off of the 200 mm Villeneuve line to the south by a 200 mm pipe. Along this pipe there are three branches of 200 mm pipe as well.

Riverside

Riverside includes 100 to 150mm pipes that branch off of the 300 mm CRNWSC transmission main heading northeast, along to the North Saskatchewan River. The Riverside system is the right loop, to the east of the supply line from the CRNWSC. The left loop is part of the Hu Haven neighborhood and is PVC pipe constructed in 1972. The ownership of the local transmission lines to the reservoir will be changing to the CRNWSC in the future.

Rivière Qui Barre

The RQB distribution system is comprised primarily of 150mm mains. The water demand is expected to increase due to the Camilla School upgrades. Also, the County noted that Sandy Beach and Sunrise Beach are requesting water via truckfill (2” line).

Sturgeon Valley

Sturgeon Valley is fed from the Allin Ridge and Summerbrook reservoirs through a series of 200 mm and 150 mm mains. It utilizes separate pressure zones, with each reservoir supplying its own primary zone and utilizing pressure reducing valves (PRVs) to service lower lying lots on each side of the Sturgeon River. A hydraulic analysis of distribution piping is not included in the scope of this study.

Sturgeon Industrial Park

The Sturgeon Industrial Park (SIP) is serviced off the SIP Reservoir adjacent to the CRNWSC transmission main. The distribution system consists of approximately 3.8 km of 250 mm and 300 mm mains, with a total of 48 service connections.

Villeneuve

Villeneuve is serviced from an 11.4 km long, 200 mm HDPE pipe from the Northern Lights Reservoir and Pump Station (capacity 40 L/s). Within Villeneuve itself, the network is made up of 150 – 200 mm HDPE, PVC and asbestos cement pipes. Currently, the airport is trucking water from Devon.

5.3.4 Industrial Raw Water Use

In 2007, as part of the Heartland Area Utility Master Plan, a raw water servicing concept was developed for the AIH. The servicing concept is shown in Figure 5.6.

In 2014, Atco Energy Solutions Ltd. obtained a Water Act Approval for a river intake and diversion on the North Saskatchewan River. Approval #00346745-00-00 allows for up to 1.1 m^3/s to be withdrawn. At the same time, Atco (marketed as Atco Industrial Water Solutions) constructed a raw water pump station in Strathcona County across the river from Sturgeon County in the Alberta's Industrial Heartland. It is understood that raw water is pumped to both Sturgeon County and Strathcona County, but the volumes are not readily available. Based on the right-of-way on title, it appears that the water transmission main conveys raw water to the Northwest Upgrader, refer to Figure 5.6.

Sturgeon County is not directly involved with the raw water supply, as it is a private business arrangement between Atco and their industrial clients.

5.4 Future Water Demands

The future water demands within the County were estimated based on the projected growth rates and the current water consumption demands.

The population projections for the County's growth areas are shown in Table 5.13. The average and maximum day demands for the reservoirs within these growth areas are listed in Table 5.14.

Table 5.13: Population Projections for Growth Areas

Community	2017 (Estimate)	Threshold 1 (2024)	Threshold 2 (2034)	Threshold 3 (2044)
Sturgeon Valley	4,249	4,756	9,461	14,202
Cardiff	1,254	1,328	1,882	2,574
Villeneuve	257	294	571	917
Alcomdale	53	56	69	82
Rivière Qui Barre	106	113	139	164

Table 5.14: Projected Water Demand for Residential Growth Areas

Community	Parameter	Scenario					Assumed Per Capita Water Use (L/c/d)
		2011	2017 (Estimate)	Threshold 1 (2024)	Threshold 2 (2034)	Threshold 3 (2044)	
Allin Ridge	Population	-	2,549	3,056	7,761	12,502	-
	Annual Water Consumption (m³/yr)	-	332,515	297,822	756,348	1,218,382	267
	Average Water Demand (L/s)	-	10.54	9.44	23.98	38.63	
	Peak Water Demand (L/s)	-	14.46	17.33	44.01	70.90	490
Summerbrook[1]	Population	-	1,700	1,700	1,700	1,700	-
	Annual Water Consumption (m³/yr)	-	82,177	82,177	82,177	82,177	267
	Average Water Demand (L/s)	-	2.61	2.61	2.61	2.61	
	Peak Water Demand (L/s)	-	9.64	9.64	9.64	9.64	490
Sturgeon Valley	Population	3,475	4,249	4,756	9,461	14,202	-
	Annual Water Consumption (m³/yr)	-	414,692	463,496	922,022	1,384,056	267
	Average Water Demand (L/s)	-	13.15	14.70	29.24	43.89	
	Peak Water Demand (L/s)	-	24.10	26.97	53.66	80.54	490
Cardiff	Population	1,190	1,254	1,328	1,882	2,574	-
	Annual Water Consumption (m³/yr)	-	78,105	74,162	105,100	143,745	153
	Average Water Demand (L/s)	-	2.48	2.35	3.33	4.56	
	Peak Water Demand (L/s)	-	3.31	3.50	4.97	6.79	228
Villeneuve	Population	225	257	294	571	917	-
	Annual Water Consumption (m³/yr)	-	61,241	70,288	136,512	219,232	655
	Average Water Demand (L/s)	-	1.94	2.23	4.33	6.95	
	Peak Water Demand (L/s)	-	3.66	4.19	8.13	13.05	1230
Alcomdale	Population	50	53	56	69	82	-
	Annual Water Consumption (m³/yr)	-	4,691	3,010	3,691	4,372	146
	Average Water Demand (L/s)	-	0.15	0.10	0.12	0.14	
	Peak Water Demand (L/s)	-	0.25	0.27	0.33	0.39	409
Riviere Qui Barre Hamlet[2]	Population	100	106	113	139	164	-
	Annual Water Consumption (m³/yr)	-	34,900	37,191	45,604	54,018	902
	Average Water Demand (L/s)	-	1.11	1.18	1.45	1.71	
	Peak Water Demand (L/s)	-	1.46	1.55	1.90	2.25	1187
Alexander First Nation[3]	Population	-	-	-	-	-	-
	Annual Water Consumption (m³/yr)	-	71,114	71,114	71,114	71,114	-
	Average Water Demand (L/s)	-	2.26	2.26	2.26	2.26	
	Peak Water Demand (L/s)	-	-	-	-	-	-
Riviere Qui Barre (Total)	Population	100	106	113	139	164	-
	Annual Water Consumption (m³/yr)	-	106,014	108,305	116,718	125,132	902
	Average Water Demand (L/s)	-	3.36	3.43	3.70	3.97	
	Peak Water Demand (L/s)	-	5.97	6.06	6.41	6.76	1187

Notes:

1. Summerbrook population assumed to be constant and unchanging.
2. 1187 L/c/d based off of historical peak day value and estimated water accounts from Reservoir (lumped data).
3. Assumed AFN Peak demand is 2x average water demand.

The non-residential growth projections and the resulting water demands are shown in Table 5.15 and 5.16, respectively. It is noted that the unit water demands for non-residential areas can be highly variable. The Sturgeon Valley (SV) East / CFB Edmonton water demands are based on the GMSS value of 6170 L/ha/day, due to the potential for highway commercial development. ProNorth and the Villeneuve Airport water demands are based on typical commercial / light industrial values and may be overly conservative depending on the type of businesses that locate there. The Villeneuve Airport water demands are lower than that proposed in the based on the Villeneuve Airport Utility Assessment Future Development report, as the current water use is low enough for the Edmonton Regional Airport Authority to truck water at present.

Table 5.15: Non-Residential Development Projections for Growth Areas

Area	Existing Developed Area (ha)	Gross Hectares Added (ha)			Net Hectares Added (ha)			Total Net Area (ha)		
		Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Alberta's Industrial Heartland	988	322	784	776	258	627	621	1,246	1,873	2,494
Sturgeon Industrial Park	235	90	140	126	72	112	100	307	420	520
ProNorth Industrial Park	33	6	56	33	5	45	26	38	82	108
SV East / CFB Edmonton	0	0	90	174	0	72	139	0	72	211
Villeneuve Airport	10	10	78	50	8	63	40	18	80	121

Notes:

1. Net area is based on 80% of gross area.

Table 5.16: Demands for Non-Residential Growth Areas

Area	Average Annual Demand (L/ha/d)	2017 Annual Water Demand (m^3/yr)	2017 Average Water Use (L/s)	Annual Water Demand (m^3/yr)			Average Water Demand (L/s)		
				Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Alberta's Industrial Heartland	1,802	650,000	20.6	819,564	1,232,365	1,640,715	26.0	39.1	52.0
Sturgeon Industrial Park	2,033	174,359	5.5	227,949	311,301	385,861	7.2	9.9	12.2
ProNorth Industrial Park	2,000	302	0.0	3,611	36,273	55,416	0.1	1.2	1.8

Area	Average Annual Demand (L/ha/d)	2017 Annual Water Demand (m^3/yr)	2017 Average Water Use (L/s)	Annual Water Demand (m^3/yr)			Average Water Demand (L/s)		
				Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
SV East / CFB Edmonton	6,170	0	0.0	0	162,516	475,373	0.0	5.2	15.1
Villeneuve Airport	2,000	7,300	0.2	12,996	58,751	88,033	0.4	1.9	2.8

Notes:

1. AIH, SIP & ProNorth based on 2017 data, SV East / CFB Edm & Villeneuve Airport estimated.
2. ProNorth, SV East / CFB Edmonton, and Villeneuve Airport average annual demand estimated based on typical non-residential use.

The Villeneuve Airport currently obtains its water privately and is not connected to the County's Hamlet of Villeneuve system. While the airport could eventually connect to the County's system, the funding and timing is uncertain. It is proposed that the Villeneuve Airport demands shown in Table 5.16 be applied to the County's infrastructure (i.e. Morinville Line, Northern Lights supply, Villeneuve supply) in Phase 2 (2034) is subsequent tables.

The water reservoir data includes truck fill demands and assume that the truckfill demand patterns increase proportionately with the local distribution system demands.

5.5 Capacity of Existing Infrastructure for Growth ("Do Nothing")

CRNWSC Redwater Line

The CRNWSC recently constructed the 400mm transmission line through the AIH to Redwater, in parallel with the existing 300mm / 250mm transmission main to Redwater.

The 2016 CRNWSC Master Plan includes the following information about the capacity of the Redwater Line, referring to the total system capacity with both transmission mains:

- The on-line pump station has three identical variable speed pumps, rated at 53.9 L/s at 71.6m head each.
- The pump / system curve maximum discharge rate with the current VFD setting is about 85 L/s (310 m^3/hour)
- A maximum historic peak flow of 61.5 L/s was recorded on July 9, 2015.
- The on-line pumping station is only needed for the 2035 peak day demand scenario, and that the on-line station can be bypassed for other scenarios.
- No upgrading to the CRNWSC system is proposed to 2035;
- The "Sturgeon County" and "Degussa" average day demands are shown as constant from 2015 to 2035 and are listed at 2.1 L/s and 14.4 L/s, respectively.
- The increase in average day demand from the Town of Redwater and the Hwy 28/63 Regional Water Service Commission from 2015 to 2035 is approximately 5 L/s.

The projected increase in AIH demands from 2017 to Phase 3 (2044) in Table 5.16 is from 20.6 L/s to 52.0 L/s. This estimated increase of about 30 L/s is significant and is not considered in the 2016 CRNWSC master plan. It is not clear from the CRNWSC report whether the system can accommodate this increase.

Morinville Water Line

The projected future average and peak day demands for communities connected to the Morinville Line are shown in Table 5.17. The increased demands are based on projected growth in Villeneuve, ProNorth and Cardiff, plus an assumed nominal growth in RQB and Alcomdale. The Villeneuve Airport is assumed to be connected to the Morinville Line by the 3rd growth phase starting in approximately 2034. This assumption will need to be reviewed as the connection may be dependent on the available capacity in the Morinville Line at the time of connection

Due to the constraints on the Morinville Line, it is assumed that there will be no net increase in flows to the Summerbrook Reservoir. Thus, all the growth in the Sturgeon Valley will be supplied by the Allin Ridge Reservoir.

Table 5.17 shows that the future County demands on the Morinville Line will exceed the County's allocation, with the total flows exceeding the transmission line's hydraulic capacity as it is currently being operated.

Table 5.17: Future Water Use along Morinville Line

Reservoir / Community	Average Annual Demand (L/s)				Max Day Demand (L/s)				Allocated Percent (%)
	2017	2024	2034	2044	2017	2024	2034	2044	
Summerbrook/ Sturgeon Valley	2.6	2.6	2.6	2.6	9.6	9.6	9.6	9.6	--
Villeneuve[5]	1.9	2.2	6.2	9.7	3.7	4.2	11.9	18.6	--
Rivière Qui Barre	1.1	1.2	1.4	1.7	6.0	6.1	6.4	6.8	--
Northern Lights / ProNorth[6]	0.2	0.3	1.3	1.9	6.5	6.5	6.5	6.5	--
Cardiff	2.5	2.4	3.3	4.6	3.3	3.5	5.0	6.8	--
Alexander First Nation[7]	2.3	2.3	2.3	2.3	4.5	4.5	4.5	4.5	--
Sturgeon County Total	10.6	10.9	17.2	22.8	30.5	34.4	43.9	52.8	23.3
Town of Morinville[2 3 4]	30.3	30.3	30.3	30.3	54.5	54.5	54.5	54.5	64.7
Village of Legal[2 4]	5.2	5.2	5.2	5.2	9.3	9.3	9.3	9.3	12.0
Total	**46.1**	**46.4**	**52.7**	**58.3**	**94.3**	**98.2**	**107.7**	**116.6**	**100.0**

Notes:

1. Table is based on an overall pipe capacity of 100 L/s.
2. Morinville and Legal flows were provided by the Town of Morinville.
3. Town of Morinville max day demand sourced from Town of Morinville: Municipal Utility Servicing Plan Update (2016).
4. Assumed that Morinville and Legal demands are unchanging.
5. Villeneuve includes airport flows in 2034/44. Max day flows for the airport were estimated as 2x average flow.
6. Northern Lights/ProNorth estimated using 51 c and 320 L/c/d. Max day estimated as constant over growth period.
7. AFN max day demands were assumed to be 2x average flow.

Local Transmission Mains

The projected future average and peak day demands for on the local transmission lines are shown in Table 5.18. This table indicates:

1. The Northern Lights / Villeneuve supply line will see a dramatic increase in demands, especially after the assumed connection of the Villeneuve Airport in Phases 2 and 3 (2034 and 2044). A hydraulic analysis of this pipe and the Morinville Line will be needed to determine if an on-line booster station is needed.

2. The Villeneuve supply line appears to be adequate based on the existing 20 L/s capacity as reported in the 2011 Hamlet of Villeneuve Utility Servicing Plan. If necessary, an on-line booster can be installed to increase the capacity of the existing line.
3. There are no plans to increase the flows in the Summerbrook supply line, so the existing pipe is adequate.
4. Hydraulic analysis of the Cardiff and RQB systems is required to determine when the existing booster station at Morinville will need to be upgraded. Based on the current capacity of 12.7 L/s (202 usppm), this booster station would need to be upgraded as during Phase 2 (2034).
5. The new Alcomdale supply line is adequate.
6. The Allin Ridge Supply Line will likely need to be twinned prior to full build out of Phase 3 (2044). Previous studies have proposed a new 450mm or 600mm connection to the 600mm EPCOR supply line.

Table 5.18: Future Local Water Transmission Main Capacity Analysis

Transmission Main	From	To	Size (mm)	Length (km)	Estimated Capacity (L/s)[1]	Average Flow (L/s)				Peak Flow (L/s)[5]			
						2017	2024	2034	2044	2017	2024	2034	2044
Northern Lights / Villeneuve[6 7]	Morinville Line	Northern Lights	300	5	70	0.2	2.3	7.3	11.5	7.4	10.7	18.4	25.1
Villeneuve[2 6]	Northern Lights	Villeneuve	200	11	40	1.9	2.2	6.2	9.7	3.7	4.2	11.9	18.6
Summerbrook Supply[3]	Morinville Line	Summerbrook	150	1	20	2.6	2.6	2.6	2.6	9.6	9.6	9.6	9.6
Cardiff Supply[8]	Morinville Line	Cardiff	200	2	30	2.5	2.4	3.3	4.6	3.3	3.5	5.0	6.8
RQB Supply[8]	Morinville Line	RQB	200	14	30	3.4	3.4	3.7	4.0	6.0	6.1	6.4	6.8
Alcomdale Supply[4]	RQB	Alcomdale	150	14	15	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.4
EPCOR 127 St Allin Ridge Supply	EPCOR	Allin Ridge	300	4	65	10.5	9.4	24.0	38.6	14.5	17.3	44.0	70.9

Notes:

1. Northern Lights, Villeneuve, RQB & Cardiff supply capacity estimated based on pipe size at 1.0 m/s; need hydraulic analysis to determine capacity.
2. Villeneuve supply capacity from Villeneuve Utilities Servicing Plan (2010, Sameng).
3. Summerbrook supply capacity from Sturgeon Valley Fire Study (2016 Update, Sameng).
4. Alcomdale Transmission Main length from Alcomdale Waterline Feasibility Report (AE 2014).
5. Peak day based on Table 5.14.
6. Northern Lights / Villeneuve & Villeneuve include airport flows in 2034/44. Max day flows for the airport were estimated as 2x average flow.
7. Northern Lights/ProNorth estimated using 51 c and 320 L/c/d. Max day estimated as constant over growth period (6.5 L/s + Villeneuve).
8. It is noted that Cardiff and RQB supply lines have booster pump capacities of 12.7 L/s.

Water Reservoirs and Pumphouses

The future reservoir storage design volumes requirements are listed in Table 5.19. The design volumes are based on both with fire flow storage and without fire storage where applicable. As the County is interested in moving towards an urban fire protection standard over time, the design storage volumes that include fire storage would apply.

As noted in Table 5.19, most of the reservoirs will have less than the design storage volumes in the future and additional storage will need to be provided.

Table 5.19: Future Water Reservoir Storage Volumes and Design Requirements

Reservoir Name	Current Active Storage Volume (m^3)	Total Required Storage With Fire Storage (m^3)				Total Required Storage Without Fire Storage (m^3)			
		2017	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	2017	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Cardiff	1,290	1,231	1,205	1,406	1,657	508	482	683	934
Northern Lights	385	890	540	719	824	530	180	359	464
Rivière Qui Barre	486	1,702	1,263	1,317	1,371	676	237	291	345
Sturgeon Industrial Park (W4)	4,956	5,360	5,654	6,110	6,519	n/a	n/a	n/a	n/a
Allin Ridge	5,000	3,234	2,958	6,047	9,159	2,283	2,006	5,095	8,208
Summerbrook	2,276	955	1,019	1,019	1,019	595	659	659	659
Villeneuve	1,036	5,246	5,308	5,756	6,315	414	476	924	1,483

Notes:

1. Total storage without fire storage is shown for comparison purposes only for communities that do not have full fire storage available.
2. Equalization Storage = 25 % of Max Day Demand.
3. Emergency Storage = 15 % of Average Day Demand OR 2-day supply, whichever is larger.
4. Fire Storage based off of methodology presented in Fire Underwriter's Survey, 1999.
5. Max day use for SIP & Northern Lights is assumed to be constant for the calculation of equalization storage.
6. Villeneuve excludes airport as it will have its own reservoir.

The future distribution and fire pumping capacities to accommodate growth are shown in Table 5.20. Several of the distribution pumps will need to be upgraded to accommodate the projected growth.

The future fire pump capacities are also shown in Table 5.20. These capacities are based on the types of development proposed (e.g. single family, industrial) and assume that the County is moving towards an urban level of fire protection.

Table 5.20: Future Pumping Capacity at Water Reservoirs

Reservoir Name	Distribution Pumps		Existing Distribution Pump Capacity (L/s)	Required Capacity Based on Estimated Peak Hour Demand (L/s)			Existing Fire Pump Capacity (L/s)	Required Fire Pump Capacity (L/s)		
	# Pumps	Capacity (L/s)	2017	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	2017	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Cardiff	2	24.2	48.5	9.4	13.3	18.2	n/a	n/a	n/a	90.0
Northern Lights	2	10.2	20.4	0.5	4.6	7.0	n/a	n/a	n/a	230.0
Rivière Qui Barre	-	-	n/a	4.7	5.8	6.9	n/a	n/a	n/a	90.0
Sturgeon Industrial Park (W4)	3	15.0	45.0	28.9	39.5	48.9	115.0	115.0	115.0	230.0
Allin Ridge	2	25.2	50.4	37.8	95.9	154.5	Future	n/a	n/a	90.0
Summerbrook	3	3.8	11.4	10.4	10.4	10.4	n/a	n/a	n/a	90.0
Villeneuve	2	12.6	25.2	8.9	17.3	27.8	60.6	60.6	60.6	90.0

Notes:

1. Total pumping capacity is approximate only and depends on pumping head.
2. Truck fill pumps are not included.
3. Peak Hour Demand estimated by 4 x Average Day Demand.
4. Fire Pump Capacity at Phase 3 is based on GMSS fire flows for specific land uses.
5. Pump Data sources shown in Table 5.11.

5.6 Role of Demand Management to Minimize New Infrastructure Requirements

The County has indicated that they would like to use demand management to minimize the investment required by the County and its stakeholders (e.g. developers, industry) to accommodate growth. This section provides a brief summary of the recommended demand management measures, and the anticipated impact of these measures on the infrastructure requirements.

Water Conservation

Water conservation is described in detail in Section 8.3.7 as part of the implementation plan for water. A slight drop in per capita water use is expected over time as older fixtures and appliances are replaced with new water efficient ones. The Cities of Edmonton and Calgary, and Strathcona County (Sherwood Park) have developed water conservation strategies and have seen large drops in per capita water use. A significant portion of this reduction has been due to new plumbing codes requiring low flow fixtures combined with high rates of new home construction.

Based on the data available, it is not possible to quantify the expected reduction was per capita use in the County, as several communities currently have relatively low water use.

A more aggressive water conservation program could be implemented, including rebate programs for low flush toilets, educational programs, and improved operational efficiencies. It is noted that the County recently initiated a tiered water billing structure where users are charged higher rates for additional water consumed. Restrictions on exterior water use are also in place in the County during periods of heavy water use.

Overall, a more aggressive water conservation program could reduce per capita demands by 20% or more. However, with the variability and unknowns within the current water demands, there is uncertainty in the effectiveness of an aggressive water conservation program.

Development Restrictions

Another option to manage water demands is to place restrictions on development in specific areas based on the availability of water to service them. This is currently the practice within parts of the Highway 14 Water Services Commission. New industries can be advised of the allowable water use. This type of restriction may be difficult to implement and can be expected to deter development.

Restrictions on Truck Fills

If truck fills are utilizing a large portion of the local transmission or storage capacity, consideration can be given to restricting access to truck fills during peak demand periods. This can include limiting access to residential customers and/or County residents only. It is also possible to use technology to create demand based pricing at truck fills.

Raw Water for Industrial Process Use

Another way to manage the overall demands on the potable water system is to expand the existing raw water system to meet future process water needs.

Leasing Capacity in Morinville Line

Upgrading the hydraulic capacity of the Morinville Line (at the County's expense) can be deferred through leasing additional capacity in the line from the Town of Morinville, the Village of Legal, or both.

Fire Flow Strategies

In lieu of extensive upgrading of the County's water reservoirs, pumphouses and distribution systems, alternative firefighting and fire prevention strategies can be implemented. This includes the super tanker currently being implemented by the County within Sturgeon Valley. It is also possible to modify building requirements, such as sprinkler systems and fire-resistant building materials.

Summary

It is recommended that the County consider all of the above measures to defer spending on water infrastructure. However, it is not practical to quantify the reduction in water demands and the associated infrastructure savings. It is therefore recommended that the current water demands be used to determine the water system upgrading to meet the future growth.

5.7 Water System Upgrades to Meet Future Water Demands

5.7.1 CRNWSC Redwater Line

The projected increase in AIH demands from 2017 to Phase 3 (2044) in Table 5.16 is from 20.6 L/s to 52.0 L/s. It is not clear from the 2016 CRNWSC master plan if the CRNWSC transmission system can accommodate this estimated increase of about 30 L/s. The CRNWSC will need to consider the actual and projected magnitude of AIH potable water demands to assess the Capacity of the Redwater Line. Additional capacity could be supplied by increasing the pumping capacity at the CRNWSC On-line Booster Station.

5.7.2 Morinville Water Line

The County will require more capacity in the Morinville Water Line than their agreement currently allows based on the overall system capacity of 100 L/s. This will require the booster pump at Oakmount Booster Station to be installed and activated.

The timing of this increase in dependent on whether the County can lease additional capacity from Morinville and/or Legal. If additional capacity cannot be leased, then it is recommended that the County needs to initiate the Oakmount Booster Station upgrade as soon as possible.

5.7.3 Local Transmission Mains

To meet the future peak day demands within the County, the following upgrades to the local transmission lines are proposed:

- The capacity of the 300mm Northern Lights supply line can increased when the hydraulic grade line (HGL) in the Morinville line is increased by activating the booster pump in the Oakmount Booster Station. As previously noted, a hydraulic analysis would be needed to confirm the capacity of the Northern Lights supply under current operating conditions.
- The Villeneuve Supply line appears to be adequate to supply Hamlet of Villeneuve and the Villeneuve Airport development through Phase 3 (2044), based on the reported capacity of 20 L/s. If necessary, the on-line booster can be installed between Northern Lights and Villeneuve to increase its hydraulic capacity.
- The Morinville Booster Station supplying water to Cardiff and RQB will need to be upgraded by approximately Phase 2 (2034).
- The 300mm Allin Ridge Supply line will need to be twinned during the build out of Phase 3 (prior to 2044).

The Allin Ridge supply line is proposed to be twinned with a 450mm main connecting to EPCOR's 600mm 127 Street Transmission Main. This twinning can be deferred through water conservation, possibly beyond the growth projections in this study.

5.7.4 Water Reservoirs and Pumphouses

The future water reservoir and pumphouse capacities to service growth are shown in Tables 5.19 and 5.20. The additional reservoir capacities needed are shown in Table 5.21. The additional pumping capacity is not shown as pumping upgrading is expected to be incorporated into future pumphouse rehabilitation.

Table 5.21: Additional Reservoir Capacity Required for Future Growth

Reservoir Name	Current Active Storage Volume (m^3)	Additional Capacity Required With Fire Storage (m^3)			Additional Capacity Required Without Fire Storage (m^3)		
		Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Cardiff	1,290	0	116	367	0	0	0
Northern Lights	385	155	334	439	0	0	79
Rivière Qui Barre	486	777	831	885	0	0	0
Sturgeon Industrial Park (W4)	4,956	698	1,154	1,563	n/a	n/a	n/a
Allin Ridge	5,000	0	1,047	4,159	0	95	3,208
Villeneuve	1,036	4,272	4,720	5,279	0	0	447

5.7.5 Site Specific Water Servicing Concept in Growth Areas

Introduction

This section describes the proposed water servicing concepts for the proposed growth areas. The pipe sizes proposed are based on “rule of thumb” and/or previous servicing studies. The figures show the general location and alignment of infrastructure.

Alberta’s Industrial Heartland

The AIH water system is shown in Figure 5.7. A new 400mm main is proposed along Highway 643, providing a connection between the two CRNWSC transmission mains. This will supply water to CKPC and provide a secondary supply to Evonik. The existing supply to Evonik can also be a secondary supply to CKPC. This 400mm main will act as a transmission main initially, connecting directly to the reservoirs of the various industries in the area. It can be converted to a distribution main in the future if the County constructs reservoirs at the connection to the CRNWSC transmission mains. The County is currently reviewing the business case for constructing these reservoirs.

There are also numerous potential connections between the CRNWSC and industry within the expected AIH growth area as shown in Figure 5.7. These connections would be County water transmission infrastructure.

Cardiff

The proposed extension to the Cardiff water system to service growth is shown in Figure 5.8. In order to have the flexibility to provide fire flows, the distribution system should connect directly to the Cardiff Reservoir. A minimum of 200mm diameter is required, with consideration of a 250mm connecting the reservoir to new development area. This will also increase fire flows to existing developed areas.

Northern Lights & ProNorth

The existing water system and projected growth at this location are shown in Figure 5.9. Northern Lights is not a priority growth area for the County and thus the timing of growth is uncertain.

The proposed expansion of the ProNorth Industrial Park is expected to have full municipal servicing eventually, possibly without fire flows during interim servicing (subject to reservoir and pumping capacity at the Northern Lights Reservoir. The proposed servicing concept for full municipal servicing is to construct watermains north from the existing Northern Lights Water Reservoir (Township Road 544) with sufficient sizing to accommodate future fire flows, refer to Figure 5.9. The Northern Lights Reservoir and Pumphouse would need to be upgraded to provide the future fire flows.

Sturgeon Industrial Park

The proposed Sturgeon Industrial Park water distribution system is shown in Figure 5.10. It includes extensions of the existing water mains to service the proposed growth area. As the industrial area requires higher fire flows, larger distribution mains are required.

It is understood that the County is considering supplying the Landing Trail from the SIP system by constructing 1.6 km of 150mm or 200mm water main along Township Road 552. This is the same location as the future SIP distribution main will be, with an expected pipe size of about 400mm. The County may wish to oversize the Landing Trail supply line for this future SIP industrial distribution use.

Sturgeon Valley

The proposed Sturgeon Valley water distribution system is shown in Figure 5.11. Water will be supplied from the Allin Ridge Reservoir through new large diameter distribution lines along Range Road 250 and west through the proposed development areas. The proposed residential area west of Range Road 250 is expected to be serviced with new 400mm (green) distribution lines running south and west, connecting to local 250mm and 300mm (brown) mains. These large distribution mains will be needed to provide fire flows as the existing, primarily 150mm and 200mm mains, are not adequate for fire flows. It is understood that the County will be constructing local upgrades to improve fire flows within the existing development areas.

The proposed commercial / institutional development at SV East / CFB Edmonton will also be serviced by the Allin Ridge Reservoir via a large diameter main. This is shown as 400mm (green) in Figure 5.11 in order to provide large fire flows and have the flexibility to service the Namao School and/or CFB Edmonton in the future.

Detailed analysis of the existing and proposed water systems will be necessary to determine the water main sizing for each stage of development, with the goal of providing fire flows to County's standards.

Figure 5.11 also shows the proposed future 450mm Allin Ridge supply line.

Villeneuve

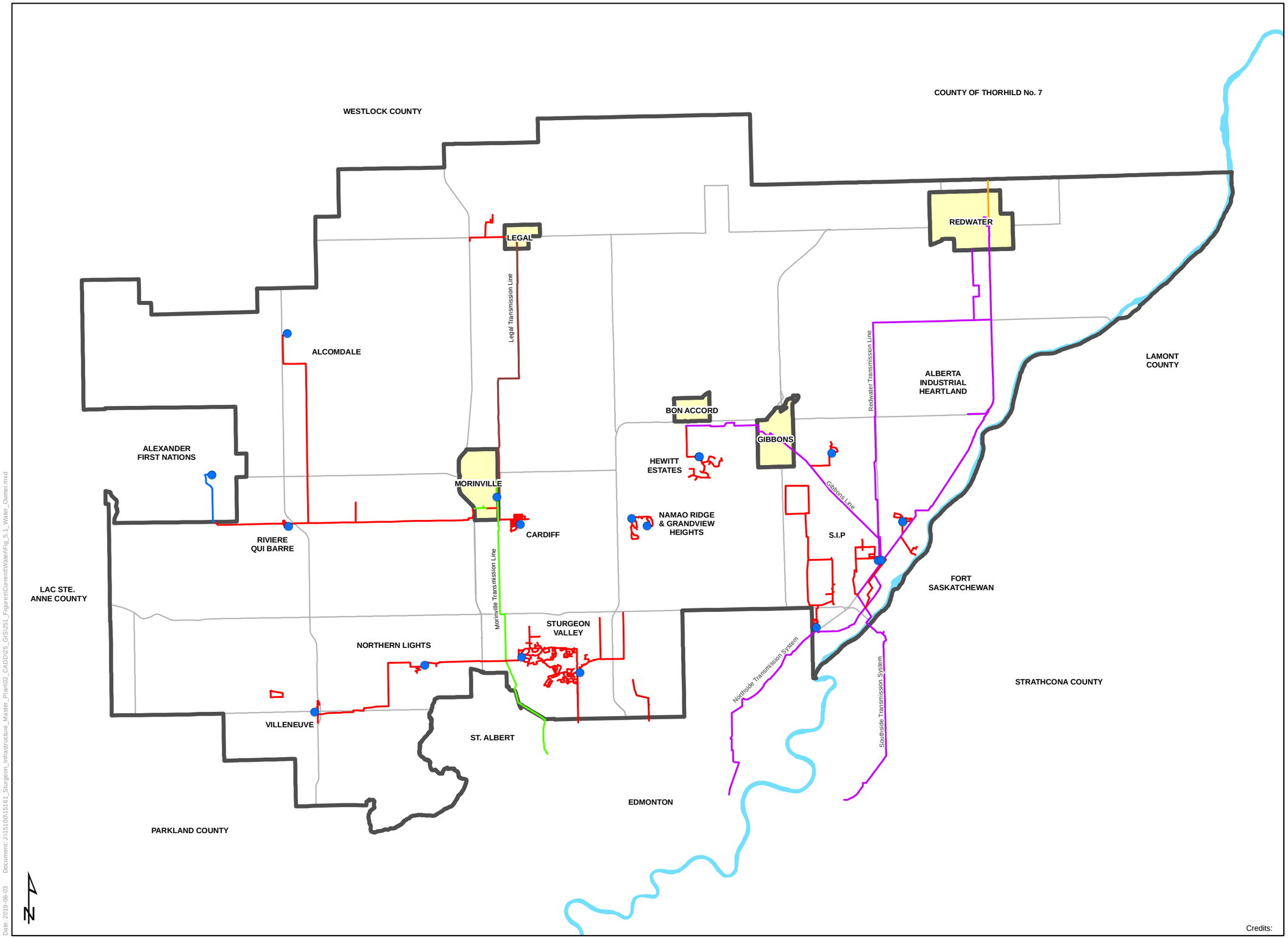
The proposed distribution system for the Hamlet of Villeneuve and the Villeneuve Airport is shown in Figure 5.12. Water mains within the hamlet will extend to the new development areas as development proceeds.

Water is expected to be extended to the Villeneuve Airport in the future based on commercial / industrial growth on the airport lands and the Airport's business case. A detailed analysis would be needed to determine if the Villeneuve supply line can connect directly to the airport reservoir, or if water would need to be re-pumped at the County's Villeneuve Reservoir.

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.1:

EXISTING WATER NETWORK BY OWNER



Water Lines

Owner

- Other/Unknown
- AFN
- CRNWSC
- Legal
- Morinville
- Sturgeon County

- Pumphouses and Reservoirs
- Major Roads
- Neighbouring Municipality
- Sturgeon County
- North Saskatchewan River

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

ISL Engineering and Land Services

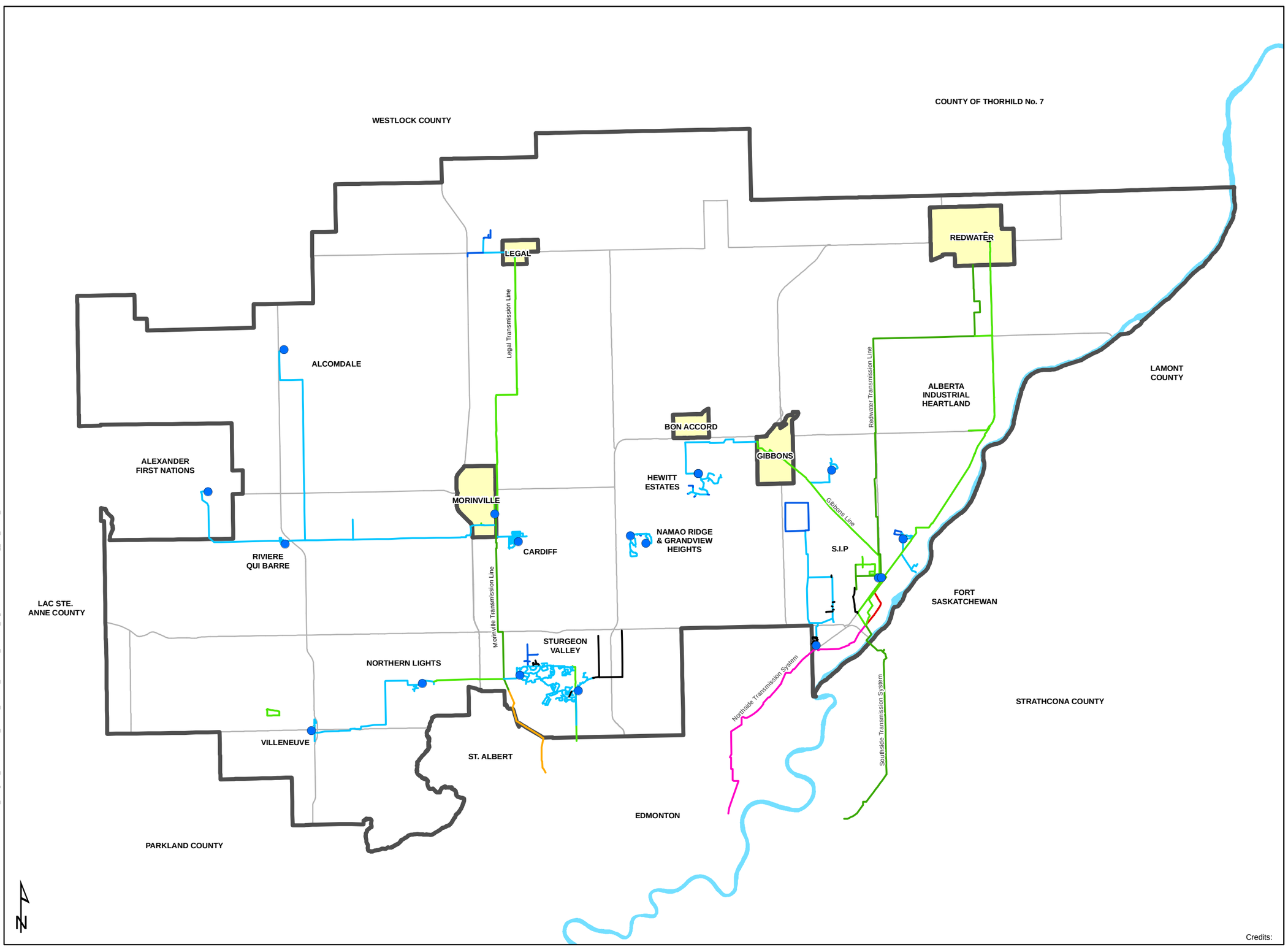
Sturgeon County

Date: 2019-06-03 Document: J:\15100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Water\Fig_5.1_Water_Owner.mxd

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.2:

EXISTING WATER NETWORK BY DIAMETER



Water Lines

DIAMETER

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550 mm
- 750 mm
- 900 mm
- Pumphouses and Reservoirs
- Major Roads
- Municipality Boundaries
- Sturgeon County
- North Saskatchewan River

0 1.5 3 6 9 12 km

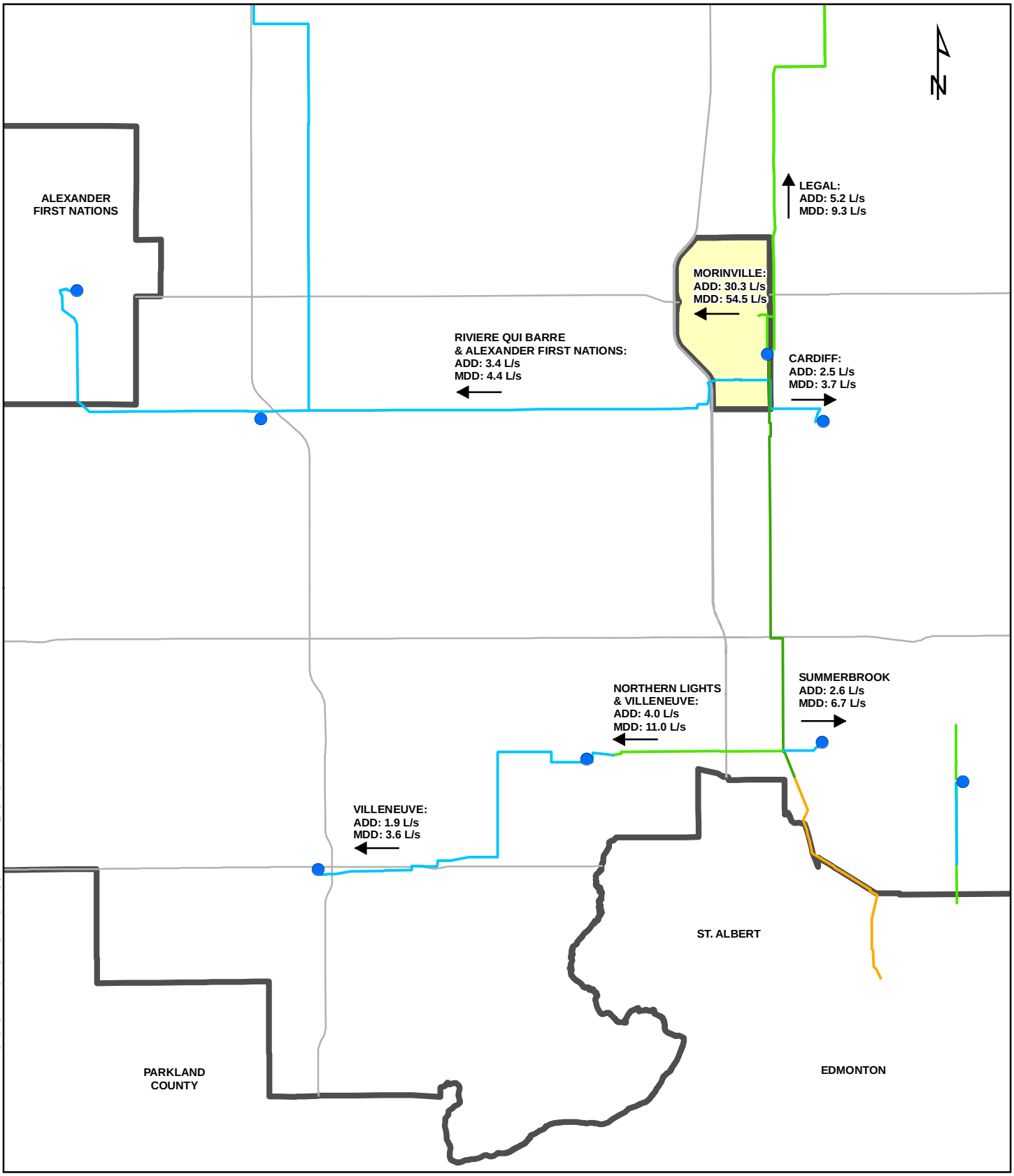
1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

ISL Engineering and Land Services

Sturgeon County

Date: 2019-06-03 Document: J115100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Water\Fig_5.2_Water_Diameter.mxd



ISL Engineering and Land Services

Water Transmission Lines
DIAMETER
- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550 mm
- 750 mm
- 900 mm
- 2017 Average Day Demand & Maximum Day Demand (Res. Fill)

- Pumphouses and Reservoirs
- Major Roads
- Neighbouring Municipality
- Sturgeon County

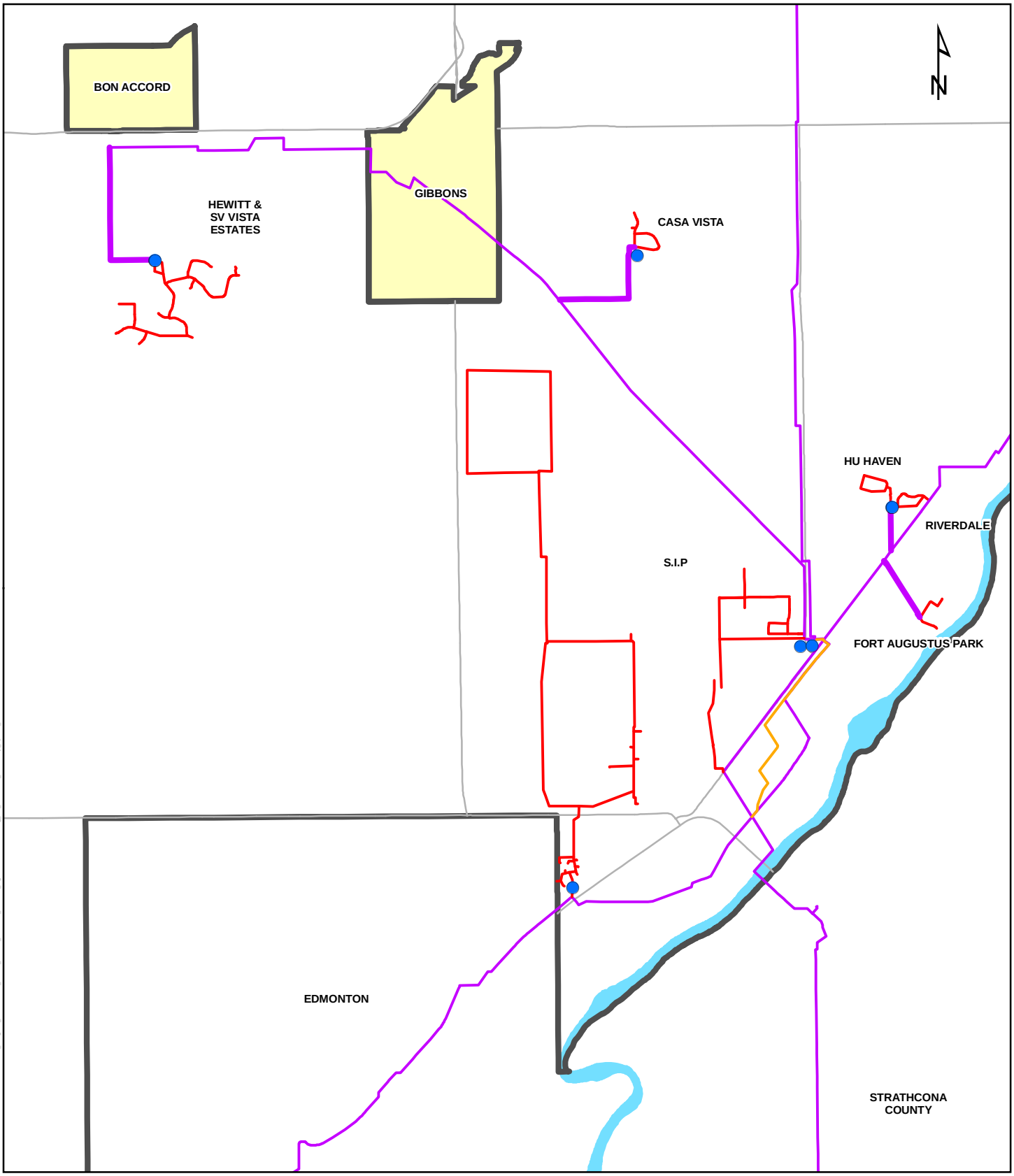
0 750 1,500 3,000 4,500 m

CANA83-3TM114 1:150,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.3:

EXISTING MORINVILLE LINE DEMANDS



ISL Engineering and Land Services

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

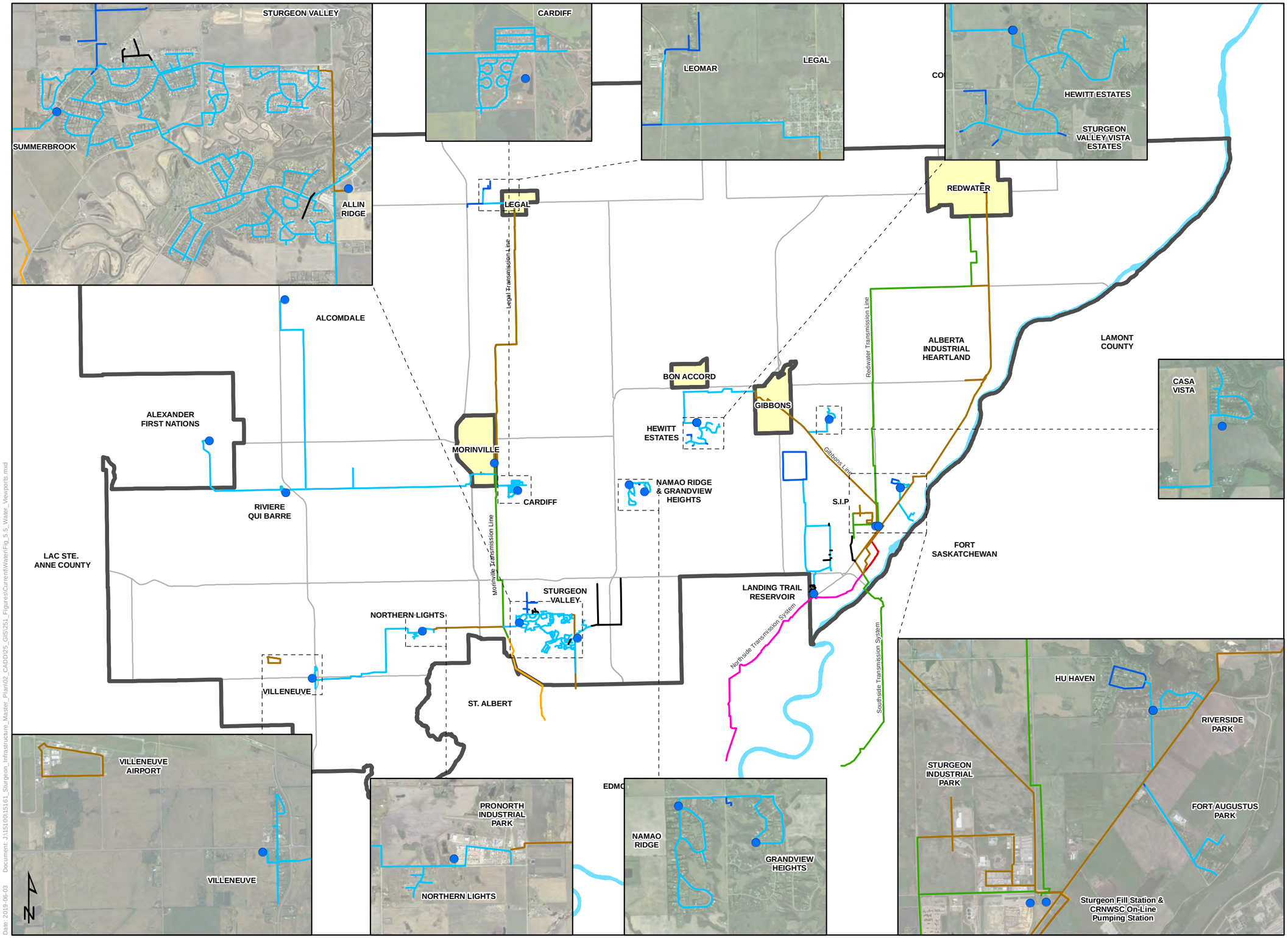
FIGURE 5.4:

FUTURE CRNWSC OWNERSHIP

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.5:

EXISTING WATER NETWORK IN KEY AREAS



Water Lines

DIAMETER

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550 mm
- 750 mm
- 900 mm
- Pumphouses and Reservoirs
- Major Roads
- Neighbouring Municipality
- Sturgeon County
- North Saskatchewan River

0 2 4 8 12 km

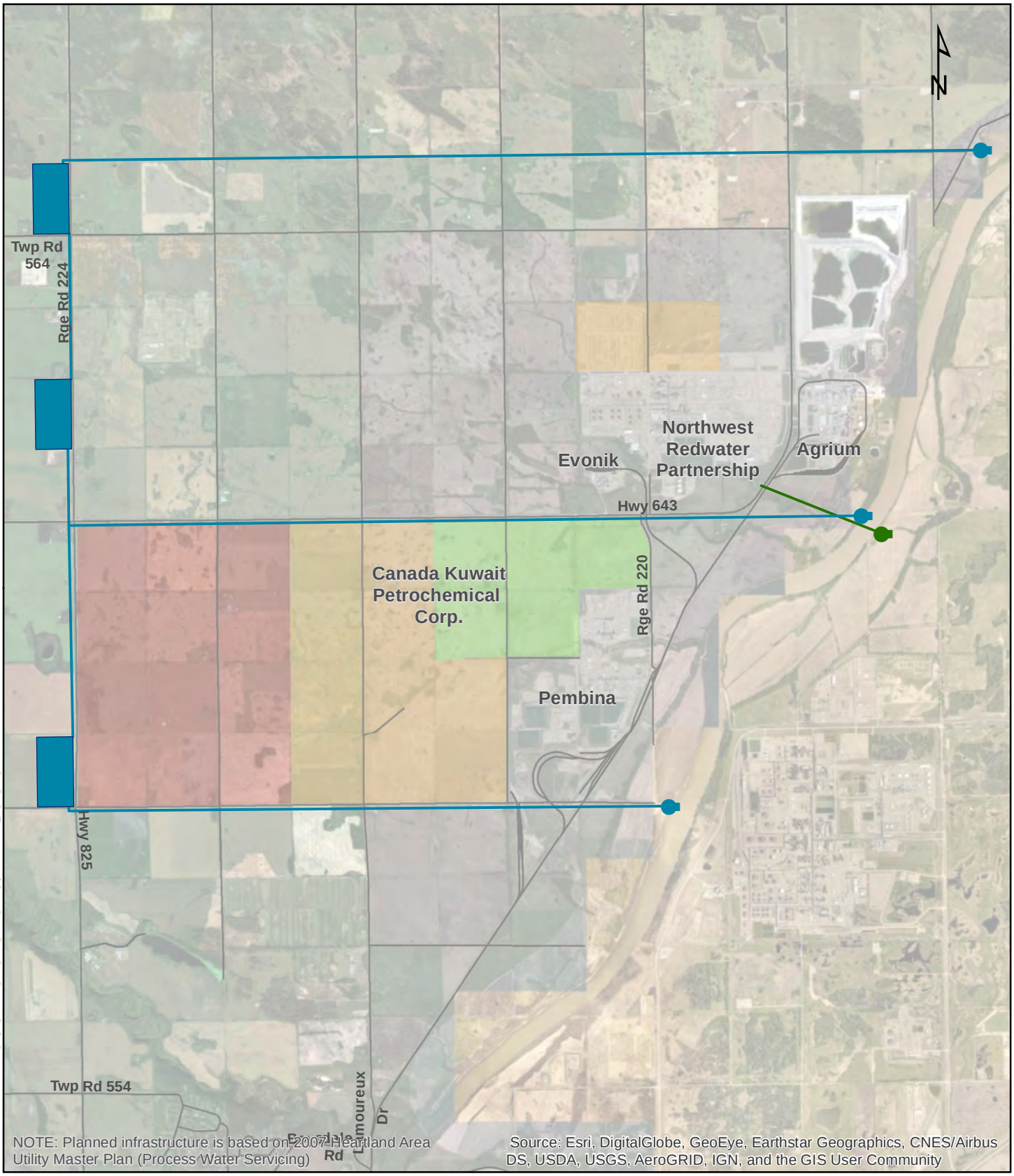
1:250,000 NAD 1983 CSRS 10TM AEP Resource

All viewports scaled at 1:50,000

ISL Engineering and Land Services

Sturgeon County

Date: 2019-06-03 Document: J:\151\00\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\CurrentWater\Fig_5.5_Water_Viewports.mxd



ISL Engineering and Land Services

0 250 500 1,000 1,500 m

CANA83-3TM114 1:60,000

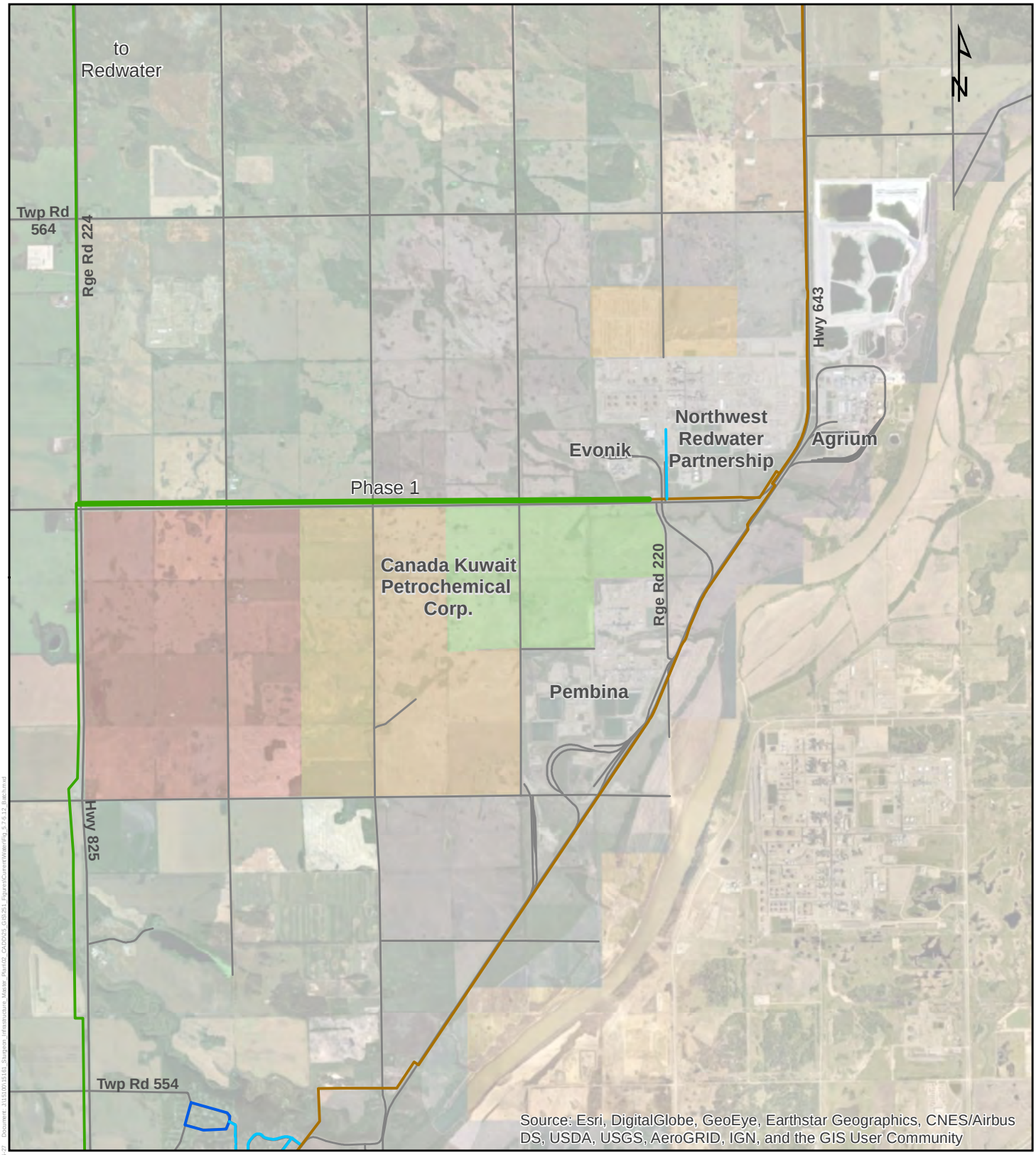
- Planned Raw Water Storage
- Planned Raw Water Pump Station
- Planned Raw Water Transmission Main
- Existing Raw Water Pump Station
- Existing Raw Water Transmision Main

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.6: EXISTING AND PLANNED RAW WATER SUPPLY TO ALBERTA INDUSTRIAL HEARTLAND



Existing Line Diameter
- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

Proposed Line Diameter
- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

- Pumphouse/Reservoir
- Proposed Pumphouse/Reservoir

Growth Phase
- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

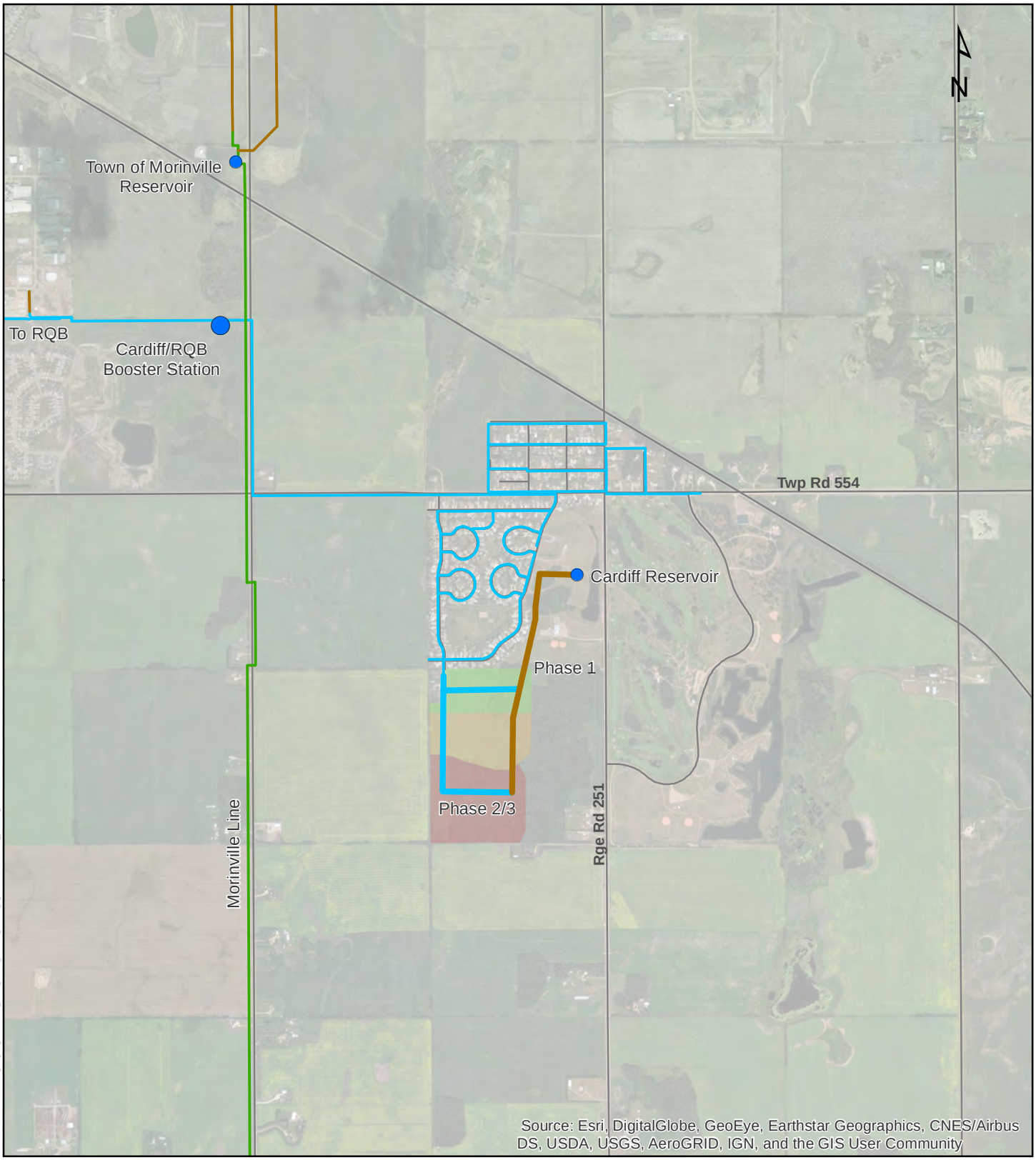
ISL Engineering and Land Services

0 250 500 1,000 1,500 m

CANA83-3TM114 1:60,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.7:
EXISTING AND PROPOSED WATER NETWORK IN ALBERTA'S INDUSTRIAL HEARTLAND



Existing Line Diameter

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

Proposed Line Diameter

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

- Pumphouse/Reservoir
- Proposed Pumphouse/Reservoir

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

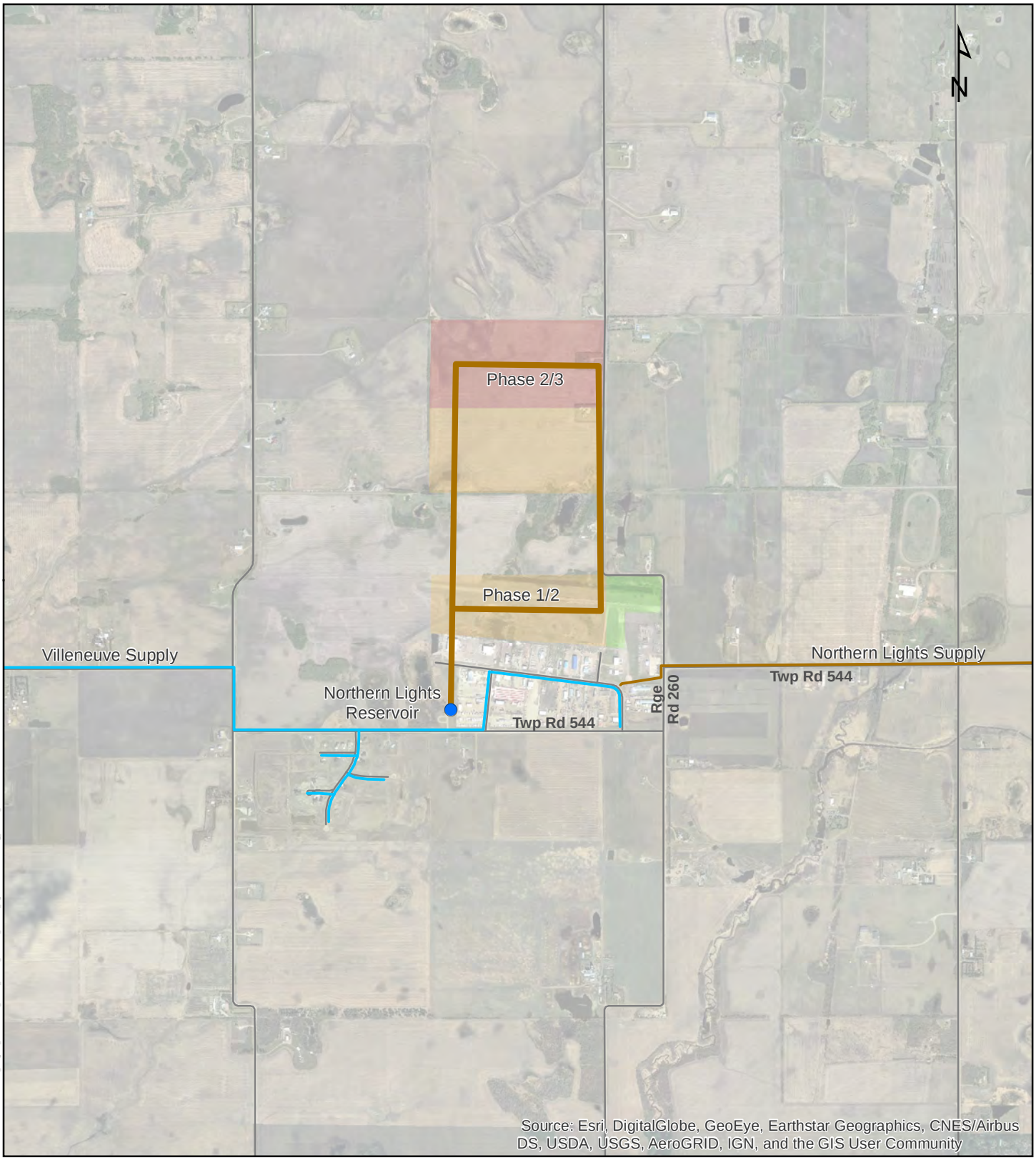
ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.8:
EXISTING AND PROPOSED WATER NETWORK IN CARDIFF



Existing Line Diameter

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

Proposed Line Diameter

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

- Pumphouse/Reservoir
- Proposed Pumphouse/Reservoir

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

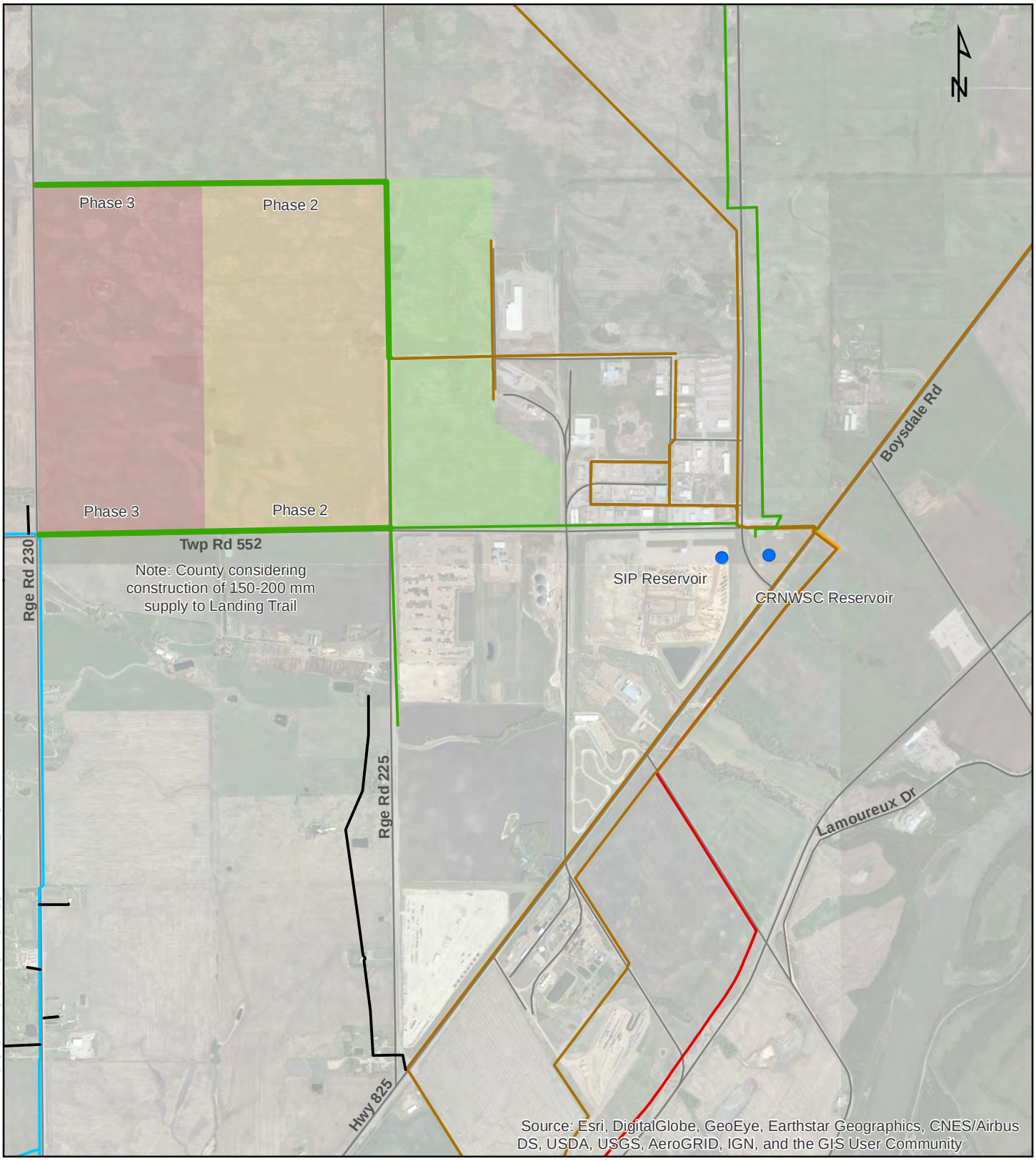
Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.9:
EXISTING AND PROPOSED WATER NETWORK IN PRO NORTH / NORTHERN LIGHTS



Existing Line Diameter
- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

Proposed Line Diameter
- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

- Pumphouse/Reservoir
- Proposed Pumphouse/Reservoir

Growth Phase
- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

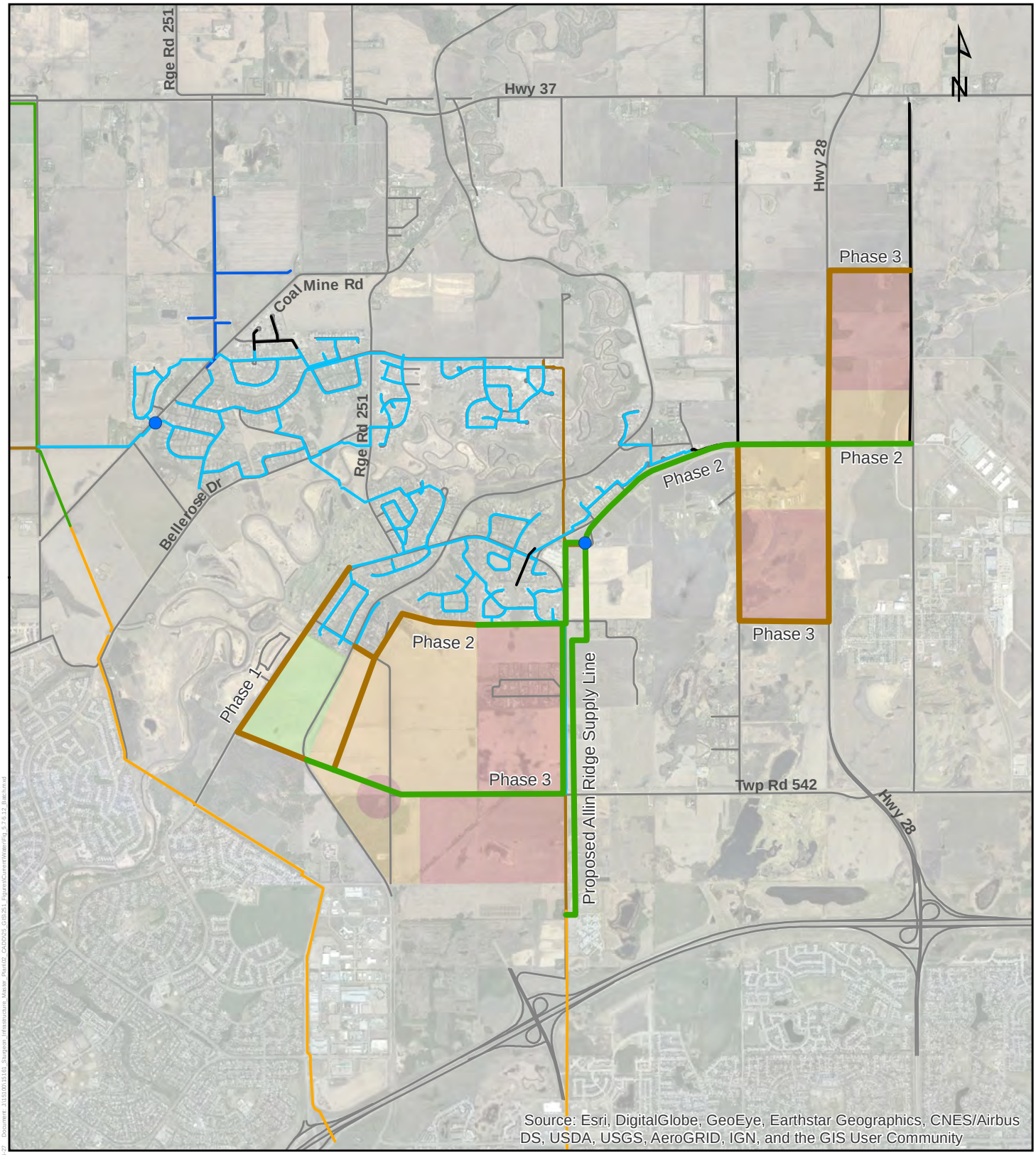
ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.10:
EXISTING AND PROPOSED WATER NETWORK IN STURGEON INDUSTRIAL PARK



Existing Line Diameter
- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

Proposed Line Diameter
- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

- Pumphouse/Reservoir
- Proposed Pumphouse/Reservoir

Growth Phase
- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

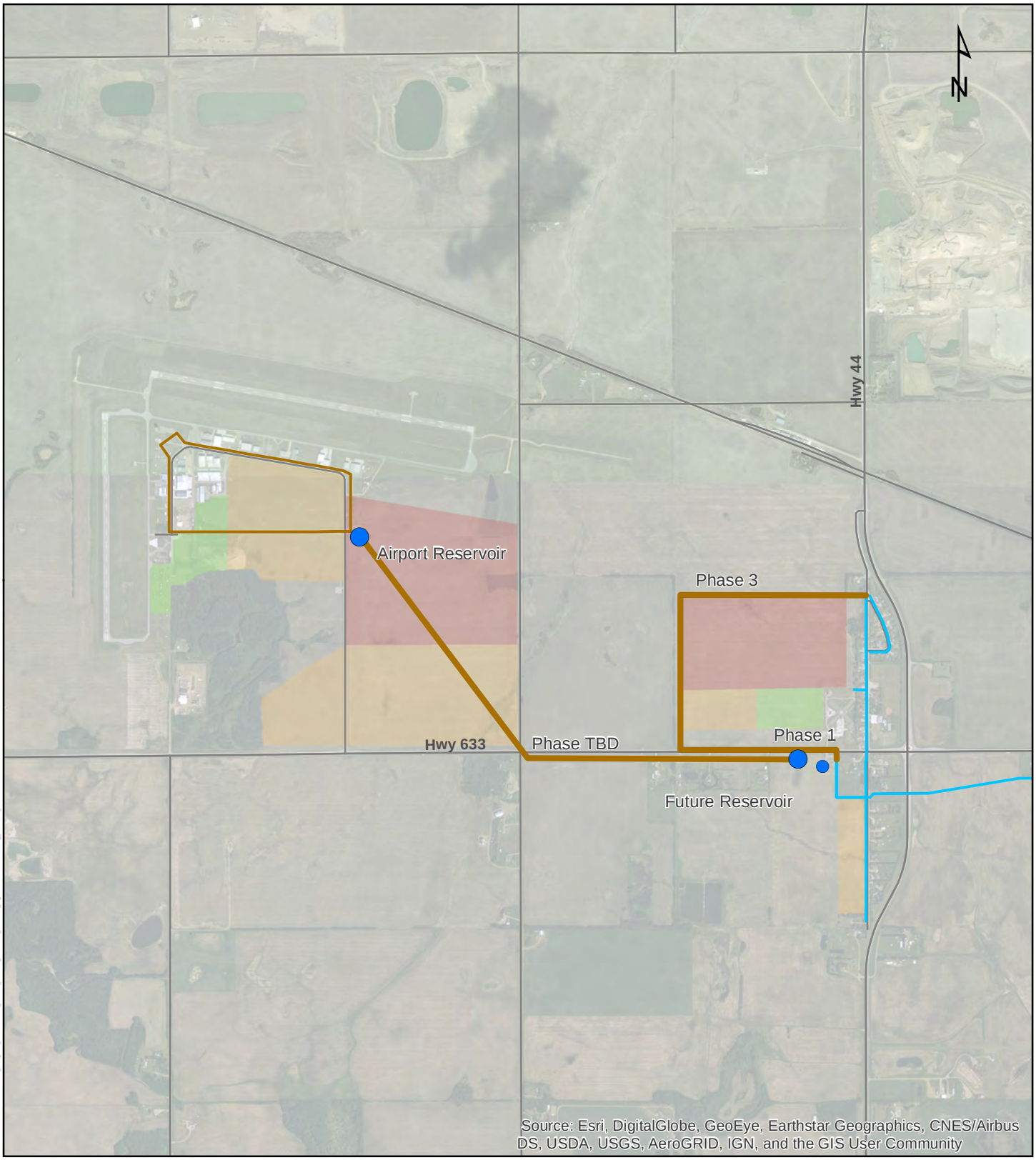
ISL Engineering and Land Services

0 200 400 800 1,200 m

CANA83-3TM114 1:50,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.11:
EXISTING AND PROPOSED WATER NETWORK IN STURGEON VALLEY AND CFB EDMONTON



Existing Line Diameter

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

Proposed Line Diameter

- Unknown
- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 400 - 500 mm
- 550-600 mm
- 750 mm
- 900 mm

- Pumphouse/Reservoir
- Proposed Pumphouse/Reservoir

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 5.12:
EXISTING AND PROPOSED WATER NETWORK IN VILLENEUVE

6.0 Wastewater Infrastructure

6.1 Introduction

Sturgeon County provides wastewater servicing to its residential and non-residential customers in two ways:

- Local collection, conveyance and treatment via wastewater lagoons; and
- Local collection and regional conveyance and treatment through the Alberta Capital Region Wastewater Commission (ACRWC) infrastructure.

The wastewater infrastructure is shown in Figure 6.1, and is color coded based on ownership (County, ACRWC, private). The wastewater infrastructure is also shown in Figure 6.2 color coded by pipe size. The local wastewater collection systems, including the County lift stations, are shown in Figure 6.3.

The communities / locations serviced by the ACRWC include: Cardiff, Sturgeon Valley, Sturgeon Industrial Park and the Alberta's Industrial Heartland.

Most communities have gravity wastewater sewers serviced to a central lift station which then discharges to the lagoon or ACRWC system. A few smaller hamlets and country residential areas are serviced by low pressure wastewater systems. The Sturgeon Industrial Park connects to the ACRWC Northeast Regional Trunk directly by gravity. The AIH industrial customers pump into a County owned AIH forcemain and gravity trunk which discharges into the ACRWC Northeast Regional Trunk.

All gravity wastewater collection systems have an increase in wastewater flows during periods of rainfall due to inflow and infiltration (I/I) into the collection systems. The I/I can result in total wet weather flows of several times the dry weather wastewater flows and can overwhelm the collection and transmission systems. The I/I rates are typically higher in older parts of the wastewater collection system. Assessment of wastewater collection system capacity includes analysis of monitored rainfall and peak wet weather flows to estimate the system capacity during large rainfall events (typically a 1:25 year event).

6.2 Existing Wastewater Generation

6.2.1 Residential Wastewater Generation

Wastewater flow data was obtained from the County's Utilities group, primarily from local wastewater lift station records. Water population / consumption data was used to supplement the existing wastewater records where needed. The annual wastewater pumped at six County lift stations from 2014 to 2017 is shown in Table 6.1.

Table 6.1: Lift Station Annual Flows

Community	Lift Station	Annual Lift station Use (m^3/year)[3]			
		2014	2015	2016	2017
Sturgeon Valley	Bellerose[2]	93,575	104,918	126,605	130,650
	Greystone Manor[2]	10,037	11,263	13,186	14,674
	River's Gate[1,2]	--	--	--	195,150
	Tuscany Hills	8,043	10,384	11,754	13,844
Cardiff	Cardiff	--	--	72,941	80,916
Villeneuve	Hamlet of Villeneuve	26,410	27,255	26,152	34,404

Notes:

1. River's Gate Lift Station was commissioned in 2017 and the table includes total flows from October 2017 to September 2018.
2. Greystone Manor, Bellerose and River's Gate Lift Stations also convey flows from ProNorth Industrial Park and Northern Lights.
3. Data is available from wastewater annual reports.

To analyze the lift station flows in Sturgeon Valley, it is necessary to estimate the population contributing to each lift station. The current (2017) estimate of the number of occupied lots connected to each lift station was provided by Sturgeon County. As the Sturgeon Valley wastewater system includes several lift stations operating in series (Northern Lights to Greystone to Bellerose to Rivers Gate), the cumulative number of lots / population needs to be determined. The cumulative number of lots and the associated population is shown in Table 6.2. Based on the number of occupied lots and the estimated 2017 population in Sturgeon Valley, it was determined that the average population density was 3.13 persons per lot. This density was applied to each lift station in Sturgeon Valley for this study.

Table 6.2: Lift Station Service Population Estimates - Sturgeon Valley

Lift Station	Number of Lots[1] [3]			Total Population[2]
	Direct	Upstream	Cumulative	
Northern Lights	17	0	17	51
Greystone	75	17	92	288
Bellerose	723	92	815	2,547
Sturgeon Valley	426	0	426	1,331
River's Gate	45	1241	1,286	4,019
Tuscany Hills	90	0	90	281
Total Sturgeon Valley (including Northern Lights)	-	-	-	**4,300**
Total Sturgeon Valley (excluding Northern Lights)	-	-	-	**4,249**

Notes:

1. Number of developed lots provided by Sturgeon County.
2. Assume 3.13 people per lot to match Sturgeon Valley population of 4,249.
3. Number of serviced lots are based on 2017 level of growth.

The 2017 data was analyzed and the average and peak wastewater generation rates in Litres per capita per day (L/c/d) is shown in Table 6.3. The per capita wastewater generation rates in Sturgeon Valley are relatively low compared to typical values of about 200 L/c/d, and the average per capita water demands of 215 L/c/d. The wastewater flows can be expected to be lower than the water demands on an annual basis due to the amount of exterior water use in Sturgeon Valley. It is recommended that more conservative wastewater generation rates be used when projecting flows from future development.

Table 6.3: Per Capita Wastewater Generation

Community	Community	Population	2017 Annual Use (m^3/year)[1]	Average Per Capita Use (L/c/d)	Peak Day Use (m^3/day)	Peak Per Capita Use (L/c/d)
Sturgeon Valley	Bellerose	2,547	130,650	141	666	261
	Greystone Manor	288	14,674	140	119	414
	River's Gate	4,019	195,150	133	1,057	263
	Tuscany Hills	281	13,844	135	96	341
	Total Sturgeon Valley	4,249	203,037	131	n/a	n/a
Cardiff	Cardiff	1,254	80,916	177	512	408
Villeneuve	Villeneuve	257	34,404	367	217	844

Notes:

1. Average annual wastewater generation is based on 2017 data except River's Gate, which is based on 2017-18 data.

The Cardiff wastewater generation rate of 177 L/c/d is slightly higher than the estimated water demands of 147 L/c/d. This may be due to inaccuracies in water / wastewater measurements or it may reflect inflow and infiltration contributing to the wastewater flows.

The Villeneuve per capita water demands, and wastewater generation rates are similar and much higher that other areas.

6.2.1 Industrial Wastewater Generation

The only industrial wastewater flow generation information was from ACRWC where they use an average annual flow of 26 L/s for the AIH trunk (forcemain) in the hydraulic model. There is no direct measurement of wastewater flows of non-residential areas in Sturgeon County. The 26 L/s value was compared to the historic potable water demands in the AIH at 650,000 m^3 in 2017, or approximately 20 L/s. It is not known how the ACRWC selected this value of 26 L/s, and it may include a factor of safety.

In the absence of direct measurement of wastewater flows, it is recommended that potable water data be used to estimate wastewater generation. The estimated wastewater generation figures for the AHI, SIP and ProNorth Industrial are shown in Table 6.4.

Table 6.4: Estimated Historical Industrial Wastewater Generation

Community / Reservoir	Annual Wastewater Use (m^3/year) Estimated				
	2014	2015	2016	2017	Average
Sturgeon Industrial Park[1]	80,308	95,645	281,769	174,359	158,020
Alberta's Industrial Heartland[1]	515,000	515,000	610,000	650,000	572,500
ProNorth Industrial Park (estimated)[2]	23,309	13,390	-223	302	9,195

Note:

1. Data from monthly bill records and annual water reports (supplied by Sturgeon County Utility Services).
2. Calculated as ProNorth = Northern Lights Reservoir - Villeneuve Reservoir - Northern Lights Residential. This assumes 51 people living in Northern Lights at 320 L/c/d.

The ProNorth water use / wastewater generation was estimated by subtracting the Villeneuve Reservoir demands and estimated Northern Lights demands (17 lots at 3 people per lot) from the Northern Lights Reservoir demands. The results shown in Table 6.4 are highly variable and are not considered to be a reliable estimate of the recent ProNorth water demands / wastewater generation.

The estimated wastewater generate rates per hectare for the AIH and SIP are shown in Table 6.5. These generation rates are typical for industrial areas, however it is noted that they are much lower than the 6170 L/ha/d specified in the County's GMSS.

Table 6.5: Estimated Industrial Wastewater Generation per Hectare.

Industrial Area	Developed Industrial Area (ha)[1]	2017 Annual Use (m^3/year)	2017 Annual Use (L/ha/d)	2017 Peak Day Use (m^3/day)[2]	2017 Peak Day Use (L/ha/d)
Sturgeon Industrial Park	235	174,359	2,033	1,233	5,247
Alberta's Industrial Heartland	988	650,000	1,802	3,562	3,605

Note:

1. AIH / ProNorth Area taken from Google Earth as an estimate.
2. Peak day use estimated from CRNWSC Master Plan (2016).

6.3 Analysis of Existing Wastewater System & Existing Demands

6.3.1 ACRWC Transmission and Treatment

Overview

Sturgeon County connects to the ACRWC's Northwest and Northeast Transmission systems. The ACRWC Northwest Transmission System is made up of the following:

- Parkland Sanitary Transmission System (PSTS);
- Morinville Pump Station and Forcemain;
- St. Albert Pump Station;
- St. Albert Regional Trunk (START).

Sturgeon County currently connects to all of these facilities except the Parkland system. Please note that the ACRWC uses the term pump station which the County uses the term lift station; these terms are synonymous.

The ACRWC Northeast Transmission System (NERTS) is made up of the following:

- Bon Accord pressure sewer from Bon Accord to Gibbons;
- ACRWC Gibbons Pump Station and forcemain;
- NERTS gravity trunk;
- ACRWC Fort Saskatchewan Pump Station and Forcemain;
- "Edmonton" Gravity Trunk to ACRWC WWTP

Sturgeon County is currently only connected to the NERTS gravity trunk but utilizes the downstream Fort Saskatchewan Pump Station and Forcemain and Edmonton Gravity Trunk.

Morinville Pump Station and Forcemain

The ACRWC Morinville Pump Station services the Town of Morinville plus the Hamlet of Cardiff. It pumps wastewater through a 450mm forcemain to the START line southeast of St. Albert. It has a capacity of 237 L/s and currently pumps an average annual flow of 40 L/s. It experiences high wet weather flows due to inflow and infiltration into the upstream collection systems (Morinville and Cardiff). The estimated peak wet weather during the ACRWC's design 1:25 year event is in excess of its pumping capacity.

To address the high wet weather inflows, the ACRWC and Town of Morinville recently commissioned a wet weather flow diversion and storage system utilizing the former Morinville wastewater lagoon. This system pumps wet weather flows to the wastewater storage facility and shuts off flows from the ACRWC Morinville Pump Station to START. This system was designed with surplus capacity to accommodate future growth in Morinville and Cardiff.

St. Albert Pump Station

The ACRWC commissioned the new St. Albert Pump Station in 2013. The station services all of the City of St. Albert and most of the Sturgeon Valley area of Sturgeon County. It discharges to the ACRWC St. Albert Regional Trunk Sewer (START) via two 600mm forcemains and one 900mm forcemain. It has an interim capacity of 1200 L/s and ultimate capacity of 2400 L/s. The estimated existing 1:25 year peak wet weather flow is 1119 L/s, which is approaching the interim capacity of 1200 L/s. The ACRWC is planning on installing an additional duty pump to increase the capacity to 1800 L/s in the near future after the START line is upgraded. A 4th duty pump will be added in the future based on flows to the station.

St. Albert Regional Trunk (START)

The START line accepts flows from Parkland, St. Albert and Morinville Pump Stations. It is comprised of two trunks, original St. Albert Outfall constructed in the 1970's and the ACRWC St. Albert Trunk constructed in the 1980's. The original trunk is severely deteriorated and the overall trunk capacity is lower than the current 1:25 year wet weather flows. The ACRWC is replacing the original St. Albert Outfall to address these issues. This upgrading is being conducted in stages, with the highest priority sections already completed.

ARWC Northeast Regional Transmission System (NERTS)

The ACRWC recently completed an assessment of the overall NERTS system. The gravity trunk servicing the Sturgeon industrial Park and the Alberta's Industrial Heartland has surplus available capacity during the simulated 1:25 year wet weather event. The existing trunk is generally flowing at less than 50% full during the peak wet weather flows and thus has capacity for significant growth in Sturgeon County, Gibbons and Bon Accord.

The ACRWC recently twinned the Fort Saskatchewan Forcemain to increase reliability and overall capacity of the downstream section of NERTS. The pump station has a capacity of 800 L/s compared to a current 1:25 year peak wet weather flow of 710 L/s. The downstream trunk has a capacity of 900 L/s, which is above the peak pumping rate of 800 L/s.

Alberta Capital Region Wastewater Treatment Plant

The Alberta Capital Region Wastewater Treatment Plant currently services the ACRWC northwest and northeast transmission systems, plus Strathcona County and the Clareview and Pilot Sound areas of northeast Edmonton. It has a treatment capacity of 105 Megalitres per day (MLD) and an annual average flow of 78 MLD. The ACRWC has plans to upgrade the plant as needed to accommodate future growth in the region.

The plant does experience excessive flows during large wet weather events and is working with its member municipalities to reduce the wet weather inflow and infiltration at its source. The ACRWC is also managing the peak flows in the transmission system by storing peak wet weather flows at Morinville (completed) and in Spruce Grove (planned).

Sturgeon County should reduce its wet weather flows to the ACRWC to address the existing wet weather flow issues within the system.

6.3.2 Local Collection System

The wastewater collection system for Sturgeon County hamlets and country residential area are summarized in Table 6.6. Pipe sizes for both the collection and transmission system are shown in Figure 6.2. The local wastewater collection systems, including the County lift stations, are shown in Figure 6.3. The wastewater collection systems for the larger communities is described below.

ISL has not investigated the flows and capacities of individual collection system pipes within the hamlets and country residential areas. Based on discussions with County staff, there are no known issues with the local collection system piping.

Table 6.6: Wastewater Collection Systems

Community / Location	Wastewater Collection System	Lift Stations / Lagoons
Alcomdale	Alcomdale system feeds into Alcomdale lagoon. No tie-in to other systems. System was constructed by the residents in the 1980's with several issues. Some connections cross private property (even through basements) and some services drain directly into the ground.	Discharge control structure is in poor control. Additionally, water levels rise rapidly after draining suggesting an infiltration issue.
Calahoo	50 - 100 mm low-pressure system which collects wastewater and sends it to the lagoon to the east side of Calahoo.	Lagoon is located to the east of Calahoo.
Cardiff	75 - 250 mm low-pressure system within Cardiff feeds into a 250 mm line which enters ACRWC transmission main via a lift station.	Cardiff Lift Station pumps to Town of Morinville connecting to ACRWC Morinville Pump Station.
Casa Vista	Individual residences are equipped with holding tanks, septic tanks and/or tile fields.	None.
Namao	A 3" sewage forcemain services the west side of Namao (west side school and community hall) and feeds the Namao lagoon to the northeast. The highschool is serviced by a 30'x10'x8.5' septic tank which feeds north into the lagoon as well.	The Lagoon is located north of the highschool.
Northern Lights	Consists of a low-pressure sewer system that discharges to an 8 km long, 150 mm forcemain (HDPE) that feeds into the Greystone Lift Station in Sturgeon Valley.	None at Northern Lights; however, this system is sent to the Greystone Lift Station.
ProNorth Industrial Park	Septic tanks with fields/mounds or by contracting hauled wastewater services. There are plans to upgrade the level of service currently provided to the area.	None.
Rivière Qui Barre	Serviced by ~50 - 100 mm low pressure system which feeds the existing lagoon to the northeast of the hamlet.	Riviere Qui Barre is serviced by a ~100 mm (4") PVC pipe which leads into the RQB lagoon. The HWL is set to 2255.30 m with a floor elevation of 2247.30 m.
Sturgeon Industrial Park (W4)	The 250 - 750 mm S.I.P sanitary system ties into the ACRWC Northeast Regional Trunk Sewer (NERTS) near the intersection of Sturgeon Way and Highway 825.	Connects to ACRWC Fort Saskatchewan Pump Station; capacity was recently increased with the twinning of downstream forcemain.
Sturgeon Valley – Bellerose	50 - 350 mm system in Sturgeon Valley including the Summerbrook Estates, Upper Manor Estates, The Banks of Sturgeon, Upper Manor Pointe, Pinnacle Ridge, and Rivrestone Pointe neighborhoods.	In addition to the neighborhoods listed, the Bellerose lift station services the Greystone Manor lift station upstream.
Sturgeon Valley – Greystone Manor	200 - 250 mm system services Greystone Manor neighborhood in northwest Sturgeon Valley. Northern Lights Estates delivers wastewater via an 8 km, 150 mm forcemain to the Greystone Lift Station.	Lift station is located just across Coal Mine Road from the entrance to Greystone Manor. This lift station feeds eventually into the Bellerose lift station to the south east.

Community / Location	Wastewater Collection System	Lift Stations / Lagoons
Sturgeon Valley – River's Gate	This area is currently developing on the north side of Sturgeon Road. It is fed by the Bellerose lift station and most of the south side of Sturgeon Valley via low pressure sewers connecting to the 450mm sewer on Sturgeon Road.	The River's Gate lift station is proposed to the south side of Sturgeon Road and on the south end of the River's Gate neighborhood.
Sturgeon Valley – Tuscany Hills	The sanitary system in the Tuscany Hills region collects wastewater and directs it eastwards to the Tuscany Hills Lift Station.	The Tuscany Hills lift station is located within the Tuscany Hills neighborhood on the south side of Range Road 250. Forcemain connects to ACRWC START.
Villeneuve	The Villeneuve system has two primary components including the Hamlet of Villeneuve, and the airport to the northwest. The airport features two 200 mm gravity sewer pipes leading to the Villeneuve airport lift station. This lift station pumps wastewater through a 100 mm PVC forcemain to the Villeneuve lagoon to the south of Hwy 633. The hamlet of Villeneuve features a 50 - 200 mm collection system that drains to the Villeneuve lift station. From this lift station, there is a 100 mm forcemain that meets up with the airport forcemain, and turns south into a 150 mm pipe towards the lagoon.	Two lift stations and a lagoon exist. The lagoon berms are in poor condition and existing breaches have been noted. The airport contributes 5.7 cubic meters per day. It is estimated that the Villeneuve lagoon is approaching capacity with room for up to 264 persons.

Notes:

1. The Data was collected from the following sources:
   - Alcomdale: Sturgeon County Alcomdale Infrastructure Transfer Study, 2017 (Associated Engineering)
   - Calahoo: GIS Data
   - Cardiff: GIS Data
   - Casa Vista: Sturgeon Utility Assessment, DCL Siemens (2009)
   - Namao: Namao Lagoon As-Built, Podmore Engineering Ltd, (1981)
   - Northern Lights: Sturgeon County Industrial Development Servicing Standards - ProNorth Industrial Area, SamEng, (2014)
   - ProNorth: Sturgeon County Industrial Development Servicing Standards - ProNorth Industrial Area , 2014 (SamEng Inc)
   - Rivière Qui Barre: Riviere Qui Barre Low Pressure Sewerage System As-Built, Podmore Engineering Ltd, (1979) and Riviere Qui Barre - Low Pressure Upgrades, MPE Engineering, (2015)
   - S.I.P: Sturgeon Utility Assessment, DCL Siemens (2009)
   - Bellerose: River's Gate Lift Station Land Use & Design Criteria Impact, Associated Engineering (2015)
   - Greystone Manor: Sturgeon County Industrial Development Servicing Standards - ProNorth Industrial Area, SamEng Inc, (2014) Greystone Manor Lift Station As-Built, Scarab Technologies Inc, (2006) & River's Gate Lift Station Land Use & Design Criteria Impact, Associated Engineering (2015)
   - River's Gate: River's Gate Lift Station Land Use & Design Criteria Impact, Associated Engineering (2015)
   - Tuscany Hills: GIS Data & River's Gate Lift Station Land Use & Design Criteria Tech Memo, AE (Dec. 2015)
   - Villeneuve: Villeneuve Wastewater Pumping Station, DCL Siemens Engineering Ltd, (2010), Villeneuve Lagoon Site Visit & Photos, Associated Engineering, (2015), & Willow Tree Project and Villeneuve Wastewater Lagoon, SamEng Inc, (2010)

Sturgeon Valley

The Sturgeon Valley wastewater collection system is shown in Figure 6.4.

Most of the development area north of the Sturgeon River are serviced by the Bellerose Lift Station. It is located on Bellerose Drive and west of Starkey Road. Until recently it pumps wastewater to the ACRWC St. Albert Pump Station through a 5.4 km long, 250mm forcemain. In late 2017 the County diverted this forcemain into the new River's Gate Lift Station.
The Greystone Lift Station services the Greystone areas in the northwest corner of Sturgeon Valley. It also receives flows from the low pressure system in Northern Lights via an 8 km forcemain.

The Tuscany Hills development at the south end of Sturgeon Valley is serviced to the Tuscany Hills Lift Station. It pumps wastewater to START via a 1.8 km, 150 mm forcemain.

The remainder of the south side of Sturgeon Valley was serviced through low pressure sewers to the Sturgeon Valley Lift Station until 2017. These flows were diverted to the new Rivers Gate Lift Station in 2017. The Sturgeon Valley Lift Station was to be abandoned and replaced by a gravity sewer, however due to hydrogen sulphide (H_2S) and resulting odour concerns, the County has decided to continue to operate the Sturgeon Valley Lift Station, pumping wastewater to the Rivers Gate Lift Station.

The Rivers Gate Lift Station was commissioned in 2017 and has been fully operational since October 2017. It pumps almost all the wastewater from Sturgeon Valley (except Tuscany Hills) to the ACRWC St. Albert Pump Station through the existing 200mm and 250mm forcemains (refer to Figure 6.4). Design reports suggest that this lift station will ultimately be used to service new development lands north and west of the existing Sturgeon Valley developments via an inverted syphon under the Sturgeon River.

Sturgeon Industrial Park

The Sturgeon Industrial Park is located along the gravity section of the ACRWC NERTS line which conveys flows from Bon Accord and Gibbons as well as the AIH. As the ACRWC NERTS trunk is relatively deep and with significant surplus capacity, servicing of the Sturgeon Industrial Park is relatively straight forward. The industrial park currently connects to the ACRWC trunk at several locations, and servicing studies have proposed additional connections to the trunk.

Alberta's Industrial Heartland

The AIH does not have a local wastewater collection system. Rather, individual industries pump their wastewater into the County owned 300 mm / 500 mm forcemain that connects to the ACRWC NERTS. This system was constructed by Agrium for their fertilizer operations, and was oversized to accommodate future connections through a cost sharing arrangements with Sturgeon County.

The Northwest Redwater (NWR) was recently connected to the upstream end of the 500 mm forcemain with a 3km long 300mm forcemain.

6.3.3 Lift Stations

Sturgeon County's lift stations are listed in Table 6.7, including their annual flow, average daily flow, peak daily flow and their current pumping capacities. Peak wet weather flow data for lift stations was not available. The capacity of the Sturgeon Valley Lift Station was not assessed as it is only being used for H_2S treatment, and can be bypassed to the 450mm gravity trunk if its capacity is exceeded.

Table 6.7: Existing Lift Station Flows and Pumping Capacities

Community	Lift Station	Pumping Capacity (L/s)[1]	Total 2017 Annual Flow (m^3)	Average Daily Flow (L/s)	Peak Daily Flow Dry Weather (L/s)[2]	Peak Wet Weather Flow (L/s)
Sturgeon Valley	Bellerose	28.0	130,650	4.1	7.7	n/a
	Greystone Manor	76.5	14,674	0.5	1.4	
	River's Gate	90.0	195,150	6.2	12.2	
	Tuscany Hills	37.2	13,844	0.4	1.1	
Cardiff	Cardiff	35.0	80,916	2.6	5.9	
Villeneuve	Villeneuve	8.2	34,404	1.1	2.5	

Notes:

1. Pumping Capacity Sources:
   - Bellerose: Capacity for the Bellerose Lift Station is based on 2009 upgrading drawing and therefore would not reflect any available increase in lift station capacity with the reduced forcemain length by connecting to the 450mm trunk.
   - Greystone Manor: Greystone Manor Pump Station Data from FLYGT Performance Curve (Product NP3153.181), provided by Sturgeon County Utility Services.
   - River's Gate: River's Gate Lift Station - Land Use & Design Criteria Impact (Draft), 2015.
   - Tuscany Hills: Tuscany Hills Pump Station Data from FLYGT Performance Curve (Product CP3127.181), provided by Sturgeon County Utility Services.
   - Cardiff:
   - Villeneuve: The Hamlet of Villeneuve Sanitary & Water Servicing Report (2015) indicates that the capacity of the Villeneuve Lift Station is only 5.5 L/s based on 2014 field testing conducted by Sturgeon County.
2. Peak daily flows based on available monitored data which is collected approximately 10 times per month. There was no information available on the peak wet weather flows at the lift stations.

Table 6.7 suggests that the existing lift stations have adequate capacity for pumping the peak dry weather flows to the downstream ACRWC system or lagoon.

The Bellerose Lift Station was reported to be operating at near its capacity (presumably during wet weather flow) prior to the re-direction of the forcemain to the 450 mm trunk upstream of Rivers Gate Lift Station.

The Villeneuve Lift Station is understood to be operating at close to its design capacity based on previous reports.

These lift stations do not monitor inflows to their wet wells or the instantaneous pump start / stop times to allow wet weather flows to be estimated. As several of these lift stations have capacities exceeding 10 times the average dry weather flows, they are expected to have sufficient capacity for conveying peak wet weather flows. The exception to this would be Bellerose and Villeneuve based on anecdotal reports.

6.3.4 Sturgeon County Wastewater Transmission

AIH Forcemain / Trunk

The only major County owned transmission facility is the AIH forcemain and trunk servicing individual industrial customers. Each industrial customer must pump their wastewater into the shared 300 mm / 500 mm forcemain that connects to the 900mm ACRWC NERTS gravity trunk. The capacity of the shared 300mm forcemain is approximately 6 MLD (69 L/s) and increases to about 18 MLD (208 L/s) when the forcemain increases to 500mm. The industrial users currently pump at a much lower rate. Based on potable water consumption data, the average annual pumping rate is 20 L/s.

Local Transmission Systems

There are two local transmission systems connecting to the ACRWC system, the Cardiff and Rivers Gate Lift Stations and forcemains.

The Cardiff Lift Station discharges into a 150 mm / 250 mm forcemain which connects to the Town of Morinville forcemain, which discharges to the ACRWC Morinville Pump Station. The Cardiff forcemain is 1.5 km of 150mm PVC pipe connecting to 1.6 km of 250mm PE pipe. It then joins the Morinville Business Industrial Park Lift Station forcemain, with 2.4 km of 250 mm PVC extending to the ACRWC station. The Cardiff Lift Station was recently upgraded and currently has a capacity of 35 L/s.

The Northern Lights low pressure system discharges through a 150 mm forcemain extends about 8 km east to the Greystone Lift Station in Sturgeon Valley.

As noted, there is a new 450 mm trunk along Sturgeon Road that accepts flows from most of Sturgeon Valley (when the Bellerose forcemain is diverted) and discharges it to the new Rivers Edge Lift Station. Flows are then pumped to the ACRWC St. Albert Pump Station. The Rivers Gate Lift Station has an interim capacity of 90 L/s based on the Rivers Gate Lift Station Technical Memorandum (Associated Engineering, December 2015) which was issued just prior to the lift station construction drawings (June 2016).

6.3.5 Wastewater Lagoons

The existing Sturgeon County lagoons are listed in Table 6.8 with their annual treatment capacity. Flow monitoring data is not available to compare the annual usage to their current capacities.

Table 6.8: Existing Lagoon Capacities

Approval #[1]	Lagoon	Capacity (m^3)	Discharge Frequency
333-01-00	Alcomdale[2]	--	1 / year
473-01-00	Calahoo	124,100	1 / year
1106-02-00	Riviere Qui Barre	63,503	--
1264-02-00	Namao	32,549	--
1264-02-00	Villeneuve	33,187	--

Notes:

1. Approvals sourced from: https://avw.alberta.ca/ApprovalViewer.aspx
2. Capacity for the Alcomdale lagoon was not available.

Based on previous reports and discussions with County staff, the Villeneuve Lagoon is in poor condition and that it has reached its treatment capacity. Concurrent to this Infrastructure Master Plan, the County undertook a study entitled Villeneuve Lagoon Repair – Phase 1 Capacity Assessment (ISL, 2019). The key findings of this study are:

- The lagoon is in urgent need of rehabilitation.
- The capacity of the lagoon in its current configuration is 90 m^3/day.
- Based on the growth assumptions, the capacity of the lagoon will be exceeded by 2025.

The Alcomdale Lagoon is also in poor condition. It is currently owned and operated by the Alcomdale Water Co-op. The Co-op recently approached Sturgeon County asking the County to take over ownership and operation of the water and wastewater system including the lagoon. The County is currently considering this request.

No information was available on the condition of the Calahoo or Riviere Que Barre lagoons.

6.4 Future Wastewater Flows

The future wastewater flows were estimated based on the projected residential and non-residential growth rates, refer to Section 3. The population projections for the County's growth areas are shown in Table 6.9. Northern Lights is included in this table as it contributes to the Sturgeon Valley wastewater system. It is not known if Northern Lights will be a growth area or not.

Table 6.9: Population Projections for Growth Areas

Lift Station	Population		
	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Northern Lights	51	51	51
Sturgeon Valley	4,756	9,461	14,202
Cardiff	1,328	1,882	2,574
Villeneuve	294	571	917

The breakdown of the future population within the Sturgeon Valley lift stations were estimated based on the projected number of developed lots within existing subdivisions (projections provided by Sturgeon County). This breakdown is shown in Table 6.10a for Phase 1 (2024) and 6.10b for Phases 2 and 3 (2034 & 2044). The existing subdivisions were estimated to be fully built out and occupied by 2034. These tables illustrate the estimated population that would be assigned to new growth areas (new subdivisions) for Phases 1, 2 and 3 (2024 to 2044).

Table 6.10a: 2024 Cumulative Population Estimate to Sturgeon Valley Lift Stations.

Lift Station	Number of Lots[1]			Total Population[2]
	Direct	Upstream	Cumulative	
Northern Lights	17	0	17	51
Greystone	92	17	109	341
Bellerose	786	109	895	2,797
Sturgeon Valley	432	0	432	1,350
River's Gate	69	1,327	1,396	4,363
Tuscany Hills	105	0	105	328
Total – Existing Subdivisions[3]	-	-	-	**4,691**
Total – Existing Subdivisions (excluding Northern Lights)	-	-	-	4,640
Sturgeon Valley Total (2024)	-	-	-	4,756
New Growth Areas (2024)	-	-	-	**65**

Notes:

1. Estimates of future developed lots provided by Sturgeon County.
2. Assumes 3.13 people per lot except Northern Lights which is 3 people per lot.
3. Excludes new growth areas.

Table 6.10b: 2034 & 2044 Cumulative Population Estimate to Sturgeon Valley Lift Stations.

Lift Station	Number of Lots[1]			Total Population[2]
	Direct	Upstream	Cumulative	
Northern Lights	17	0	17	51
Greystone	104	17	121	378
Bellerose	833	121	954	2,981
Sturgeon Valley	436	0	436	1,363
River's Gate	87	1,390	1,477	4,616
Tuscany Hills	117	0	117	366
Total – Existing Subdivisions[3]	-	-	-	**4,981**
Total – Existing Subdivisions (Excluding Northern Lights)	-	-	-	4,930
Sturgeon Valley Total (2034)	-	-	-	9,461
New Growth Areas (2034)	-	-	-	**4,480**
Sturgeon Valley Total (2044)	-	-	-	14,202
New Growth Areas (2044)	-	-	-	**9,221**

Notes:

1. Estimates of future developed lots provided by Sturgeon County.
2. Assumes 3.13 people per lot except Northern Lights which is 3 people per lot.
3. Excludes new growth areas.

Please note that this approach results in a relatively low population assigned to the new growth areas, especially when compared to the geographical area in the Phase I (2024) area. The approach was selected to address the capacity constraints in the Greystone and Bellerose Lift Stations given the proposed growth in ProNorth. It should be noted that the population increase in Sturgeon Valley and accompanying increase in wastewater flows to the Rivers Gate Lift Station will be the same whether the population is assigned to existing upstream developments or the proposed Phase 1 (2024) growth area south of the Sturgeon River.

The new growth area is expected to be serviced by the Rivers Gate Lift Station and potentially by a connection directly to the START line. The breakdown will depend primarily on the local topography, but could be influence by the available capacity of the Rivers Gate Lift Station.

The projected future non-residential development areas are shown in Table 6.11. ProNorth does not have wastewater servicing but has the potential to be connected. SV East / CFB Edmonton is a potential non-residential (commercial / institutional) development at Highway 28 and Township Road 544.

Table 6.11: Projected Future Non-Residential Flows

Lift Station	Wastewater Generation (L/ha/d)[1]	Total Development Area (ha)			Average Flows (L/s)		
	Average	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Alberta's Industrial Heartland	1,802	1,246	1,873	2,494	26.0	39.1	52.0
Sturgeon Industrial Park	2,033	307	420	520	7.2	9.9	12.2
ProNorth Industrial Park	2,000	38	82	108	0.9	1.9	2.5
SV East / CFB Edmonton	6,170	0	72	211	0.0	5.1	15.1

Notes:

1. AIH / SIP taken from Water Tables; ProNorth estimated as 2,000 L/ha/d; SV East / CFB Edmonton is 6,170 L/ha/d (GMSS).

The projected average wastewater flow generation is also shown in Table 6.11. The average flows were estimated based on the current wastewater generation rates in AIH and SIP, refer to Table 6.5. The rates for ProNorth was estimated based on typical values, including the current AIH and SIP generation rates. Given that ProNorth does not currently have wastewater servicing, it is unlikely that a major water use industry will be located there. As the Sturgeon Valley East / CFB Edmonton development could include highway commercial (e.g. restaurants), there is potential for high water use and wastewater generation, thus the GMSS value of 6170 L/ha/d was used.

With the proposed development within ProNorth, the total wastewater generated by Northern Lights and ProNorth were estimated, refer to Table 612. This includes the residential and non-residential projections in Tables 6.10 and 6.11.

Table 6.12: Future Wastewater Flows from Northern Lights Subdivision and ProNorth Industrial Park

Lift Station	Average Flows (L/s)		
	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Northern Lights subdivision	0.1	0.1	0.1
ProNorth Industrial Park	0.9	1.9	2.5
Total	1.0	2.0	2.6

Notes:

1. From Tables 6.11 & 6.12.
2. Northern Lights estimated using 51 c and 200 L/c/d (6.10a/6.10b).

The projected future average and peak daily flows to the various lift stations are listed in Table 6.13. As previously noted, a portion of the Sturgeon Valley new growth areas will be directed to the Rivers Gate Lift Station. This table utilizes the existing wastewater generation rates for existing development and an average generation rate of 200 L/c/d for future development. The Northern Lights / ProNorth flows are taken from Table 6.12.

Table 6.13: Projected Future Lift Station Wastewater Flows

Lift Station	Capacity (L/s)	Wastewater Generation Rates (L/c/d)		Average DWF (L/s)[3]			Peak Daily Flow (L/s)[4]		
		Existing	Future	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
Northern Lights[1]	-	200	200	0.1	0.1	0.1	0.2	0.2	0.2
ProNorth	-	-	-	0.9	1.9	2.5	1.8	3.8	5.0
Greystone	77	140	200	1.8	2.9	3.5	3.6	5.8	7.0
Bellerose	28	141	200	7.5	8.9	9.5	15.4	18.3	19.5
River's Gate (existing subdivisions)	90	133	200	11.1	12.7	13.3	22.9	26.1	27.3
Tuscany Hills	37	135	200	0.8	0.8	0.8	1.6	1.8	1.8
New Growth Areas	-	-	200	0.2	10.4	21.3	0.2	15.7	32.2
Cardiff[2]	35	177	200	2.4	3.3	4.6	3.5	5.0	6.8
Villeneuve[2]	8	367	200	2.2	4.3	7.0	4.2	8.1	13.1

Notes:

1. Northern Lights estimated using 51 c and 200 L/c/d (6.10a/6.10b).
2. Cardiff and Villeneuve taken from water tables.
3. ProNorth contributions are assumed to be connected to the Northern Lights Forcemain, i.e. are included in d/s lift station flows.
4. ADWF based on population projections from 6.10a & 6.10b, average per capita use (Table 6.3) and plus contributions from ProNorth.
5. Peak daily flow based historical peak data and population projections. ProNorth contributions estimated from Table 6.12 using a factor of 2x.

6.5 Capacity of Existing Infrastructure for Growth

6.5.1 ACRWC Transmission System

As previously mentioned, the ACRWC is required to upgrade its transmission and treatment system to service its members, provided that the municipalities manage their flow to the ACRWC Level of Service (LOS) limits. The ACRWC regularly analyzes the wet weather flows in their system using both flow monitoring and hydraulic model. Their hydraulic modeling typically looks forward 25 years or more, and analyzes the capacity requirements for a 1:25 year rainfall event. The ACRWC then prioritizes upgrades to address projected capacity constraints. Upgrading is prioritized based on system reliability and on the physical condition of the infrastructure.

In the past 10 years the ACRWC has conducted major upgrades to their transmission system including the St. Albert Pump Station (2012), the Fort Saskatchewan Forcemain (2017) and the START Line. Due to the length of START and the need to upgrade and rehabilitate the entire length, upgrading is being staged on a priority basis. It is understood that the upgrading is currently about 25% complete and that the ACRWC plans on completing the upgrading within the next 10 to 15 years.

While the START Line is in the process of being upgraded, the ACRWC is not placing any restrictions on the County servicing new development areas to START, or in making new connections to it (provided that LOS limits are followed).

6.5.2 Local Growth Areas

Prior to determining the capacity of the existing infrastructure to accommodate growth, the location of growth areas and local topography need to be considered. The proximity of the existing infrastructure to each growth area are presented in Figures 6.5 to 6.11 (note: these figures also show proposed servicing concepts discussed in Section 6.7).

Alberta's Industrial Heartland

The layout of the existing wastewater collection system in the AIH is shown in Figure 6.5. The existing 300mm Agrium / Heartland Forcemain has a capacity of 6 MLD (69 L/s), while the downstream 500mm Heartland Forcemain has a capacity of 18 MLD (208 L/s). The 350mm NWR Upgrader Forcemain connects to the upstream end of 500mm, as the capacity of the 300mm forcemain is dedicated to Agrium. The capacity of section of the existing AIH forcemains are shown in Table 6.14.

The projected total AIH development areas for the three growth phases are also shown in Table 6.14, along with the average flows for each phase. The projected wastewater flows are based on the current wastewater flow generation rate of 1802 L/ha/d. As the 300mm and 350mm forcemains are dedicated to Agrium and the NWR Upgrader, only the flows to the 500mm forcemain were considered. As shown in Table 6.14, the 500mm forcemain appears to capacity to service all 3 phases of growth, assuming that the industries discharge their wastewater at a fairly constant rate.

Table 6.14: Alberta's Industrial Heartland Forcemain Capacity Analysis

Community	Capacity[1]		Total Development Area (ha)[2]			Average Flows (L/s)[3]			
	(MLD)	(L/s)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Existing (2017)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
300mm Forcemain	6.0	69.4	-	-	-	-	-	-	-
350mm Forcemain[4]	6.4	74.1	-	-	-	-	-	-	-
500mm Forcemain	18.0	208.3	1,246	1,873	2,494	20.6	26.0	39.1	52.0

Notes:

1. Capacity of 300mm & 500mm FM sourced from Heartland Area Utility Master Plan, 2007. 350mm was interpolated.
2. Assumes all growth goes to the 500 mm Forcemain.
3. Based on 1802 L/ha/d from Table 6.12.
4. 350mm Forcemain was built independently by a customer in the AIH and is separate from the 300mm.

Cardiff

The existing Cardiff infrastructure and growth areas are shown in Figure 6.6. It is assumed that the proposed growth area would need to be serviced directly to the Cardiff Lift Station as there are no reports indicating that the existing sewers were designed for this additional service area. This should be reviewed at the time of development.

The Cardiff Lift Station was recently upgraded and appears to have additional capacity for the projected growth (Phase 3, 2044). It is noted that concurrent to the lift station upgrading, that the County undertook a brief inflow / infiltration investigation to identify probable sources of I/I into the Cardiff collection system. Management of I/I will be important to reserve as much lift station capacity as possible for the proposed growth. This will require monitoring of wet weather flows.

Northern Lights & ProNorth Industrial Park

The existing wastewater system and projected growth at Northern Lights / ProNorth Industrial Park are shown in Figure 6.7. Northern Lights uses a low pressure system to pump wastewater to the Greystone Lift Station in Sturgeon Valley via a 150mm forcemain. ProNorth does not currently have any wastewater servicing.

As the Northern Lights forcemain was installed as part of the Northern Lights development, any connections from ProNorth development may require upgrading of the system, subject to a detailed hydraulic analysis.

Sturgeon Industrial Park

The Sturgeon Industrial Park is proposed to be serviced to the ACRWC Northeast Regional Trunk Sewer (NERTS) which runs adjacent to the SIP, refer to Figure 6.8. Existing Sewers would be extended west to service the proposed SIP growth areas. The growth area shown in this figure is consistent with the proposed service area to the existing County sewers in the 2008 Southeast Sturgeon Utility Assessment. It is understood that the existing County sewers connecting to the ACRWC is adequately sized, however it has not been independently verified.

Sturgeon Valley

The proposed Sturgeon Valley growth areas and existing wastewater infrastructure is shown in Figure 6.9. The growth areas are adjacent to the four existing wastewater systems. The capability of each system to accommodate growth is briefly summarized below:

- Sturgeon Valley Lift Station – does not have any surplus capacity, nor can it be upgraded to accommodate growth;
- Tuscany Hills – does not have capacity for growth and cannot be cost effectively upgraded;
- Rivers Gate Lift Station – has capacity for growth and can be upgraded as needed;
- START – has or will have capacity for growth following ACRWC upgrading.

The entire growth area can be serviced to the Rivers Gate Lift Station by gravity. Only the south and southeast areas have the potential to be serviced to START by gravity. It is also possible to service the growth area to START with a new lift station. To minimize servicing costs, it is preferable to maximize the area that is serviced to START by gravity, with the remaining area being serviced to the Rivers Gate Lift Station by gravity.

Two servicing concepts were considered for the southwest part of Sturgeon Valley for assessing the capacity of existing Rivers Gate Lift Station to accommodate growth:

1. Service the entire area to the Rivers Gate Lift Station (maximum potential impact on Rivers Gate);
2. Service the maximum potential area to START by gravity, and the remaining lands to the Rivers Gate Lift Station (minimum impact on Rivers Gate Lift Station without constructing a new lift station). It is important to note that any gravity servicing directly to START will likely need to connect on the east side of Range Road 250 where START is at a lower elevation. Based on the elevation of the upstream section of START, the maximum potential gravity service area to START (connecting east of Range Road 250) is shown in Figure 6.9.

The service areas, populations and wastewater flow projections for each option are shown in Table 6.15. The lift station assessment is described in Section 6.5.3 below.

Table 6.15: Servicing Concepts and Phase 3 Wastewater Flows for SW Sturgeon Valley

Option	SW Sturgeon Valley Servicing Concept	Area Serviced to River's Gate (ha)	Area Serviced to START (ha)	Population to River's Gate[1]	Population to START[1]	River's Gate Flows - Growth Area Only		Total River's Gate (Flows)	
						Average DWF (L/s)	Peak Day DWF (L/s)	Average DWF (L/s)[2]	Peak Day DWF (L/s)[3]
1	Entire SW Area to Rivers Gate	566	0	9,221	0	21.3	32.2	34.6	59.6
2	Maximum Area to START by gravity	334	232	5,443	3,778	12.6	19.0	25.9	46.4

Notes:

1. Option 2 populations estimated as a ratio of the areas.
2. Average DWF includes ProNorth contributions.
3. Peak Day DWF includes ProNorth contributions with an assumed peak factor of 2.

Sturgeon Valley East / CFB Edmonton

Non-residential development is anticipated in the Sturgeon Valley East / CFB Edmonton area, along Highway 28 and north and south of Township Road 544, see Figure 6.10. This development area is unserviced at present, and new infrastructure will be required to service it.

This area is partially within the Sturgeon Valley area, which has a wastewater servicing concept (Sturgeon Valley Utility Servicing Update). The two quarter sections west of Highway 28 were included in the proposed Southeast Trunk in the previous studies, which discharged to START via an adjacent lift station. The location of previous proposed Southeast Trunk is shown in Figure 6.10. The servicing concept for this area is described in Section 6.7.

The START Line has, or will have following ACRWC upgrading, capacity to service this area.

Villeneuve

The Villeneuve wastewater system includes both the Hamlet of Villeneuve and the Villeneuve Airport development, refer to Figure 6.11. The existing system incorporates separate lift stations with the downstream portion of the forcemains connecting to the Villeneuve Lagoon being shared.

The proposed growth area in the hamlet is assumed to connect to the existing Hamlet of Villeneuve Lift Station. If necessary, the lift station and forcemain would be upgraded to service future growth. An upgraded lift station is assumed to be located adjacent to the existing one, with a new forcemain running parallel to the existing one.

The Villeneuve Airport is considering growth to the south and east, and the previous servicing studies proposed that a new lift station would be located on the southeast part of the site, closer to the lagoon as shown in Figure 6.11.

As the downstream section of the forcemain to the lagoon is to be shared, increased pumping rates and heads from one lift station will impact the other lift station. It is assumed that the County and the Edmonton Regional Airport Authority will coordinate upgrades to these pumping facilities.

6.5.3 Lift Station Capacity Assessment

Sturgeon Valley

The capability of the existing lift stations to accommodate growth was assessed based on the above flow projections and servicing concepts. The existing capacity of each lift station and its forecast average and peak daily (dry weather) flow is shown in Table 6.16. As described previously, two servicing options for the southwest part of Sturgeon Valley are detailed in order to provide a range in future Rivers Gate flows.

Table 6.16: Lift Station Capacity Assessment

Lift Station	Capacity (L/s)	Peak Daily Flow (L/s)			Peak Wet Weather Flow (L/s)		
		Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)	Phase 1 (2024)	Phase 2 (2034)	Phase 3 (2044)
New Northern Lights LS[1]	n/a	2.0	4.0	5.2	Insufficient information available to estimate future peak wet weather flows		
Greystone	76.5	3.6	5.8	7.0			
Bellerose	28.0	15.4	18.3	19.5			
River's Gate – Servicing Option 1[2]	90.0	23.1	41.8	59.6			
River's Gate – Servicing Option 2[2]	90.0	23.0	35.4	46.4			
Tuscany Hills	37.2	1.6	1.8	1.8			
Cardiff	35.0	3.5	5.0	6.8			
Villeneuve	8.2	4.2	8.1	13.1			

Notes:

1. New Northern Lights Lift Station (LS) includes both ProNorth and Northern Lights. Peak assumed to be 2x average flow.
2. River's Gate Option 1 & 2 are estimated as the total peak flows from U/S of River's Gate + area ratio population estimates from 6.13.
3. Lift station capacity sources provided in Table 6.7.

The capacity of the existing Sturgeon Valley lift stations appears to be adequate as with the exception of the Rivers Gate Lift Station, the amount of additional flows to the lift stations is expected to be minimal. It is recognized that without monitored wet weather flows to each lift station, it is not possible to ascertain the available capacity of these lift stations under existing or future growth conditions. Anecdotal information suggests that the Bellerose Lift Station may require upgrading to meet current peak wet weather flows.

The Rivers Gate Lift Station in Sturgeon Valley appears to have adequate capacity to accommodate extensive growth. The amount of growth that it can accommodate will depend on the magnitude of the wet weather flows being discharged. Servicing the lands near START to the ACRWC trunk, preferably by gravity, will minimize the flows to Rivers Gate and thus defer potential future lift station upgrading.

Cardiff

The Cardiff Lift Station was recently upgraded and appears to have additional capacity for the projected growth (Phase 3, 2044). It is noted that concurrent to the lift station upgrading, that the County undertook a brief inflow / infiltration investigation to identify probable sources of I/I into the Cardiff collection system. Management of I/I will be important to reserve as much lift station capacity as possible for the proposed growth. This will require monitoring of wet weather flows.

Villeneuve

The Villeneuve Lift Station appears to be approaching its capacity and may exceed its hydraulic capacity during large rainfall events. The lift station does not appear to have any capacity to accommodate growth within the Hamlet of Villeneuve.

6.5.4 Lagoons

The only growth area that is serviced by a lagoon is Villeneuve. As previously mentioned, the existing lagoon is in urgent need of rehabilitation and is expected to reach its capacity by 2025.

6.6 Role of Demand Management to Minimize New Infrastructure Requirements

Water Conservation

Water conservation has the potential to reduce the average annual water use by 20% or more through water efficient fixtures and appliances. Virtually all indoor residential water use is returned as wastewater, so this can equate to the same per capita wastewater generation rates. Given the uncertainties in the peak wet weather flows compared to the existing pumping capacities, it is difficult to know the effectiveness of water conservation on the timing and sizing of new infrastructure. It is recommended that water conservation be pursued as noted in Section 5.x, but that it not be considered for infrastructure planning purposes in the short to medium term.

Inflow / Infiltration Control

Sturgeon County's monitoring data did not allow for a rigorous analysis of the inflow / infiltration (I/I) influence on the peak wet weather flows. However, based on the age of most communities, it is expected that the areas with gravity sewers have relatively high I/I. Low pressure systems typically how low I/I as there is no mechanism for groundwater or surface water to enter the pressure pipe system.

I/I reduction can result in reductions in the peak wet weather flows which is the key metric for wastewater system upgrading. I/I reduction programs typically include the following:

- Private homeowners disconnecting foundation drains from the wastewater system, extending roof leaders away from their homes, and providing positive drainage away from their homes.
- Municipalities removing cross connections (catchbasins to wastewater system) and rehabilitating deteriorated gravity sewer pipes and manholes.

However, it is difficult to implement I/I reduction programs due to the costs involved and the impacts on private homeowners. While I/I reduction should be pursued, it cannot be relied upon to significantly reduce peak wastewater flows to defer infrastructure spending.

It is noted that the ACRWC is requiring its members to undertake I/I assessment studies in an effort to reduce the impacts of I/I on the Commission's transmission and treatment infrastructure.

Interim Servicing

It is feasible to manage infrastructure spending by providing a lower level of wastewater servicing as part of an interim servicing concept. The best example of this would be the ProNorth Industrial Park where each business is currently using pump outs to management their wastewater servicing needs. This is not seen as an ideal permanent servicing concepts due to the on-going operation and maintenance costs (including impacts on County roads). However, it is a viable interim servicing concept that will defer infrastructure.

It is noted that the County needs to be careful about allowing additional development utilizing pump outs for wastewater servicing. Developers should have a clear business plan indicating when a permanent (piped) system will be in place.

6.7 Wastewater System Upgrades to Meet Future Flows

The above demand management measures are not expected to make a significant difference in the short to medium term. With the exception of Villeneuve, the current water use and wastewater generation rates are relatively low, so water conservation is not expected to reduce the projected wastewater flows. Based on the lack of detailed wet weather flow data, it is not possible to determine the potential impact that an Inflow / infiltration reduction program would have. Interim servicing is expected to be effective for ProNorth Industrial Park, but likely not at the other growth areas.

The previous sections outline the projected flows, and analysis of capacity of the existing systems. The proposed servicing concepts and any required infrastructure upgrades are described briefly below.

ACRWC Transmission System

Based on discussions with the ACRWC, it is understood that their transmission system has capacity to accommodate Sturgeon County growth to Phase 3 (2044), with the exception of the START Line. The ACRWC is currently upgrading START in stages to accommodate the cumulative flows from St. Albert, Spruce Grove, Stony Plain, Morinville, Parkland County and Sturgeon County.

Alberta's Industrial Heartland

The capacity of 500mm forcemain appears to be adequate for servicing the AIH industries through Phase 3 (2044). Industries will need to connect to the 500mm forcemain, as the existing 300mm and 350mm are dedicated to Agrium and the NWR Upgrader, respectively. To confirm the long term capacity of the 500mm forcemain, the County should monitor water and/or wastewater use to confirm peak daily and (if possible) peak instantaneous wastewater use.

To Service Phases 2 (2034) and 3 (2044), it is proposed to construct the 300mm forcemain along Township Road 561 and along Range Road 224 and connect it to the downstream 500mm forcemain (proposed in the Heartland Utility Servicing Update Report). The proposed AIH servicing concept is shown in Figure 6.5.

Cardiff

It is believed that the Cardiff Lift Station has adequate capacity to accommodate the projected growth, but a detailed analysis of the wet weather flows would be needed to confirm. This was investigated recently but without detailed wet weather inflow data. The growth area will presumably need to connect directly to the Cardiff Lift Station, as shown in the Cardiff servicing concept in Figure 6.6.

Northern Lights / ProNorth Industrial Park

The study was undertaken on the assumption that Northern Lights would not be one of the growth areas. It is understood that the existing forcemain was sized for full development of Northern Lights.

The proposed expansion of the ProNorth Industrial Park is expected to have full municipal servicing eventually, possibly with interim servicing with septic tanks and pump outs similar to the existing industrial development. The proposed servicing concept for full municipal servicing is to construct gravity sewers south to Township Road 544 near the existing Northern Lights Water Reservoir, refer to Figure 6.7. A new lift station would be constructed and connected to the existing 150 mm forcemain to the Greystone Lift Station. This would require the existing and future Northern Lights low pressure system discharge into the new lift station and be re-pumped to the Greystone Lift Station. As previously noted, the capacity of the Sturgeon Valley lift stations would need to be reviewed in detail prior to approval of this servicing concept.

Interim servicing of ProNorth with septic tanks would allow the new lift station to be deferred. Alternately, ProNorth could use low pressure sewers connecting to the Northern Lights Forcemain on an interim basis, provided that the County collects funds to construct the proposed lift station when the total Northern Lights and

ProNorth flows exceed the capacity of the system. It will be important to carefully size the ProNorth low pressure system to allow the Northern Lights system to operate as designed.

Sturgeon Industrial Park

The Sturgeon Industrial Park is proposed to be serviced to the ACRWC NERTS system utilizing the existing County wastewater trunks, refer to Figure 6.8. The layout of the proposed sewers and the proposed service area are consistent with the 2008 SE Sturgeon Utility Assessment.

Sturgeon Valley Lift Stations and Forcemains

As outlined in Section 6.5.2 and 6.5.3, the proposed growth area in the southwest part of Sturgeon Valley can be serviced to a combination of:

- The Rivers Gate Lift Station;
- Gravity connection to START (connecting east of Range Road 250); and/or
- A new lift station connected to START if necessary.

Due to concerns about the long term capacity of the Rivers Gate Lift Station, it is preferred to maximize the development that is serviced directly to START. The estimated maximum potential service area to START is shown in Figure 6.9. The maximum and minimum dry weather flows to Rivers Gate Lift Station are shown in Table 6.15.

It is not possible to determine the capability of existing lift stations to accommodate growth without detailed understanding of existing peak wet weather flows and a projection of potential peak flows during major wet weather event (e.g. 1:25 year, 24 hour). It is also not known if growth in ProNorth can be accommodated through Sturgeon Valley without upgrading the existing lift stations. A detailed analysis of the Greystone, Bellerose and Rivers Gate Lift Station is required as part of a wastewater master plan.

Sturgeon Valley East / CFB Edmonton

It is proposed to service the Sturgeon Valley East / CFB Edmonton growth area utilizing the downstream portion of the Southeast Trunk and lift station to START, refer to Figure 6.10. Local trunks would connect the proposed growth area to the Southeast Trunk approximately 1km north of START, see Figure 6.10.

Due to the low topography in the far northeast corner of the proposed growth area, it is expected that part of the lands east of Highway 28 and north of Township Road 544 will need to be serviced by a local lift station.

Villeneuve

The Villeneuve Lift Station will need to be upgraded soon, and definitely prior to the completion of the Phase 2 (2034) growth. The exact timing of the upgrading cannot be determined without accurate wet weather flow data.

The Villeneuve Lagoon will need to be upgraded to accommodate growth in both the Hamlet of Villeneuve and the Villeneuve Airport. The key recommendations of the 2018 Villeneuve Lagoon Repair – Phase 1 Capacity Assessment study are:

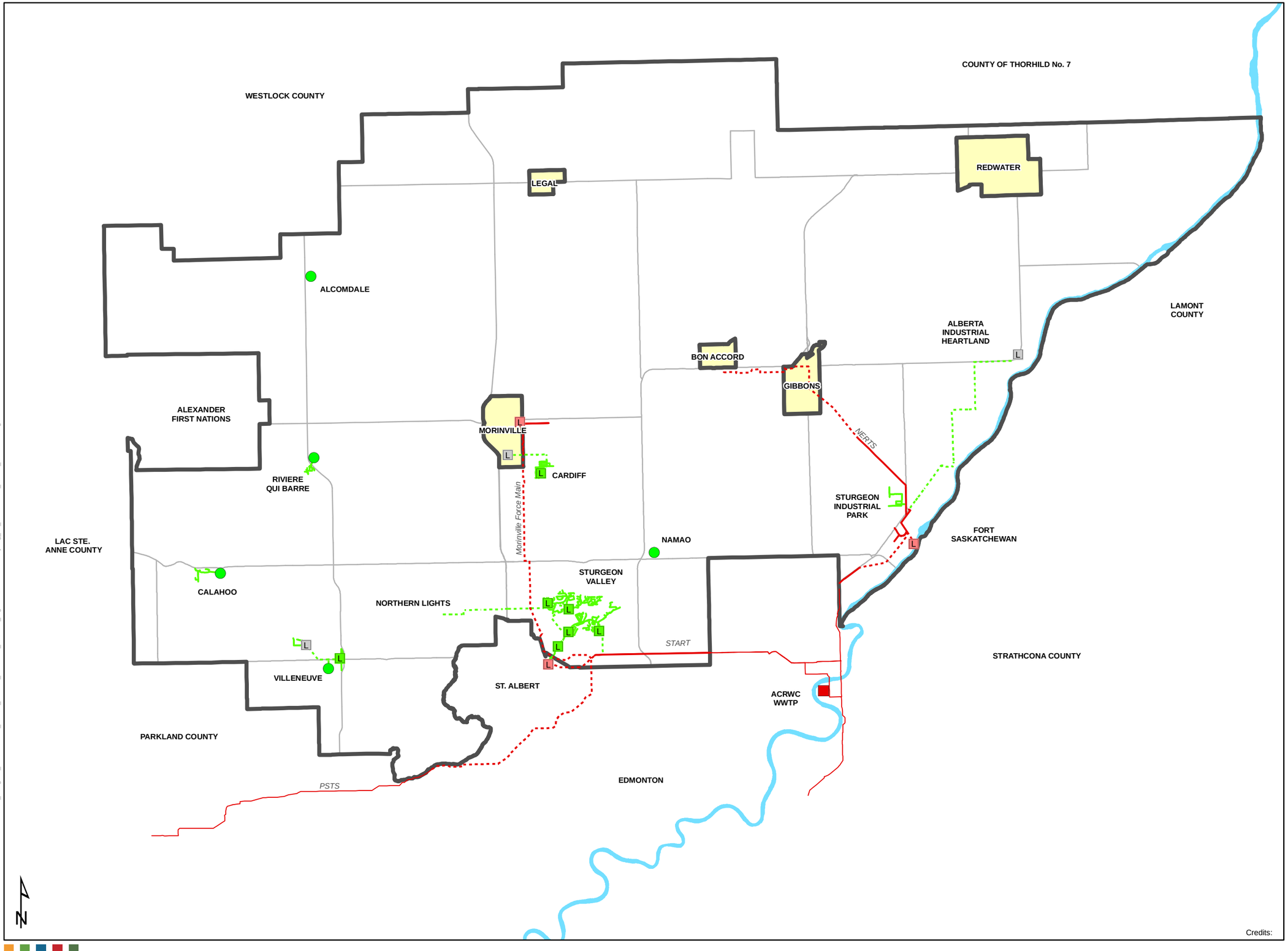
- Four options were investigated, including 1) optimization within the existing footprint; 2) lagoon expansion; 3) aeration to increase capacity; and 4) pumping to ACRWC Parkland Gravity Trunk.
- The options would increase the capacity of the lagoon to service to between 2039 and 2076 (based on growth assumptions), at costs ranging from $1.5M to $4.6M.
- The recommended option is optimization (Option 1), with servicing to 2039 at a cost of $1.5M

It is understood that the County is currently seeking external funding for the option of pumping to the ACRWC Parkland Gravity Trunk, and that if funding is not available, then the County will proceed with the recommended option.

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.1:

EXISTING WASTEWATER NETWORK BY OWNER



Sanitary Lines

Force Main Owner

- Sturgeon County Force Main
- ACRWC

Gravity Line Owner

- Sturgeon County
- ACRWC
- Other

Lagoons & Lift Stations

Owner

- Sturgeon Lift Station
- ACRWC Lift Station
- Other/Private Lift Station
- Sturgeon Lagoon
- ACRWC Treatment Plant

- Major Roads
- Neighbouring Municipality
- Sturgeon County
- North Saskatchewan River

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

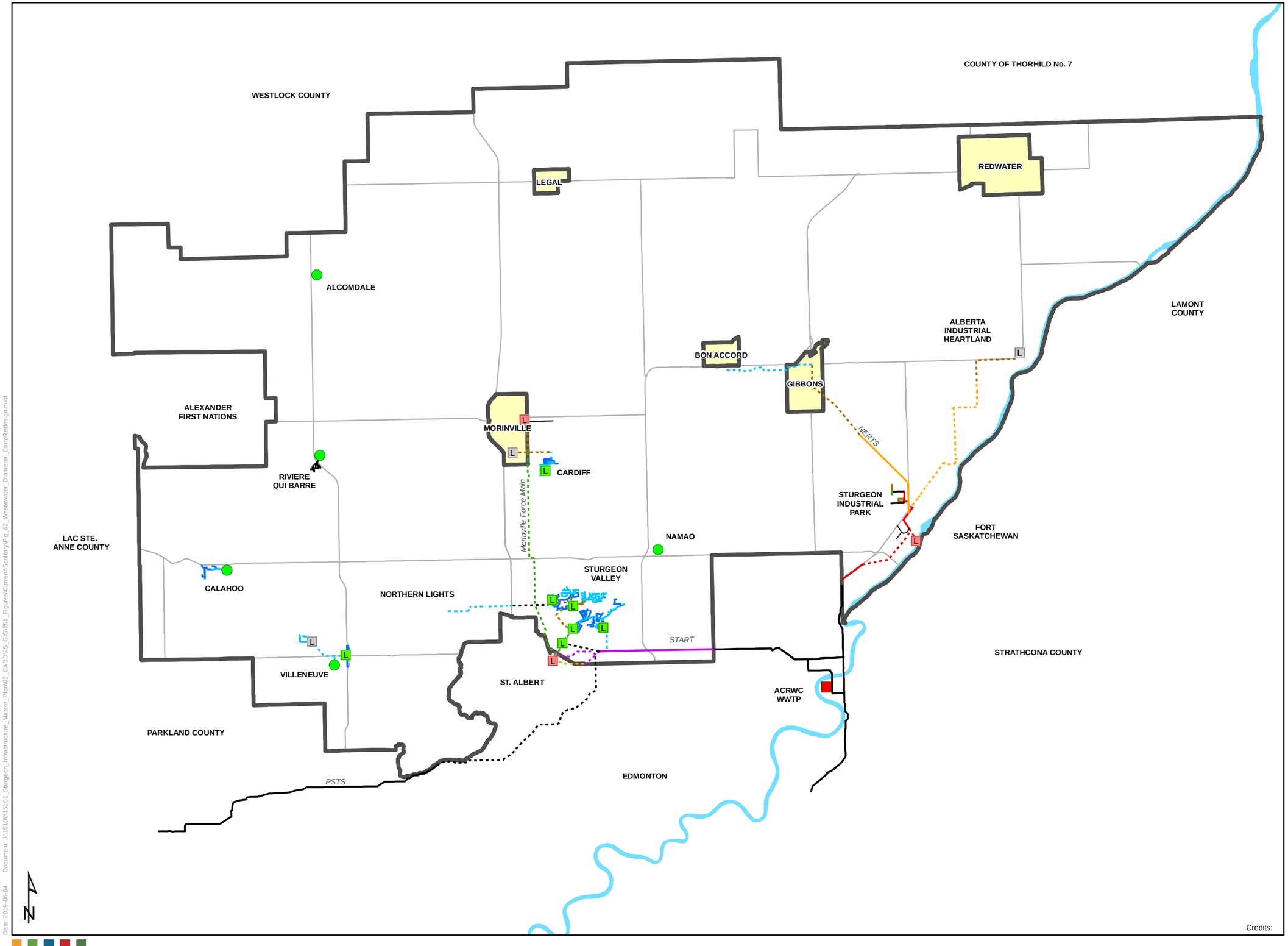
Credits:

Date: 2019-06-04 Document: J:\151\00\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Sanitary\Fig_61_Wastewater_Owner_CartoRedesign.mxd

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.2:

EXISTING WASTEWATER NETWORK BY DIAMETER



Sanitary Lines

Force Main Diameter

- 100 - 200 mm
- 250 - 300 mm
- 350 - 450 mm
- 500 - 600 mm
- 750 - 900 mm
- > 900 mm
- Unknown

Gravity Line Diameter

- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 350 - 450 mm
- 500 - 600 mm
- 750 - 900 mm
- > 900 mm
- Unknown

Lagoons & Lift Stations

Owner

- Sturgeon Lift Station
- ACRWC Lift Station
- Other/Private Lift Station
- Sturgeon Lagoon
- ACRWC Treatment Plant

- Major Roads
- Neighbouring Municipality
- Sturgeon County
- North Saskatchewan River

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

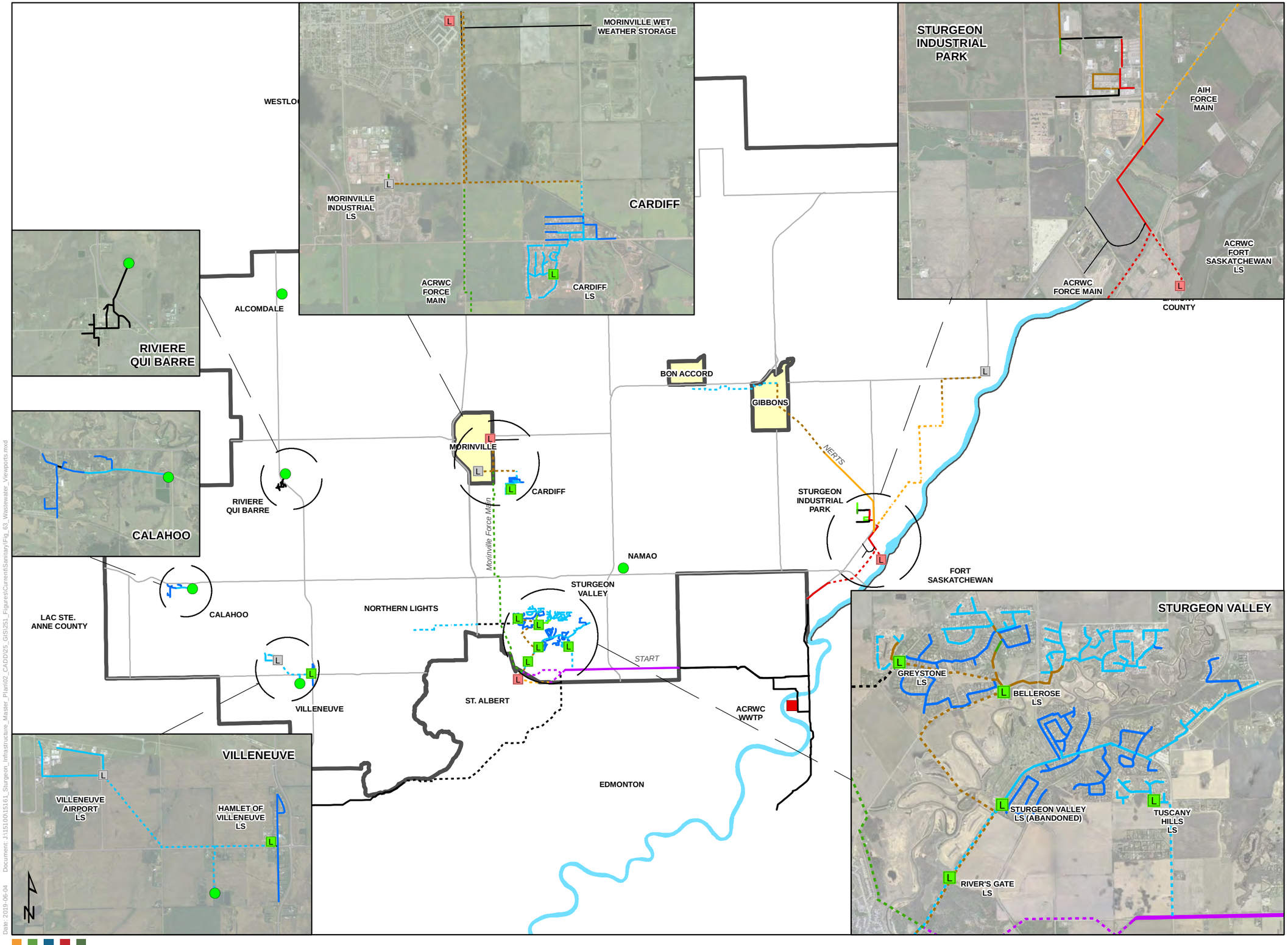
ISL Engineering and Land Services

Sturgeon County

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.3:

EXISTING WASTEWATER NETWORK IN KEY AREAS



Sanitary Lines (FM)

Force Main Diameter

- 100 - 200 mm
- 250 - 300 mm
- 350 - 450 mm
- 500 - 600 mm
- 750 - 900 mm
- > 900 mm
- Unknown

Gravity Line Diameter

- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 350 - 450 mm
- 500 - 600 mm
- 750 - 900 mm
- > 900 mm
- Unknown

Lagoons & Lift Stations

Owner

- Sturgeon Lift Station
- ACRWC Lift Station
- Other/Private Lift Station
- Sturgeon Lagoon
- ACRWC Treatment Plant

- Major Roads
- Neighbouring Municipality
- Sturgeon County
- North Saskatchewan River

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

All viewports scaled at 1:50,000

ISL Engineering and Land Services

Sturgeon County

Document: J:\15100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\25I_Figures\Current\Sanitary\Fig_63_Wastewater_Viewports.mxd

Date: 2019-06-04

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.4: STURGEON VALLEY WASTEWATER COLLECTION SYSTEM

ACRWC Morinville Forcemain

GREYSTONE LS

From Pro North / Northern Nights FM

BELLEROSE LS

STURGEON VALLEY LS

TUSCANY HILLS LS

200 FM
250 FM

RIVERS GATE LS

200 FM
250 FM

ST. ALBERT

ACRWC START

900 FM

ACRWC ST. ALBERT LS

2 - 600 FM

EDMONTON

Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,

Force Main Diameter

- 100 - 200 mm
- 250 - 300 mm
- 350 - 450 mm
- 500 - 600 mm
- 750 - 900 mm
- > 900 mm
- Unknown

Gravity Line Diameter

- < 100 mm
- 100 - 200 mm
- 250 - 300 mm
- 350 - 450 mm
- 500 - 600 mm
- 750 - 900 mm
- > 900 mm
- Unknown
- Direction of Flow

Lagoons & Lift Stations

Owner

- Sturgeon Lift Station
- ACRWC Lift Station
- Other/Private Lift Station
- Sturgeon Lagoon
- ACRWC Treatment Plant
- Sturgeon County

Collection Area

- Bellerose LS
- Greystone LS
- River's Gate LS
- Sturgeon Valley LS
- Tuscany Hills LS

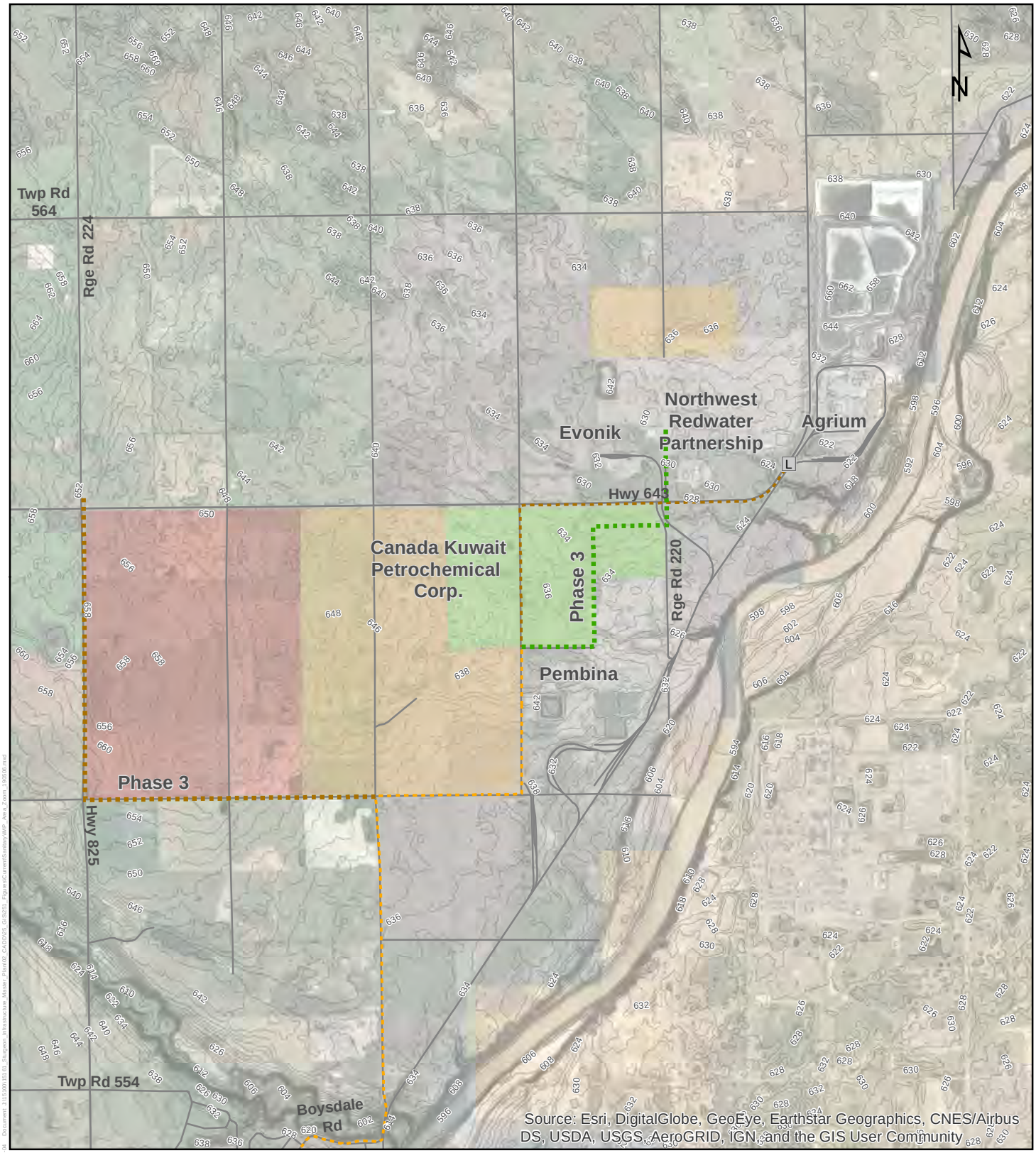
0 0.15 0.3 0.6 0.9 1.2 km

1:25,000 NAD 1983 CSRS 10TM AEP Resource

ISL Engineering and Land Services

Sturgeon County

Date: 2019-05-07 Document: J:\15100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Sanitary\Fig_64_Sturgeon Valley Wastewater Collection System.mxd



Force Main: Existing, Proposed
Gravity Line: Existing, Proposed

- < 100 mm
- 100-200 mm
- 250-300 mm
- 350-450 mm
- 500-600 mm
- 750-900 mm
- > 900 mm
- Unknown

- Direction of Flow
- Sturgeon Lift Station
- ACRWC Lift Station
- Other/Private Lift Station
- Sturgeon Lagoon
- Proposed Sturgeon LS
- Proposed Private LS

Growth Phase
- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

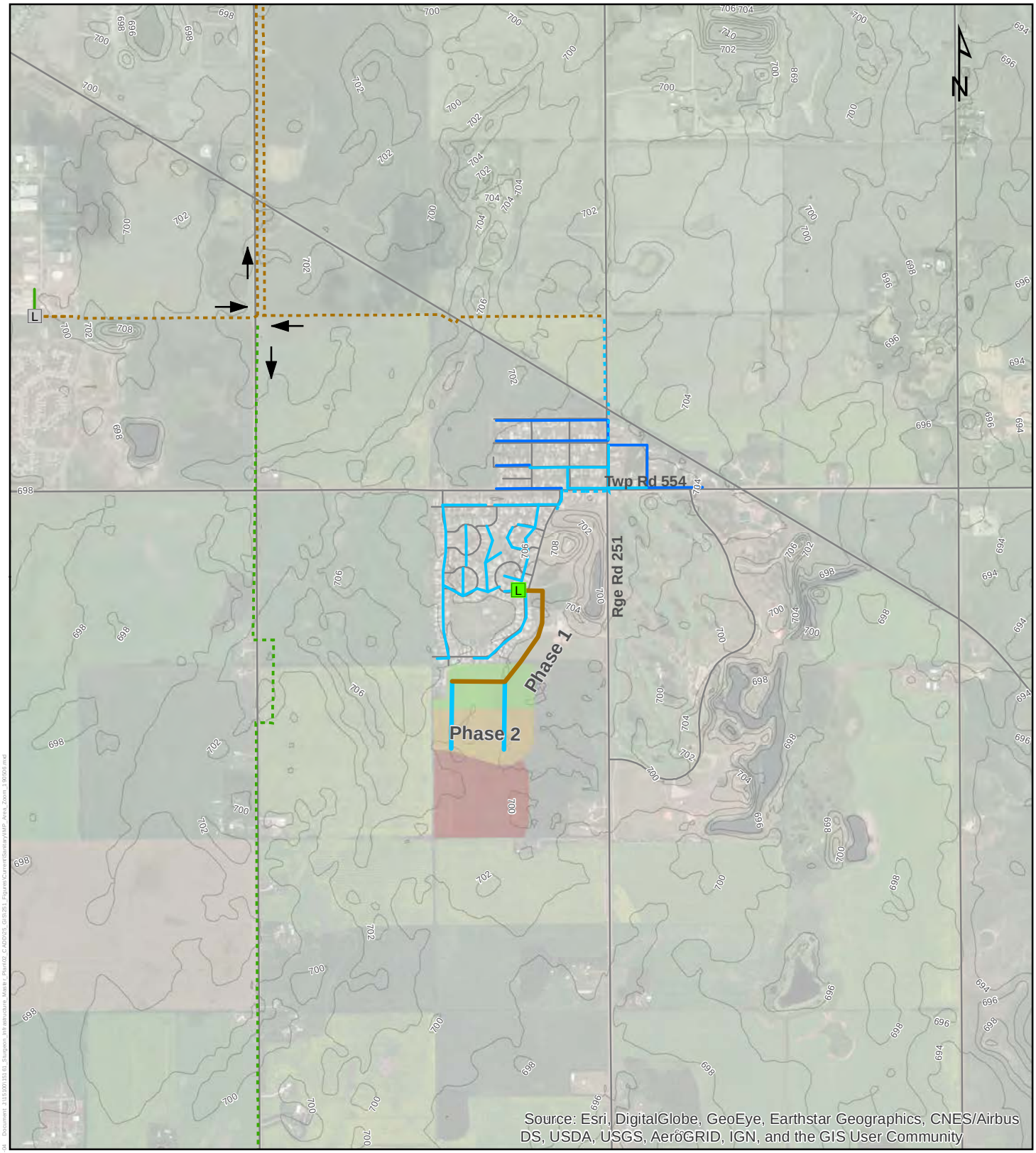
ISL Engineering and Land Services

0 250 500 1,000 1,500 m

CANA83-3TM114 1:60,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.5:
EXISTING AND PROPOSED WASTEWATER NETWORK IN ALBERTA'S INDUSTRIAL HEARTLAND



Force Main
Existing Proposed

Gravity Line
Existing Proposed

< 100 mm
100-200 mm
250-300 mm
350-450 mm
500-600 mm
750-900 mm
> 900 mm
Unknown

Direction of Flow
Sturgeon Lift Station
ACRWC Lift Station
Other/Private Lift Station
Sturgeon Lagoon
Proposed Sturgeon LS
Proposed Private LS

Growth Phase
1 (2024)
2 (2034)
3 (2044)
Road

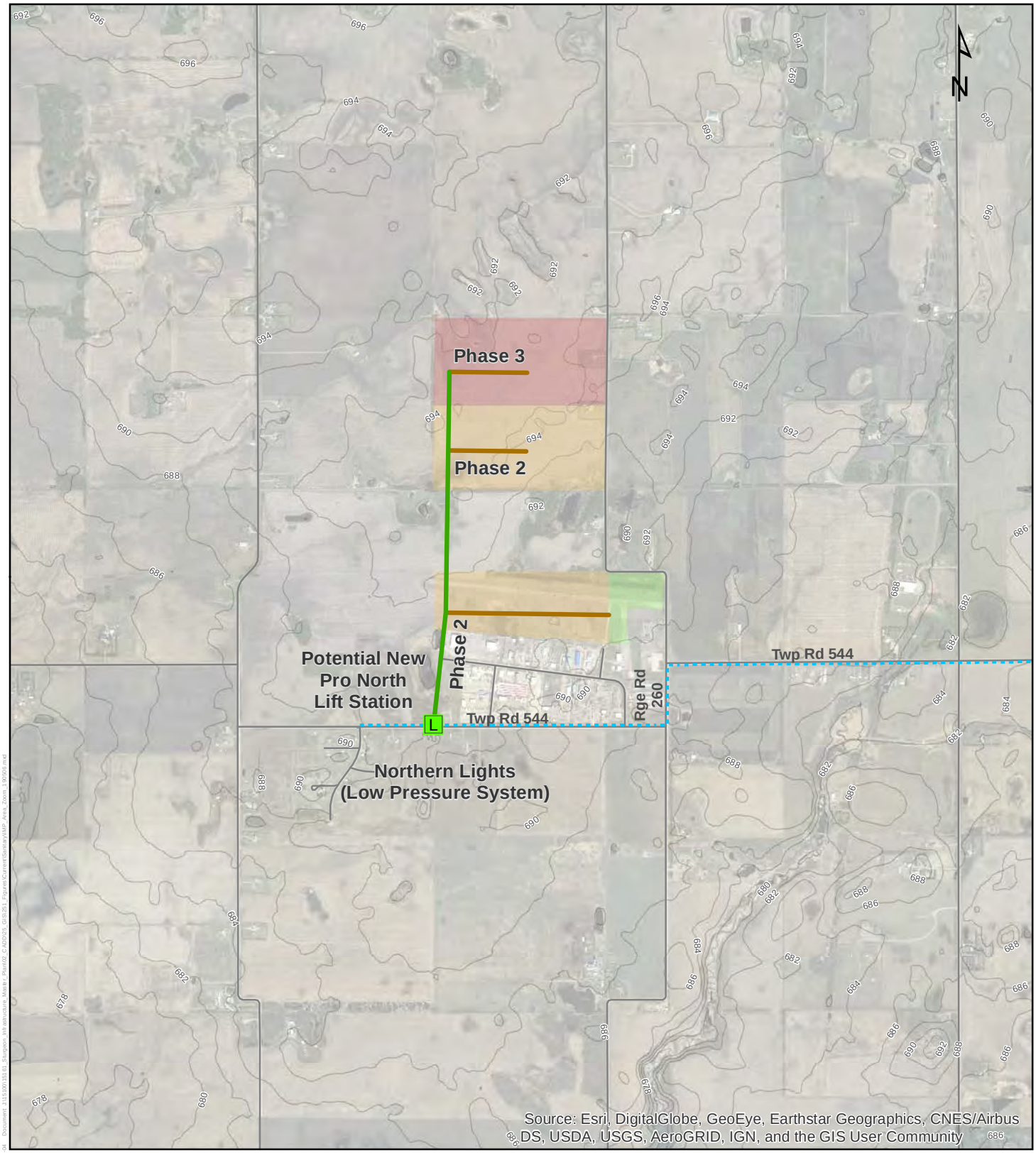
ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.6:
EXISTING AND PROPOSED WASTEWATER NETWORK IN CARDIFF



Force Main
Existing Proposed

Gravity Line
Existing Proposed

< 100 mm
100-200 mm
250-300 mm
350-450 mm
500-600 mm
750-900 mm
> 900 mm
Unknown

Direction of Flow
Sturgeon Lift Station
ACRWC Lift Station
Other/Private Lift Station
Sturgeon Lagoon
Proposed Sturgeon LS
Proposed Private LS

Growth Phase
1 (2024)
2 (2034)
3 (2044)
Road

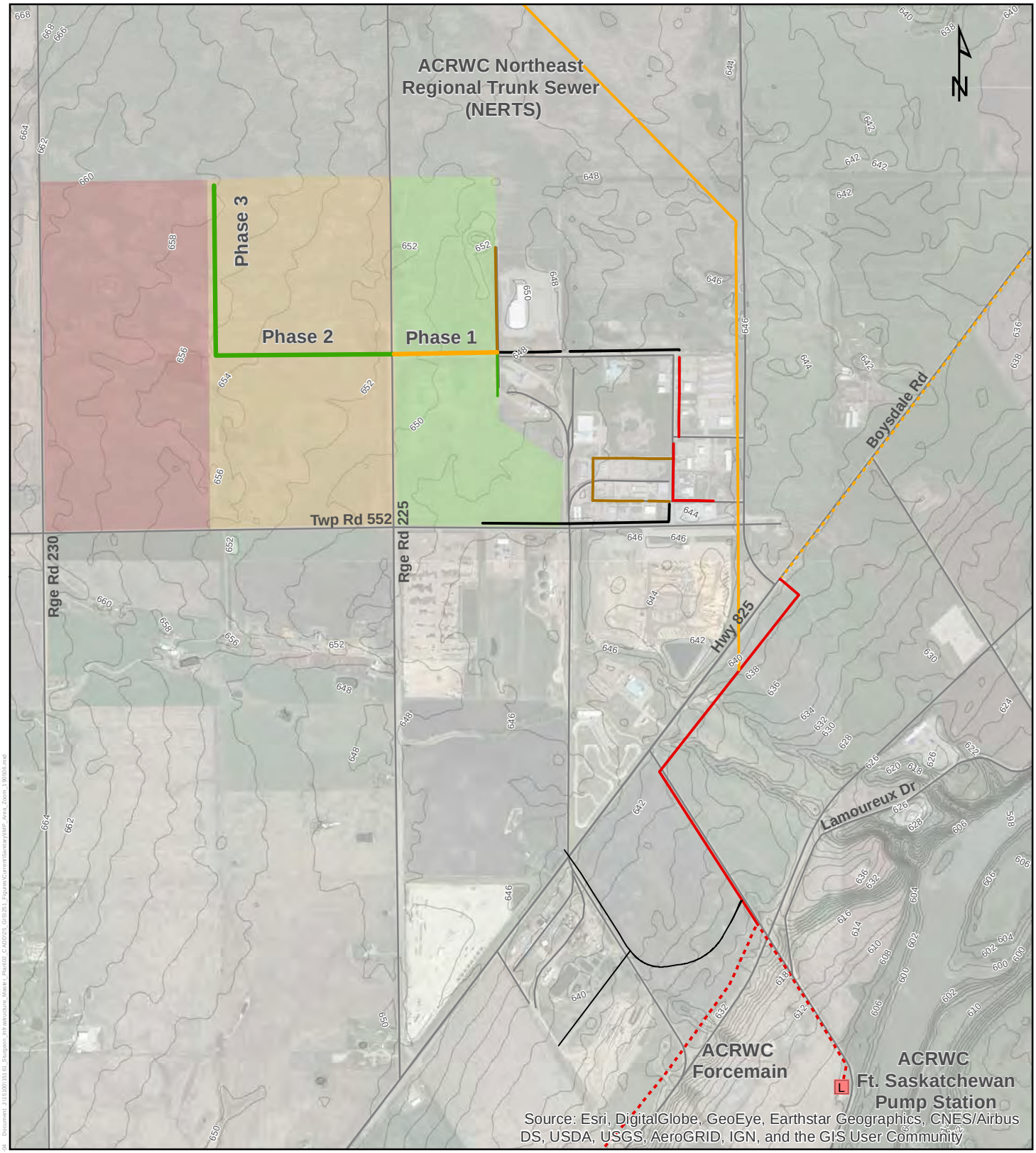
ISL Engineering and Land Services

0 125 250 500 750 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.7:
EXISTING AND PROPOSED WASTEWATER NETWORK IN PRO NORTH / NORTHERN LIGHTS



Force Main
Existing Proposed

Gravity Line
Existing Proposed

< 100 mm
100-200 mm
250-300 mm
350-450 mm
500-600 mm
750-900 mm
> 900 mm
Unknown

Direction of Flow
Sturgeon Lift Station
ACRWC Lift Station
Other/Private Lift Station
Sturgeon Lagoon
Proposed Sturgeon LS
Proposed Private LS

Growth Phase
1 (2024)
2 (2034)
3 (2044)
Road

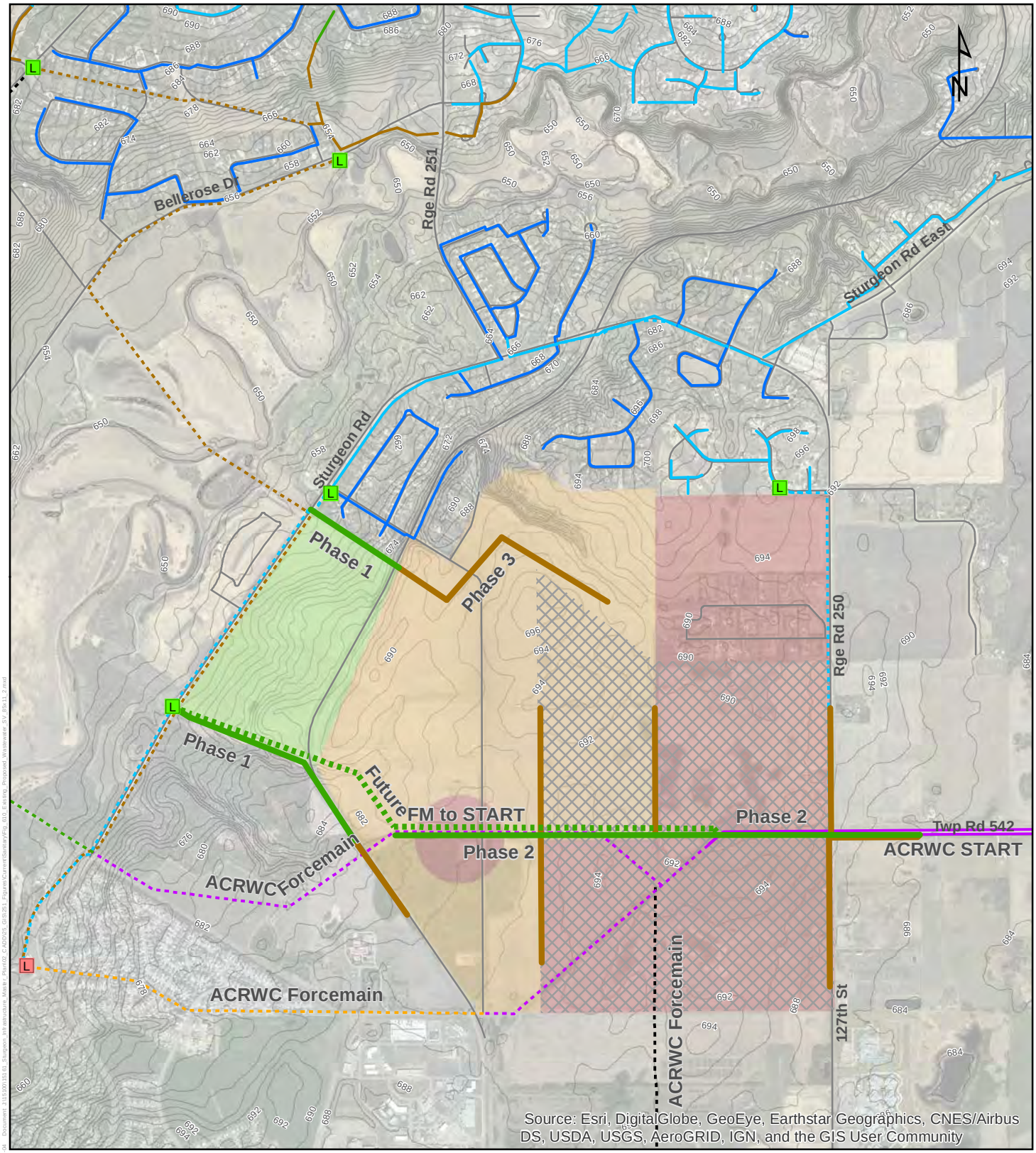
ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.8:
EXISTING AND PROPOSED WASTEWATER NETWORK IN STURGEON INDUSTRIAL PARK



Force Main: Existing, Proposed
Gravity Line: Existing, Proposed

- < 100 mm
- 100-200 mm
- 250-300 mm
- 350-450 mm
- 500-600 mm
- 750-900 mm
- > 900 mm
- Unknown

- Direction of Flow
- Sturgeon Lift Station
- ACRWC Lift Station
- Other/Private Lift Station
- Sturgeon Lagoon
- Proposed Sturgeon LS
- Proposed Private LS
- Potential START Gravity Service Area

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

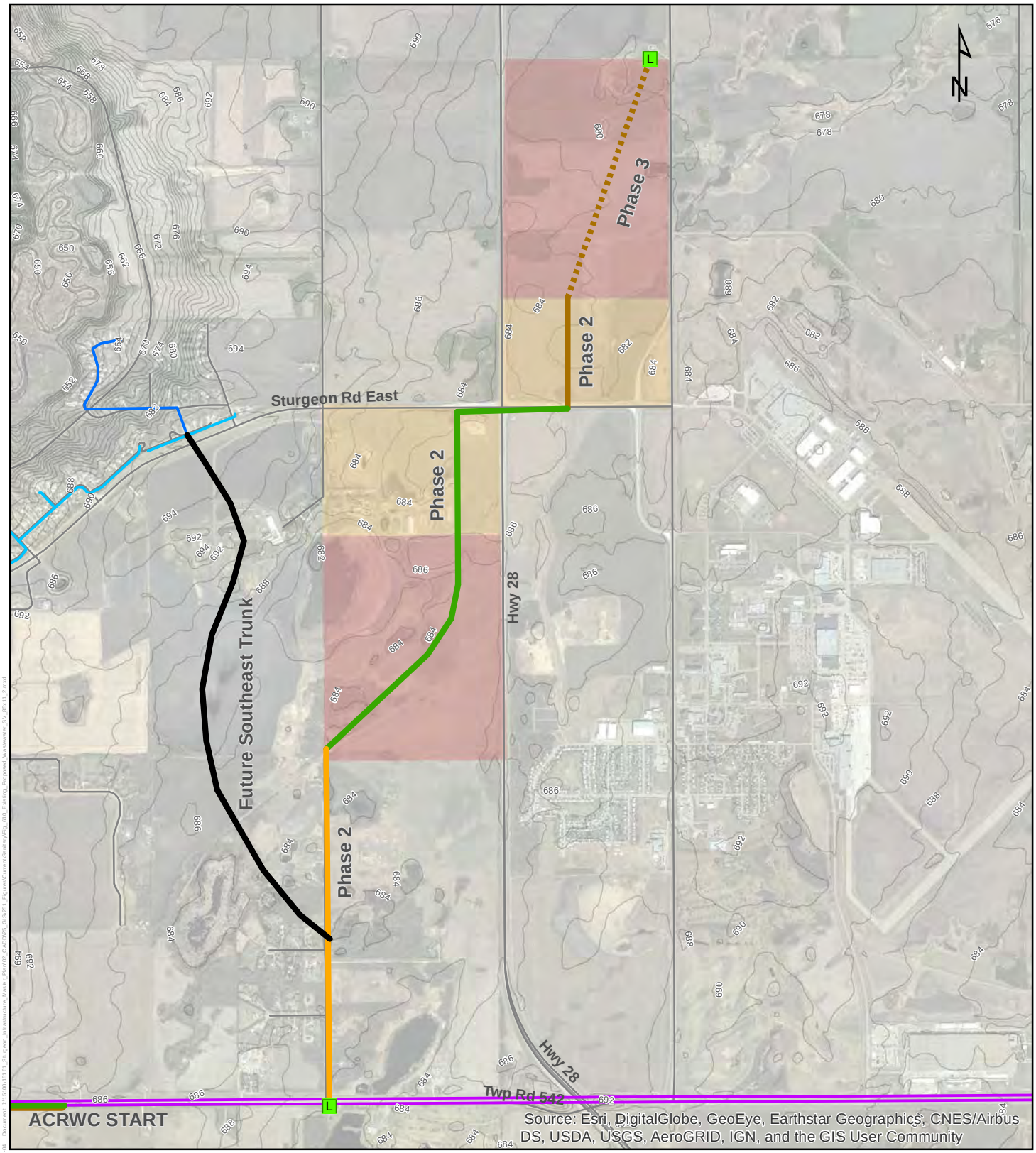
ISL Engineering and Land Services

0 125 250 500 750 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.9:
EXISTING AND PROPOSED WASTEWATER NETWORK IN STURGEON VALLEY



Force Main: Existing, Proposed
Gravity Line: Existing, Proposed

- < 100 mm
- 100-200 mm
- 250-300 mm
- 350-450 mm
- 500-600 mm
- 750-900 mm
- > 900 mm
- Unknown

- Direction of Flow
- L Sturgeon Lift Station
- L ACRWC Lift Station
- L Other/Private Lift Station
- Sturgeon Lagoon
- L Proposed Sturgeon LS
- L Proposed Private LS

Growth Phase
- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

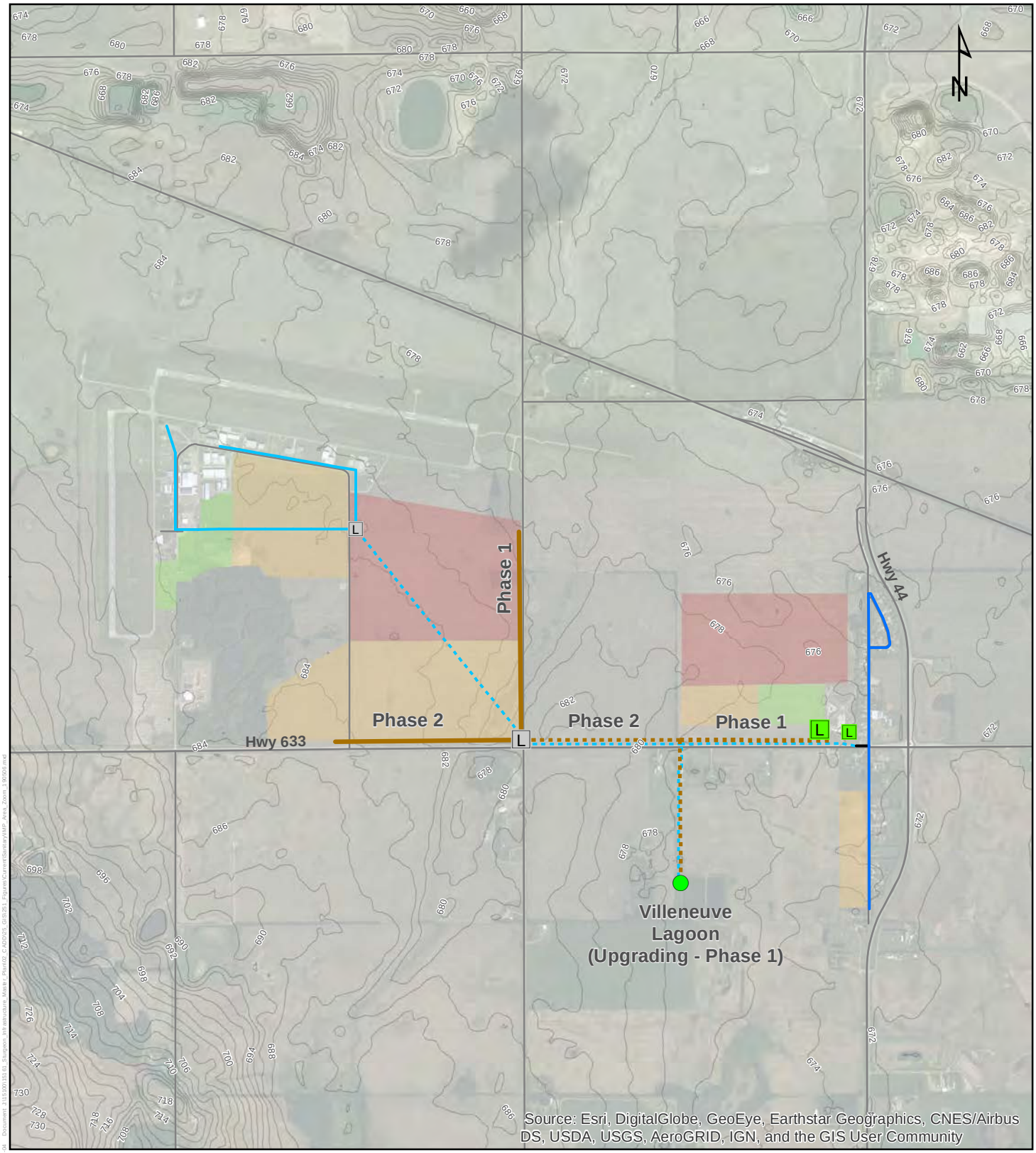
ISL Engineering and Land Services

0 125 250 500 750 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.10:
EXISTING AND PROPOSED WASTEWATER NETWORK IN STURGEON VALLEY EAST & CFB EDMONTON



Force Main: Existing / Proposed
Gravity Line: Existing / Proposed

- < 100 mm
- 100-200 mm
- 250-300 mm
- 350-450 mm
- 500-600 mm
- 750-900 mm
- > 900 mm
- Unknown

- Direction of Flow
- Sturgeon Lift Station
- ACRWC Lift Station
- Other/Private Lift Station
- Sturgeon Lagoon
- Proposed Sturgeon LS
- Proposed Private LS

Growth Phase
- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

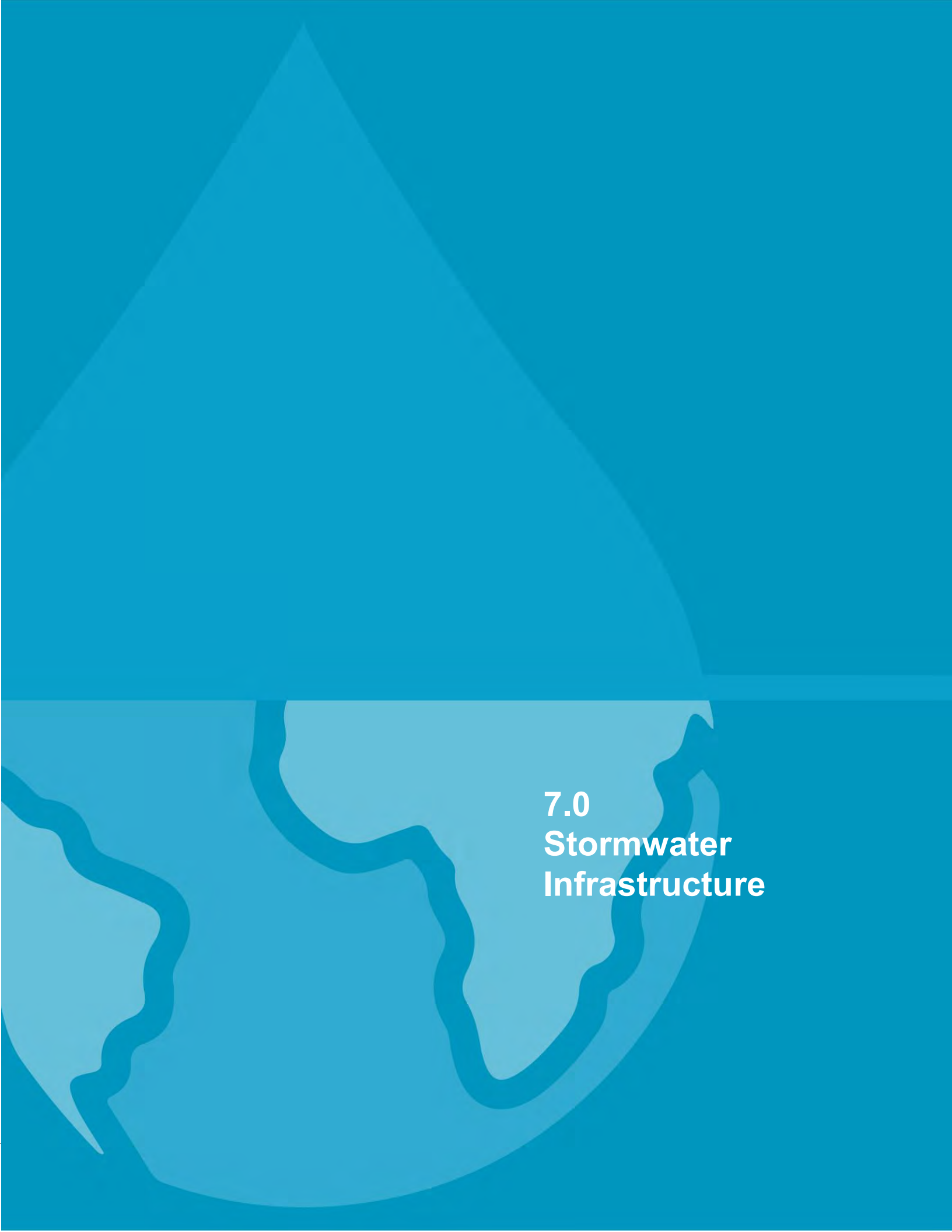
ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 6.11:
EXISTING AND PROPOSED WASTEWATER NETWORK IN VILLENEUVE



7.0 Stormwater Infrastructure

7.1 Introduction

Stormwater is distinct from water and wastewater in that stormwater runoff is naturally occurring and that conveyance facilities such as watercourses, creeks and rivers are naturally occurring. Also, much of the constructed stormwater conveyance systems are roadway ditches and culverts that are provided as part of a transportation network, often with little thought on the larger stormwater drainage system.

Overall, Sturgeon County has very little conventional stormwater drainage infrastructure such as storm sewers, stormwater management facilities (SWMF), outfalls. There are a number of constructed drainage ditches that provide agricultural drainage.

This project will consider both naturally occurring watercourses / creeks / rivers and constructed drainage facilities (ditches, pipes, SWMF), with a focus on stormwater infrastructure needed to service existing and future development.

7.2 Existing Drainage Basins and Major Hydrographical Features

Following sub-sections describe existing rivers and creeks in the County including their pertinent hydrographic information. The major creeks, lakes and rivers, along with their watershed boundaries are shown in Figure 7.1.

North Saskatchewan River

All of Sturgeon County drains to the North Saskatchewan River (NSR), primarily through the Sturgeon and Redwater River systems. The NSR has an average bed slope of 0.035% as it passes Sturgeon County.

There are a number of un-named watercourses draining directly to the NSR are in the east and southeast part of the County. These un-named watercourses tend to be relatively short and steep, connecting the upland areas to the river, and thus have high natural erosion rates. These channels can be a challenge for stormwater servicing due to the existing erosion issues and the sensitivity to increases in annual runoff volumes.

Big Lake and Sturgeon River

The Sturgeon River flows from west to east throughout Sturgeon County, originating in Parkland County and flowing through Lac St. Anne County. It joins Riviere Que Barre at the west end of the county and then flows southeast into Big Lake immediately west of St. Albert. Water from Big Lake then flows into the downstream section of the Sturgeon River in St. Albert. Downstream of St. Albert and Sturgeon Valley, the Sturgeon River flows northeast towards Gibbons before turning southeast where it flows into the North Saskatchewan River. The Sturgeon River has an average bed slope of approximately 0.09% within Sturgeon County.

The major watercourses that drain into the Sturgeon River / Big Lake are:

- Atim Creek, which originates in Parkland County and flows into the west end of Big Lake. It has an average bed slope of 2.4%.
- Riviere Que Barre, which originates in Westlock County and flows through the northwest corner of Sturgeon County, Alexander First Nation and back into Sturgeon County before flowing into the Sturgeon River. It has an average bed slope of 0.08%.
- Carrot Creek, which originates in Morinville and flows through natural channels and constructed ditches before becoming well defined in the northwest corner of St. Albert. It flows into the north end of Big Lake and has an average bed slope of about 0.23%.

Redwater River

The Redwater River drains the north portions of Sturgeon County including:

- a small area in the northwest part of the County;
- a large area in the north-central part of the County, including Ferrydell Creek; and
- the northeast corner of the County between Redwater and the North Saskatchewan River

The main stem of the Redwater River from Redwater to the NSR is about 15 km long and has an average longitudinal slope of 0.11%.

7.3 Existing Stormwater Infrastructure

This section presents a brief summary of the stormwater drainage infrastructure that has been constructed to facilitate residential, industrial and/or agricultural development. Drainage infrastructure that is in the County's GIS system, including storm sewers and registered ditch easements, are shown in Figure 7.2. Existing stormwater infrastructure for the key growth areas is also shown in Figures 7.3 to 7.8.

Based on a review of the background documents and discussions with County staff, the existing drainage system appears to be working reasonably well with numerous local issues that need to be addressed.

7.3.1 Drainage Ditches

As the County has thousands of kilometers roadway ditches, this sub-section will focus on major ditches only.

Manawan Canal

Manawan Canal flows southeast from Manawan Lake, around the northeast corner of Morinville and eventually joins into the Sturgeon River near Carbondale. The canal was constructed to provide agricultural drainage and to stabilize water levels in Manawan Lake. It is approximately 27 km long and has an average longitudinal slope of approximately 0.18%. This canal was constructed in the 1950's and rehabilitated in the 1970's. The canal also drains the northeast part of the Town of Morinville Landowners contribute to the maintenance of the canal through annual charges.

Villeneuve South Ditch

There are two watercourses / ditches draining the Hamlet of Villeneuve. The south ditch drains the south part of the hamlet plus the wastewater lagoon treated effluent. It is approximately 6.0 km in length and has an average bed slope of 0.17%. The upstream 4.2 km appears to be constructed and has a registered easement (refer to Figure 7.2). The remaining 1.8 km downstream is natural and drains into the Sturgeon River. It is understood that this ditch system (including culverts) is undersized and that the County is in the process of upgrading it.

Carrot Creek Ditches

There are a series of ditches draining urban development and agricultural land to Carrot Creek. They are immediately south of Morinville on the east side of Highway 2, a portion north of Highway 37 on the west side of Highway 2, and an east-west ditch at the north edge of St. Albert. These ditches have overtopped their banks during spring runoff conditions with flooding at the south end of Morinville noted by Town staff.

Sturgeon Industrial Park Ditches

There are approximately 6 ditches draining portions of the Sturgeon Industrial Park. These ditches typically originate in the agricultural land north and west of the SIP, drain existing developments within the park, and connect to local ravines and watercourses down to the North Saskatchewan River. One of these ditches (Drainage Basin E in SIP Stormwater Master Plan) is registered in the County's GIS system.

Alberta's Industrial Heartland Ditch / Outfall and Watercourses

There are several small creeks or natural watercourses draining the AIH into the North Saskatchewan River. These generally drain agricultural lands and are have not been upgraded.

Line 3 of the AIH Basin 7 drainage system was recently constructed facilitate upstream development within that basin. It commences south of Township Road 560 along Range Road 221 and extends to the northeast and then east to the river, refer to Figure 7.2.

7.3.2 Stormwater Management Facilities

There are limited Stormwater Management Facilities (SWMF) with Sturgeon County, with only newer development areas having SWMF. There was no GIS data or record drawings available for SWMF. The following descriptions are based on background reports and air photo imagery. Locations of known SWMF are shown in Figure 7.2.

Based on the age of the facilities and changes in design criteria, it is anticipated that a number of existing SWMF are undersized would require upgrading to accommodate future growth. There is no information available on existing SWMF being oversized to accommodate future development. Available information on existing stormwater management facilities is listed in Table 7.1 and is described below.

Table 7.1: Existing Stormwater Management Facilities

SWMF	Surface Area	Current Storage Volume	Required Storage Volume	Maximum Discharge Rate	Comments
	(ha)	(m^3)	(m^3)	(L/s/ha)	
Greystone Manor	1.2	n/a	n/a	n/a	
Tuscany Hills	1.4	n/a	n/a	n/a	
Rivers Gate	n/a	19,929	19,929	2.5	
Northern Lights	n/a	2,400	13,400	n/a	SWMF is undersized and is to be upgraded and outfall constructed
ProNorth	n/a	3,900	28,400	n/a	SWMF is undersized and is to be upgraded

Sturgeon Valley

There are three existing SWMF within Sturgeon Valley: Greystone Manor, Tuscany Hills and Rivers Gate. These SWMF were sized for their current development area. The Rivers Gate SWMF was designed to allow flow from upstream SWMF to flow through it to the Sturgeon River.

The other subdivisions within Sturgeon Valley were developed without stormwater management facilities. It is noted that most of these older subdivisions had relatively low imperviousness compared to typical urban developments. Also, stormwater runoff was directed to the Sturgeon River through a series of swales, which would provide a degree of stormwater treatment prior to discharge to the Sturgeon River.

Northern Nights Subdivision

There is a small temporary SWMF in the southwest corner of the Northern Lights development. Based on a 2013 report, it is understood that this SWMF does not have adequate storage nor a suitable outlet location to discharge to. The existing SWMF has 2,400 m^3 of storage but requires 13,400 m^3 of storage from the existing Stage 1 development to control discharge to 2.5 L/s/ha. Also, the SWMF currently needs to be pumped to the adjacent County road ditch.

ProNorth Industrial Park

Based on ProNorth Industrial Park Stormwater Management Study (April 2018), the existing SWMF is undersized for a 1:100-year rainfall event. The existing SWMF has a capacity of 3,900 m^3 and can be expanded to 13,800 m^3. Based on current development, 28,400 m^3 of storage is required. The report recommends that additional storage be constructed adjacent to the existing SWMF. The ProNorth SWMF drains to Carrot Creek via an open drainage channel.

Riviere Que Barre

There is a small pond located at the north end of Riviere Que Barre. Sturgeon County did undertake a drainage study of the hamlet in 2016 to assess the surface drainage issues. The scope of that study did not include an assessment of this pond as a SWMF. It is understood that this pond was not designed as a stormwater management facility with a controlled outlet rate.

Sturgeon Industrial Park

There are two existing SWMF that are visible within the Sturgeon Industrial Park development, refer to Figures 7.2 and 7.6. These SWMF were presumably designed for individual industrial sites as there is no design information available. These SWMF drain to the North Saskatchewan River via a series of ditches, culverts and natural drainage channels.

Alberta's Industrial Heartland

There are several open water storage facilities within the current AIH developments, but it is not evident which are stormwater facilities, and which are related to process water. These SWMF are licensed by the Province of Alberta.

7.3.3 Storm Sewers / Local Drainage Ditches

Storm sewers are generally limited to the Sturgeon Valley and Cardiff development areas. The remainder of the County is serviced with local ditches. No information is available on where existing storm sewers have been oversized to accommodate future development.

Sturgeon Valley

Sturgeon Valley uses a combination of storm sewers and local ditches to drain stormwater to the Sturgeon River. The storm sewers are shown in Figure 7.2 and summarized below (based on available GIS data). In addition to the local ditch system, there are two natural watercourses within Sturgeon Valley draining to the Sturgeon River. The existing storm sewers are summarized below:

- **Greystone Manor** – 1.4 km of storm sewers, with pipe sizes range from 250 – 900 mm
- **Tuscany Hills** – 2.2 km of storm sewers
- **Riverstone Pointe** – 3.6 km of storm sewers, with pipe sizes range from 250 – 600 mm
- **Pinnacle Ridge** – 1.5 km of storm sewers, with pipe sizes range from 675 – 750 mm
- **Summerbrook Estates** – 1.0 km of storm sewers, with pipe size ranges from 375 – 600 mm

Cardiff

The storm drainage system in Cardiff includes approximately 500 m of concrete pipes ranging from 450 to 900 mm draining to the field in the south.

7.3.4 Assessment of Existing Drainage System

Based on a review of the background documents and discussions with County staff, the existing drainage system appears to be working reasonably well with numerous local issues that need to be addressed. The key issues are summarized below:

- A number of existing SWMF are likely undersized and will therefore require upgrading to meet current standards. The Northern Lights and ProNorth SWMF are examples of undersized facilities.
- A number of the rural swales need to be upgraded. The South Villeneuve Ditch is proposed to be upgraded and the Carrot Creek ditch immediately south of Morinville also appears to be overloaded during major spring melt conditions.
- There are several existing swales and watercourses connecting industrial areas (Sturgeon Industrial Park and AIH) directly to the North Saskatchewan River. Any connections without SWMF with very low outlet rates will require downstream erosion protection due to the steep slopes in these watercourses.
- There are limited examples of where stormwater infrastructure has been constructed to accommodate future growth. The noted exception is Line 3 of the AIH Basin 7 was recently constructed and designed to accommodate future upstream development.

7.4 SWMF Design and Allowable Post-development Release Rates

SWMF need to be designed for storm events up to and including a 1:100-year event. With the relatively low release rates in the Edmonton Metropolitan Region, it is necessary to consider both the short and long duration events and the 1:100-year, 24-hour duration typically governs.

Climate change is affecting the rainfall intensity – duration – frequency (IDF) relationship, and thus the total rainfall volume that is expected to fall in a 24-hour period is increasing. The City of Edmonton has recently revised its servicing standards to reflect a larger 1:100-year, 24-hour rainfall depth for sizing SWMF. It is expected that other municipalities in the Edmonton Metropolitan Region will do the same.

One of the key design parameters for stormwater drainage systems is the allowable discharge rate from SWMF. This is normally based on the estimated 1:100-year pre-development peak flows and/or the available capacity in the downstream pipe or watercourse. It can also be refined to minimize the potential for erosion in downstream watercourses. The proposed post-development release rates from previous studies are summarized in Table 7.2 and described below.

The 2004 Big Lake Stormwater Management Plan recommended a maximum release rate of 2.5 L/s/ha based on pre-development flow rates upstream of Big Lake. This was established to manage flooding levels within Big Lake, upstream tributaries and downstream Sturgeon River to pre-development elevations. This release rate has been used extensively for new developments in the Big Lake / Sturgeon River watershed, including Sturgeon County, the City of St. Albert and the Town of Morinville.

The Alberta's Industrial Heartland Utility Master Plan (2007) recommended a post-development release rate of 1.0 L/s/ha based on estimated pre-development runoff and concerns about erosion risk in the steeper drainage channels near the North Saskatchewan River. A subsequent analysis carried out on behalf of a private developer indicated that the pre-development runoff rates for Drainage Basin 7 of the AIH (south end of AIH adjacent to North Saskatchewan River and Sturgeon River) would be between 2.6 and 6.9 L/s/ha. That study recommended a release rate of 7.0 L/s/ha with downstream erosion protection to mitigate the erosion risk. An outlet rate of 7.0 L/s/ha was adopted for Drainage Basin 7 provided that downstream ditch sections are designed with

adequate erosion protection. Line 3 at the downstream end of Basin 7 has been constructed with erosion protection to facilitate the proposed 7 L/s/ha outlet rate.

Table 7.2: Allowable Post-Development Release Rate References

Source	Locations Used / Intended	Allowable post-development release rate (L/s/ha)	Comments
2004 Big Lake Stormwater Management Plan	Big Lake / Sturgeon River Watershed, Sturgeon County, St. Albert, and the Town of Morinville	2.5	Discharge rate has been widely adopted with the watershed
Alberta's Industrial Heartland Master Plan (2007)	Alberta's Industrial Heartland	1.0	No developments have been constructed using this rate to date.
Pembina Railyard Storm Review Memo, May 2014	Drainage Basin 7 of the Alberta's Industrial Heartland	7.0	Infrastructure between SWMF and North Saskatchewan River to be sized for this rate; requires downstream erosion protection.
2010 Sturgeon Industrial Park Stormwater Master Plan	All new developments within S.I.P	3.0	Rate was selected based on compatibility with downstream culvert capacity

The 2010 Sturgeon Industrial Park Stormwater Master Plan proposes a maximum release rate of 3.0 L/s/ha for all new developments.

The variation in the above allowable post-development release rates across Sturgeon County are due to:

- local hydrological conditions (e.g. presence of natural storage in upstream wetlands, average ground slopes) which are used to estimate the pre-development flow rates;
- downstream constraints such as ditch / creek / pipe capacities and erosion potential due to steep slopes; and
- the cumulative impact when a large area is developed, and the corresponding increase in annual runoff volume.

The increase in allowable discharge rate from 1 L/s/ha to 7 L/s/ha in the AIH is somewhat unusual but can be justified if the outfall channels to the North Saskatchewan River are designed to manage the cumulative discharge rates. This includes both the conveyance capacity and erosion control, provided that the erosion control system can manage any potential increases in total suspended solids being discharged to the North Saskatchewan River.

It should be noted that it is not necessary to restrict flows to pre-development rates when discharging directly to the North Saskatchewan River due to the very large capacity of the river compared to stormwater discharges. Alberta Environment and Parks recent approvals of SWMF discharging to the North Saskatchewan River have focused exclusively on water quality controls.

7.5 Capacity of Existing Infrastructure for Growth

Based on the description of existing stormwater infrastructure, there are only two locations where stormwater infrastructure has been constructed with allowance for future upstream development:

- Line 3 Outfall for Basin 7 of the AIH; and
- Rivers Gate Outfall Structure to the Sturgeon River (upstream development required to provide own storage).

It is noted that, in general, natural creeks and watercourses can be used for conveying stormwater runoff from upstream development areas, as long as the developments utilize stormwater management to control discharge rates to pre-development levels or other approved rates. Thus, with adequate stormwater management, existing watercourses generally have capacity to accommodate growth.

Examples of where the existing natural watercourses can be used to accommodate growth are:

- Local areas within Sturgeon Valley;
- The north and south ditches draining Villeneuve;
- Existing watercourses draining to the North Saskatchewan River within the Sturgeon Industrial Park (hydraulic capacity).

It should also be noted that some creeks and watercourses located immediately adjacent to the North Saskatchewan River may be very erosion prone and thus do not have capacity to accept stormwater runoff controlled to pre-development rates. As illustrated in the AIH, controlling stormwater to very low rates (e.g. 1.0 L/s/ha) requires large SWMF which may not be economical. In this case, constructed ditches with erosion protection is the only viable way to provide stormwater servicing to the area.

In other cases, the local drainage system is poorly defined and there is no current outlet available. This is the case for the proposed development in Cardiff and at the south part of Sturgeon Valley.

As there is almost no constructed stormwater infrastructure to service new growth areas, it is not practical to determine the capacity of existing infrastructure, nor is it practical to determine the gap between the existing infrastructure and that needed for growth.

7.6 Role of Demand Management to Minimize New Infrastructure Requirements

There are limited opportunities to minimize the stormwater infrastructure requirements. Stormwater management facilities will be required for all new developments. The downstream infrastructure requirements can be minimized, and in some cases eliminated, with the use of large SWMF with very low outlet rates. Conversely, the size and cost of SWMF can be reduced by using higher outlet rates, which will require suitable downstream outfalls including erosion protection.

Low Impact Development (LID) can reduce the runoff volume and rates. LID should be considered as an option where the SWMF discharge to small, erosion prone watercourses. The benefit of LID in these situations is the reduction in annual runoff volume, which is a key issue for erosion in natural channels. The cost effectiveness of LID to reduce runoff volumes can only be determined on a case to case basis.

7.7 Stormwater System Upgrades to Meet Future Stormwater Flows

The stormwater system upgrades to meet future stormwater flows at each proposed growth area are described below. The proposed drainage concepts are shown in Figures 7.3 to 7.8. As each development will need to construct its own local stormwater collection system and SWMF, the discussion below focuses on the stormwater infrastructure needed to convey stormwater runoff from the SWMF to the receiving water body.

Alberta's Industrial Heartland

The existing drainage basin boundaries as per Heartland Utility Master Plan are shown in Figure 7.3.

The only existing County stormwater infrastructure is the Line 3 outfall for servicing Basin 7. The servicing concept for the upstream part of Basin 7 includes two stormwater ditches, referred to as Lines 1 and 2, refer to Figure 7.3.

A detailed stormwater servicing study is needed to determine the most cost-effective way to service the proposed growth area. The growth area is generally located within Basins 5 and 6, which drains to two natural watercourses to the North Saskatchewan River. The current plan is to utilize a very low outlet rate of 1.0 L/s/ha to minimize the need for downstream erosion protection. A detailed analysis could determine that it is more cost effective to minimize the SWMF land dedication and construct a protected outfall similar to the stepped gabion drop structure installed for Basin 7.

With the large industrial developments in the AIH, it is assumed that the industries will construct their own private SWMF, with the County coordinating the planning and construction of the storm drainage channels.

Cardiff

The existing topography is relatively flat and extending the drainage off site may not be feasible. The stormwater drainage concept in the draft Estates at Cardiff ASP is to utilize an evaporation SWMF with an overflow to the park site. This concept appears to be feasible, but detailed engineering analysis is needed to confirm the SWMF size. The stormwater drainage concept is shown in Figure 7.4.

ProNorth Industrial Park

The existing ProNorth SWMF is also undersized for its current development area. This will also need to be corrected to allow further development of this industrial area.

To service the proposed new development areas to the north, additional stormwater management facilities are proposed, as shown in Figure 7.5. These SWMF will discharge to Carrot Creek either through the same drainage channel as the existing SWMF as shown in Figure 7.5, or via an alternate alignment.

Sturgeon Industrial Park

The proposed drainage basin boundaries in the SIP Stormwater Master Plan are shown in Figure 7.6. The proposed growth area in the SIP are located entirely within Basin E-1P. The proposed servicing concept for this basin includes SWMF connecting to drainage channels and culverts, eventually discharging to the North Saskatchewan River. Previous studies recommend an allowable outlet rate of 3.0 L/s/ha for the SIP, which may not be low enough to manage erosion in the downstream watercourses. It is recommended that the allowable outlet rate be reviewed, considering these steep natural watercourses.

While the existing SWMF have been constructed by private industry, the future SWMF could be either privately or publicly owned and operated in the future.

Sturgeon Valley

The proposed drainage basin boundaries for the proposed growth areas in the southwest part of Sturgeon Valley are shown in Figure 7.7. These boundaries generally follow the proposed post-development boundaries in previous Sturgeon Valley stormwater studies.

The Rivers Gate SWMF was designed for the two catchment areas south of Sturgeon Road to drain through it to the Sturgeon River. The adjacent catchment is to discharge to the Sturgeon River through an existing watercourse. The southwest area will be serviced by a new stormwater trunk and outfall to the Sturgeon River, refer to Figure 7.7.

The drainage basin south of Township Road 542 (Valour Road) and west of Range Road 250 naturally drains to the east towards Lakeside Golf Course. There is no natural outlet for these lands other than the wetland next to the golf course. To convey stormwater to the Sturgeon River, a new outlet would need to be constructed as shown in Figure 7.8 and proposed in the Sturgeon Valley Utility Servicing Update. This outlet is proposed to be a combination of drainage channels and storm sewers.

Sturgeon Valley East and CFB Edmonton

The proposed development in Sturgeon Valley East west of Highway 28 is also proposed to drain to the Sturgeon River by the above outlet, refer to Figure 7.8.

The lands east of Highway 28 in CFB Edmonton appear to be too low to be serviced by gravity to the west. The proposed servicing concept is to drain these lands to the northeast through the natural watercourse to the Sturgeon River, refer to Figure 7.8.

Villeneuve

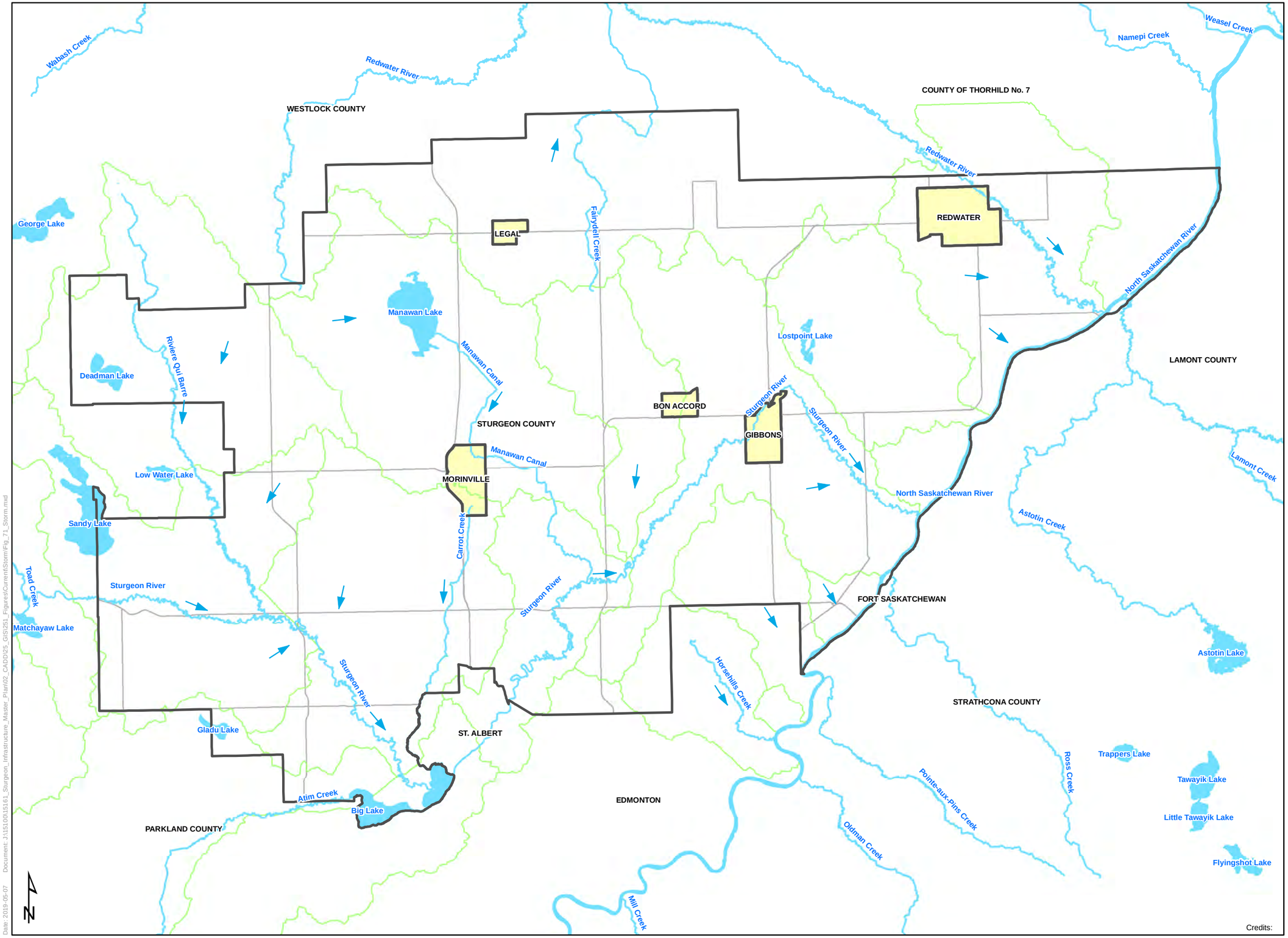
The Hamlet of Villeneuve currently drains to the South Ditch, which drains from the south side of the hamlet east to the upper reach of the Sturgeon River. The proposed servicing concept for the proposed growth area in the hamlet, as proposed in the Villeneuve Area Structure Plan, is shown in Figure 7.9. It includes a new storm sewer that drains to the south, connecting into a drainage channel that connects to the South Ditch. The location of the connection point depends on the elevation of the storm sewer and the drainage ditch.

The Villeneuve Airport is located adjacent to the North Ditch, refer to Figure 7.9. The proposed stormwater servicing concept for the airport development includes a SWMF located adjacent to Range Road 270, with discharge to the North Ditch to the north and east.

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.1:

MAJOR CREEKS, RIVERS AND LAKES



Direction of Flow

Rivers and Creeks

Lakes

Approximate Watershed Boundaries

Major Roads

Municipality Boundaries

Sturgeon County

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

ISL Engineering and Land Services

Sturgeon County

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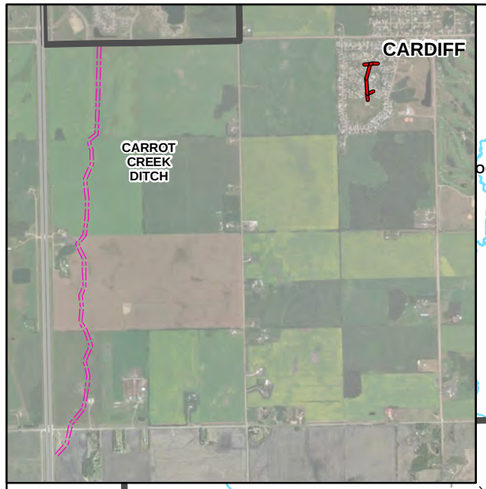
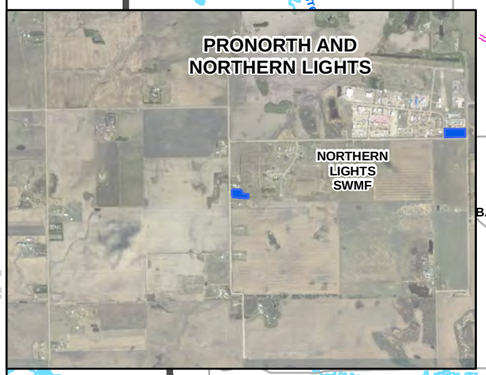
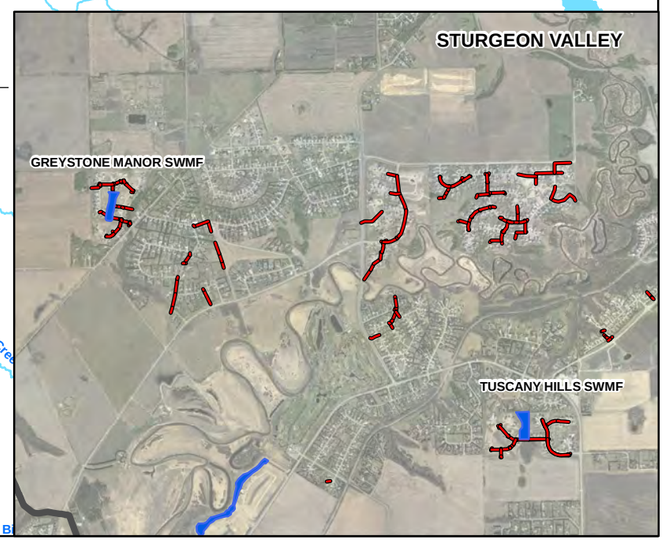
STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.2:

STORMWATER INFRASTRUCTURE







Redwater River
OCK COUNTY
LEGAL
Fairydell Creek
Manawan Lake
ALCOMDALE
Riviere Qui Barre
Deadman Lake
Lostpoint Lake
BON ACCORD
Sturgeon River
GIBBONS
LAMONT COUNTY
AIH DRAINAGE BASIN 7
STURGEON COUNTY
Manawan Canal
MORINVILLE
CARDIFF
BARRE
Carrot Creek
North Saskatchewan River
HU HAVEN/RIVERSIDE
STURGEON INDUSTRIAL PARK
FORT AUGUSTUS
Lamont Creek
Astotin Creek
FORT SASKATCHEWAN
Matchayaw Lake
CALAHOO
PRONORTH
NORTHERN LIGHTS
STURGEON VALLEY
Horsehills Creek
VILLENEUVE AIRPORT
VILLENEUVE
Gladu Lake
VILLENEUVE SOUTH DITCH
ST. ALBERT
Big Lake
EDMONTON
Oldman Creek
Mill Creek

- Existing Storm Sewers
- Stormwater Management Facility
- Registered Ditches
- Lakes
- Rivers and Creeks
- Municipality Boundaries
- Sturgeon County

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

All viewports are scaled at 1:50,000

ISL Engineering and Land Services

Sturgeon County

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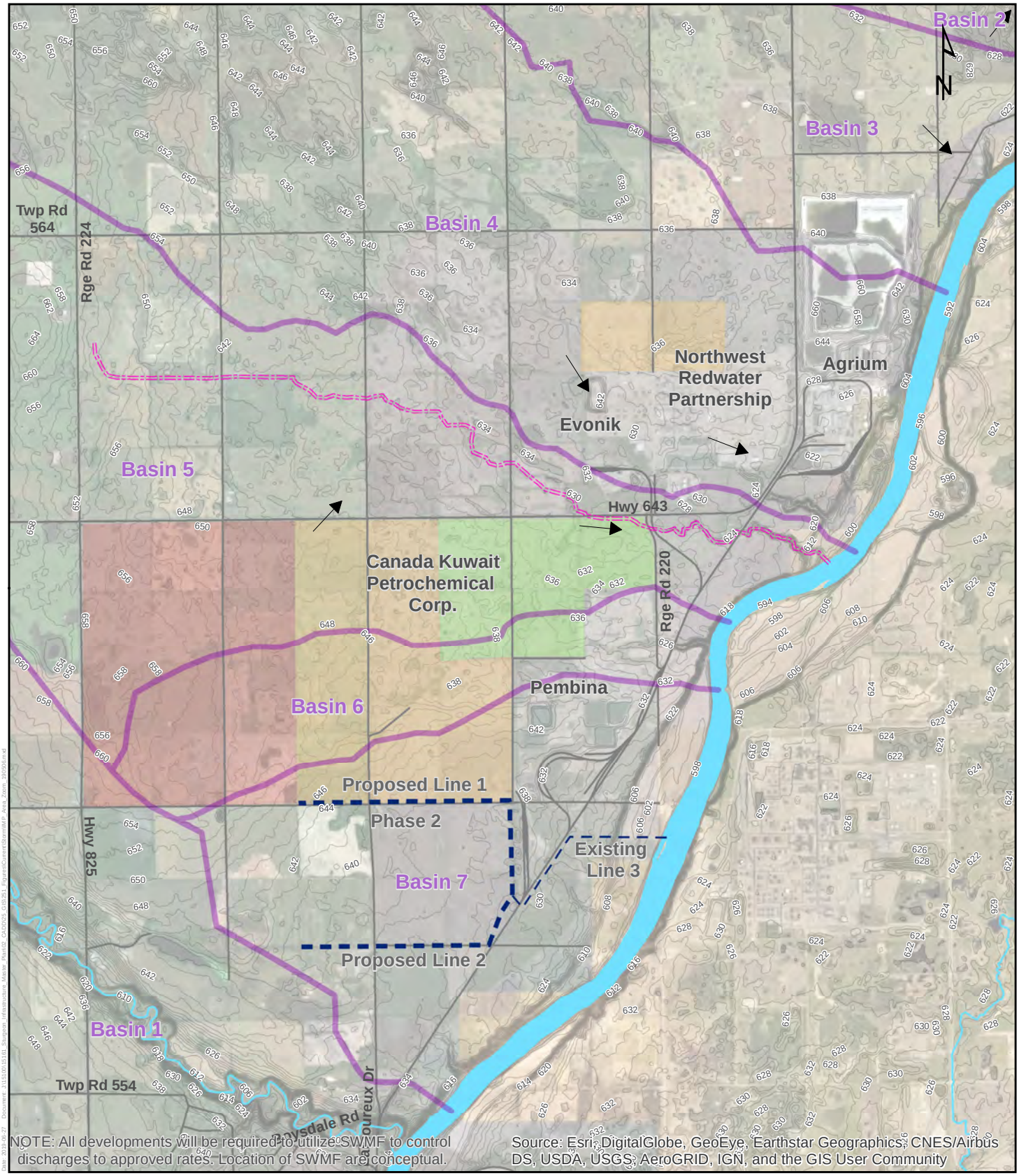


ISL Engineering and Land Services

0 250 500 1,000 1,500 m

CANA83-3TM114 1:60,000

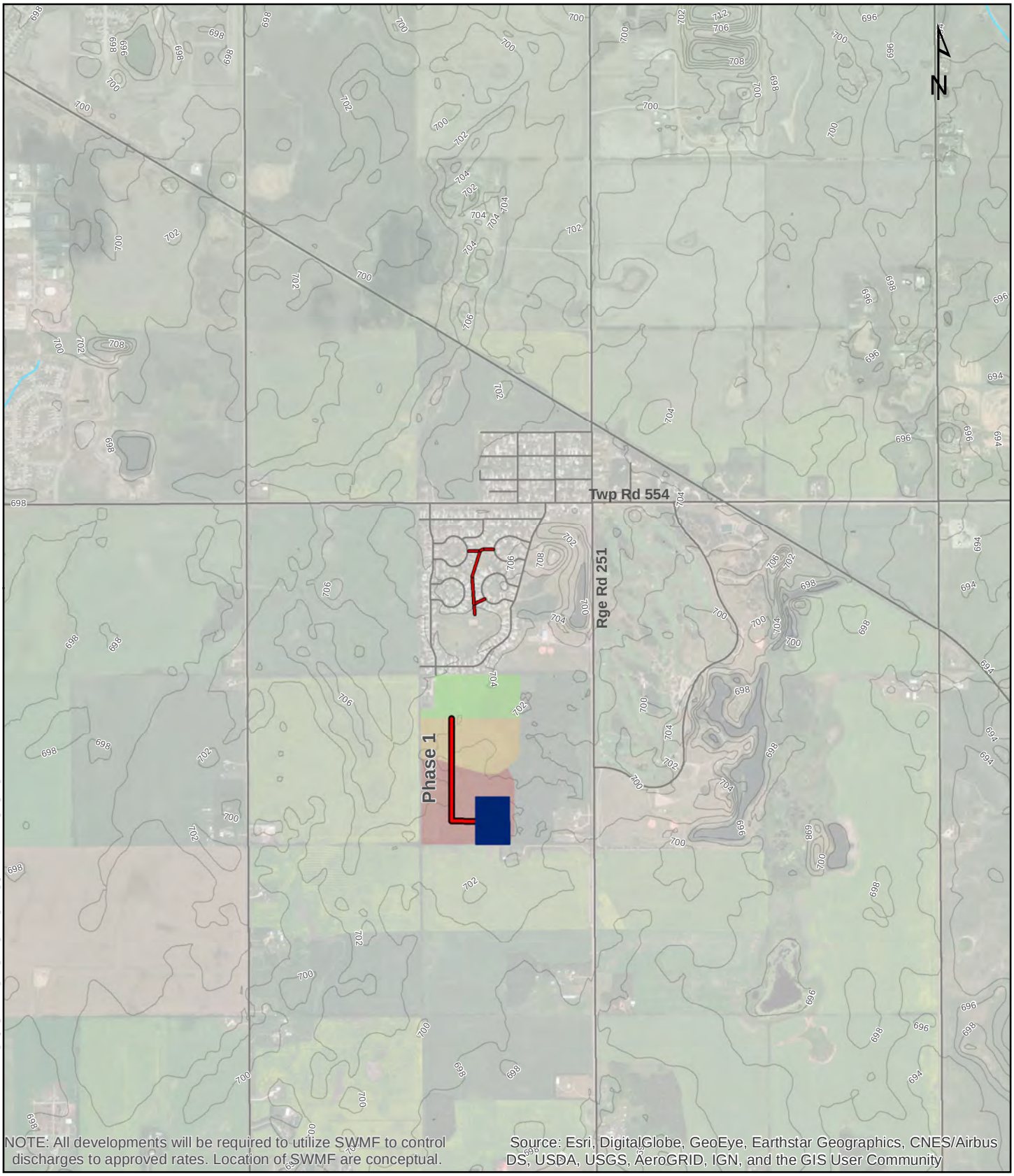
- Storm Sewers
- Proposed Sewers
- Registered Ditches
- Existing Drainage Channels
- Proposed Drainage Channels
- Stormwater Management Facility
- Proposed SWMF
- Direction of Flow
- Storm Sub-Basin Boundary
- Lakes
- Rivers and Creeks

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Major Roads

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.3:
EXISTING AND PROPOSED STORMWATER NETWORK IN ALBERTA'S INDUSTRIAL HEARTLAND



ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

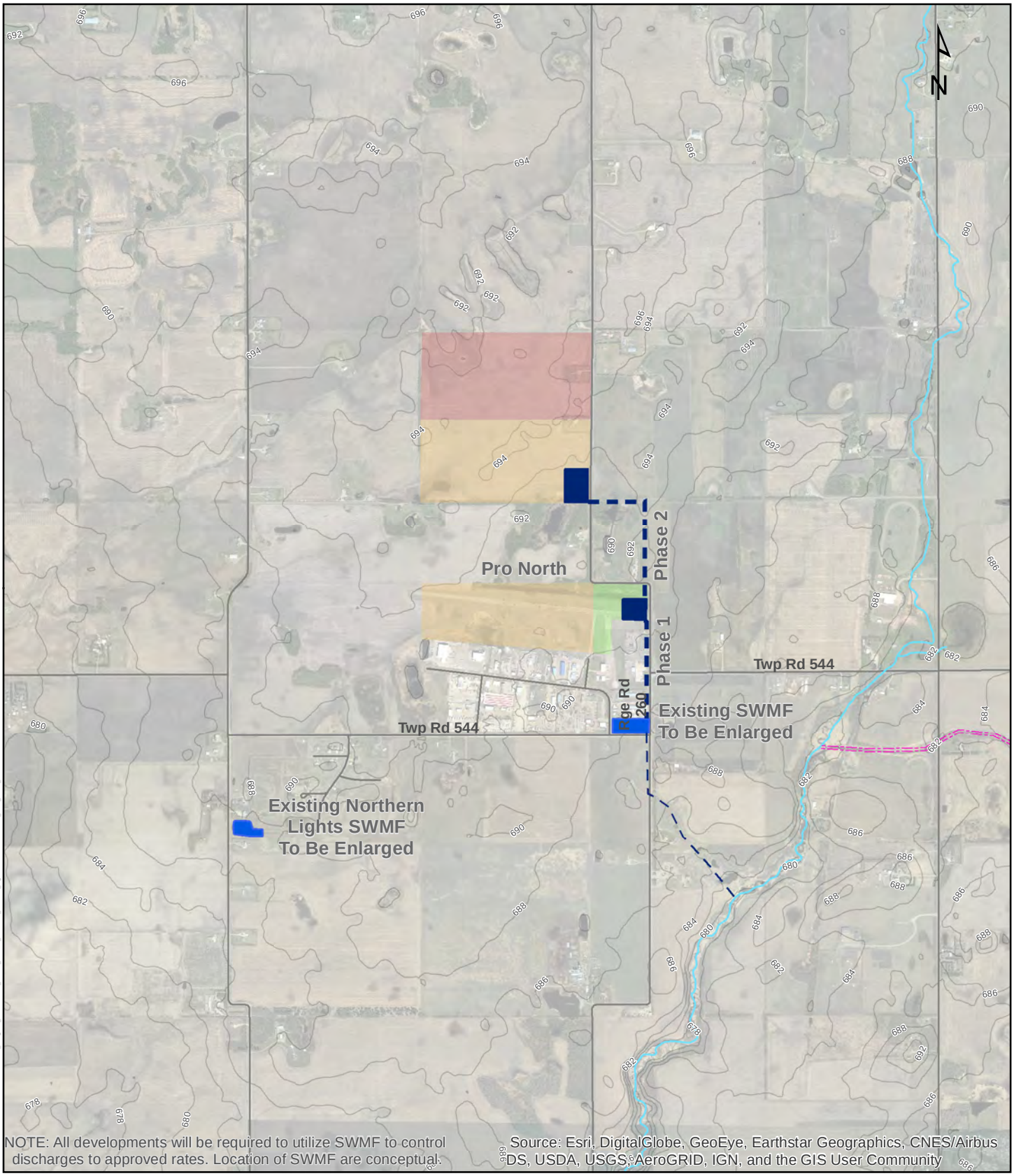
- Storm Sewers
- Proposed Sewers
- Registered Ditches
- Existing Drainage Channels
- Proposed Drainage Channels
- Stormwater Management Facility
- Proposed SWMF
- Direction of Flow
- Storm Sub-Basin Boundary
- Lakes
- Rivers and Creeks

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Major Roads

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.4:
EXISTING AND PROPOSED STORMWATER NETWORK IN CARDIFF



NOTE: All developments will be required to utilize SWMF to control discharges to approved rates. Location of SWMF are conceptual.

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

ISL Engineering and Land Services

0 125 250 500 750 m

CANA83-3TM114 1:25,000

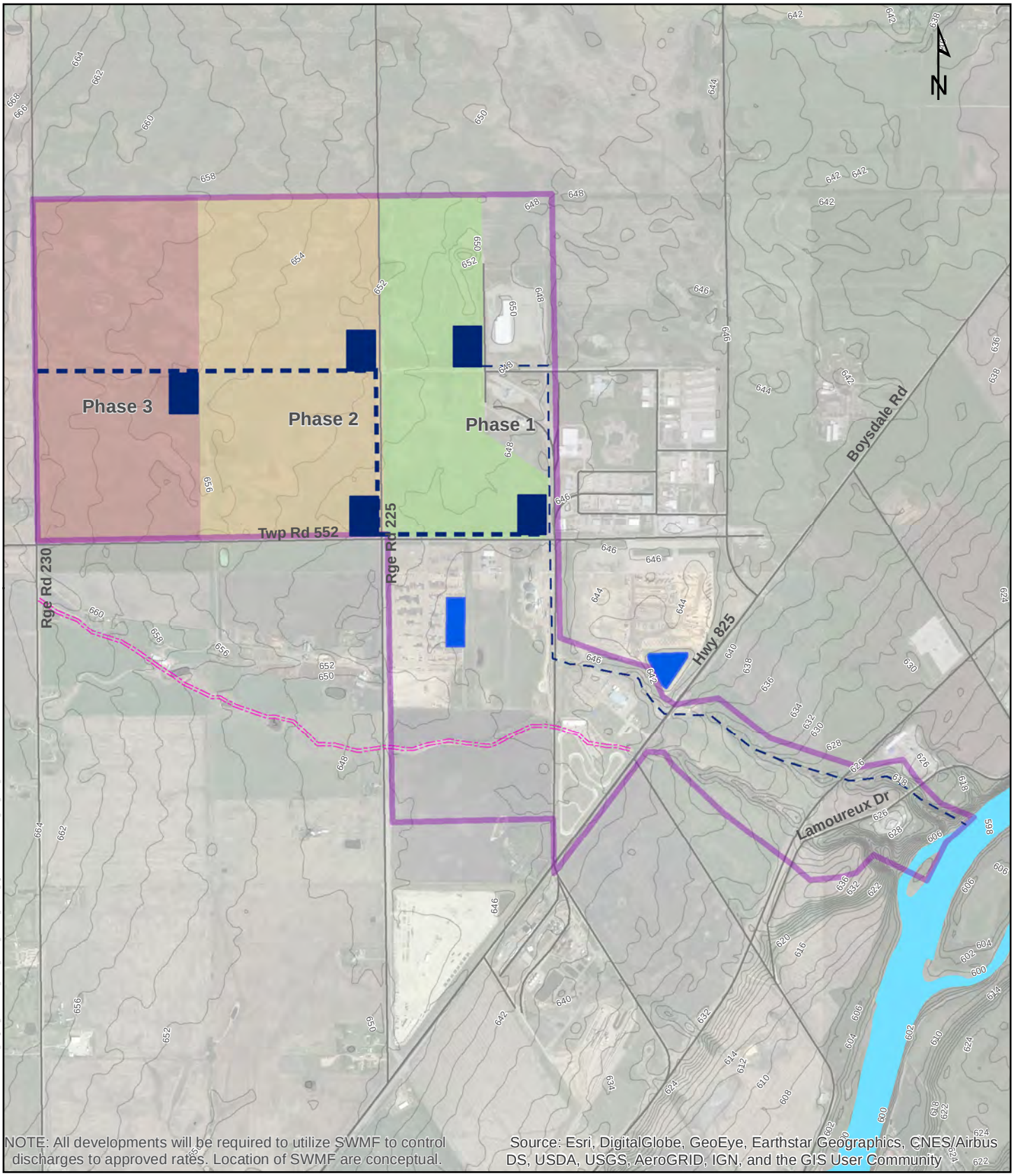
- Storm Sewers
- Proposed Sewers
- Registered Ditches
- Existing Drainage Channels
- Proposed Drainage Channels
- Stormwater Management Facility
- Proposed SWMF
- Direction of Flow
- Storm Sub-Basin Boundary
- Lakes
- Rivers and Creeks

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Major Roads

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.5:
EXISTING AND PROPOSED STORMWATER NETWORK IN PRO NORTH / NORTHERN LIGHTS



NOTE: All developments will be required to utilize SWMF to control discharges to approved rates. Location of SWMF are conceptual.

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

ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

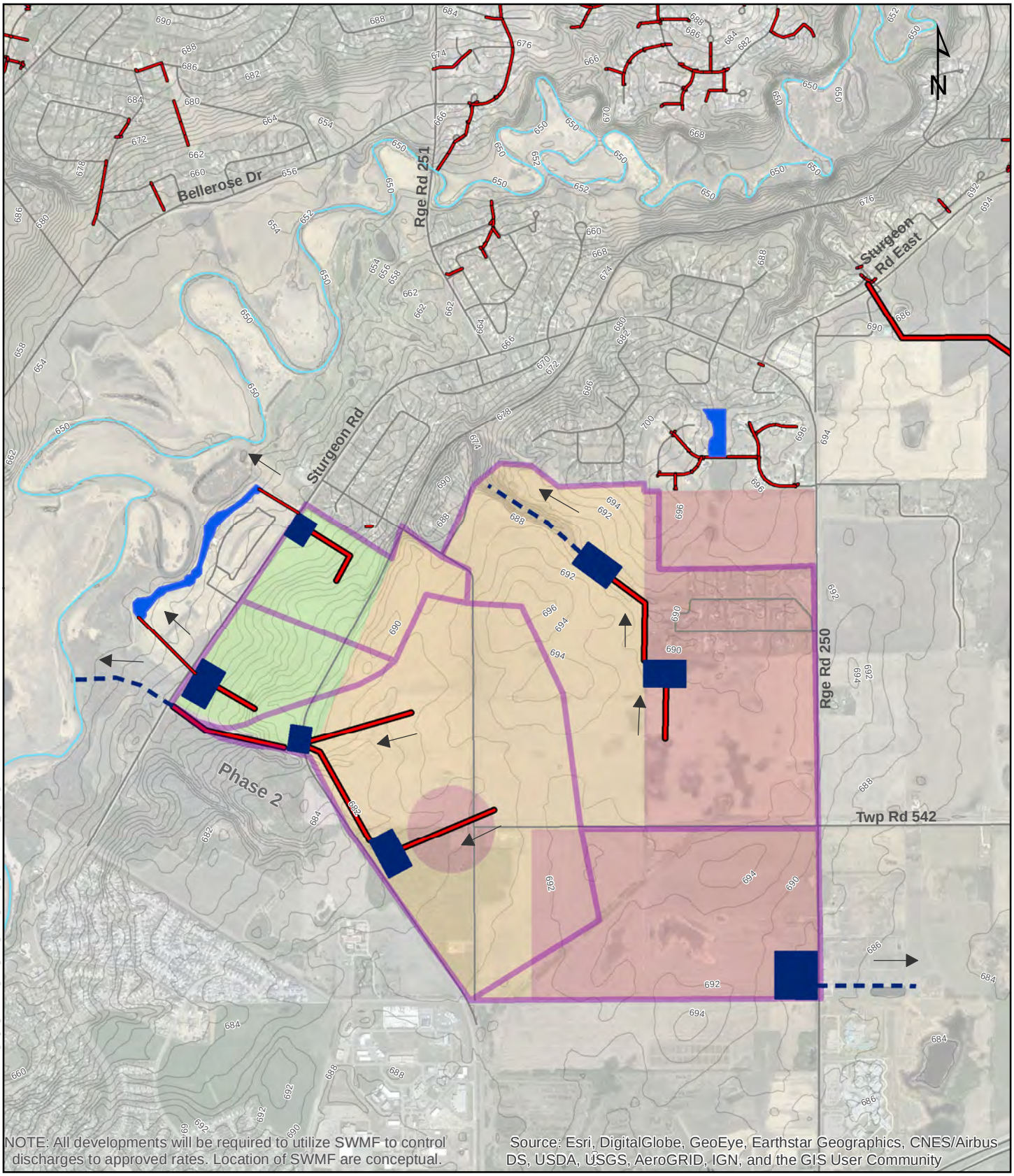
- Storm Sewers
- Proposed Sewers
- Registered Ditches
- Existing Drainage Channels
- Proposed Drainage Channels
- Stormwater Management Facility
- Proposed SWMF
- Direction of Flow
- Storm Sub-Basin Boundary
- Lakes
- Rivers and Creeks

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Major Roads

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.6:
EXISTING AND PROPOSED STORMWATER NETWORK IN STURGEON INDUSTRIAL PARK



ISL Engineering and Land Services

0 125 250 500 750 m

CANA83-3TM114 1:25,000

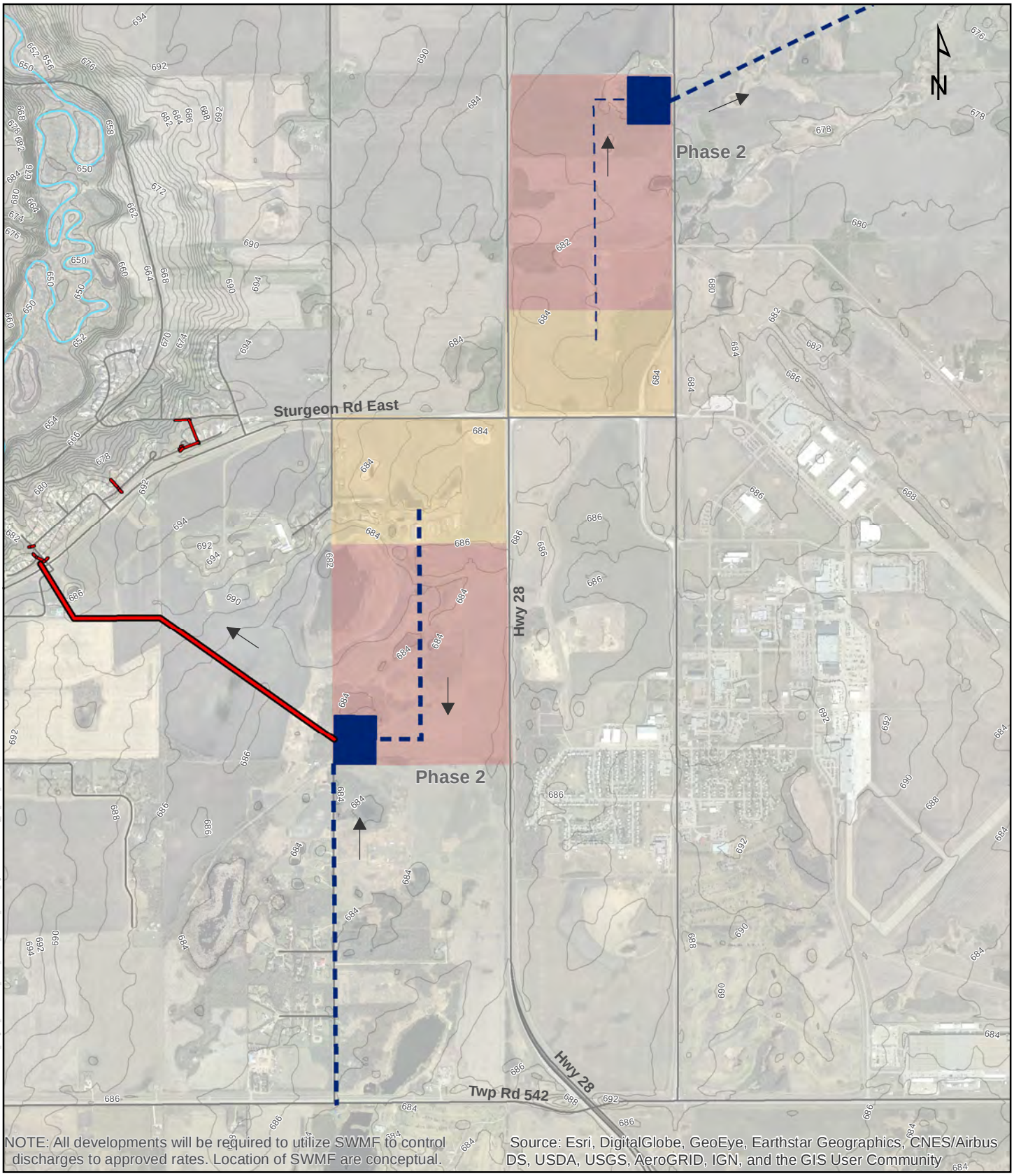
- Storm Sewers
- Proposed Sewers
- Registered Ditches
- Existing Drainage Channels
- Proposed Drainage Channels
- Stormwater Management Facility
- Proposed SWMF
- Direction of Flow
- Storm Sub-Basin Boundary
- Lakes
- Rivers and Creeks

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.7:
EXISTING AND PROPOSED STORMWATER NETWORK IN STURGEON VALLEY



ISL Engineering and Land Services

- Storm Sewers
- Proposed Sewers
- Registered Ditches
- Existing Drainage Channels
- Proposed Drainage Channels
- Stormwater Management Facility
- Proposed SWMF
- Direction of Flow
- Storm Sub-Basin Boundary
- Lakes
- Rivers and Creeks

Growth Phase

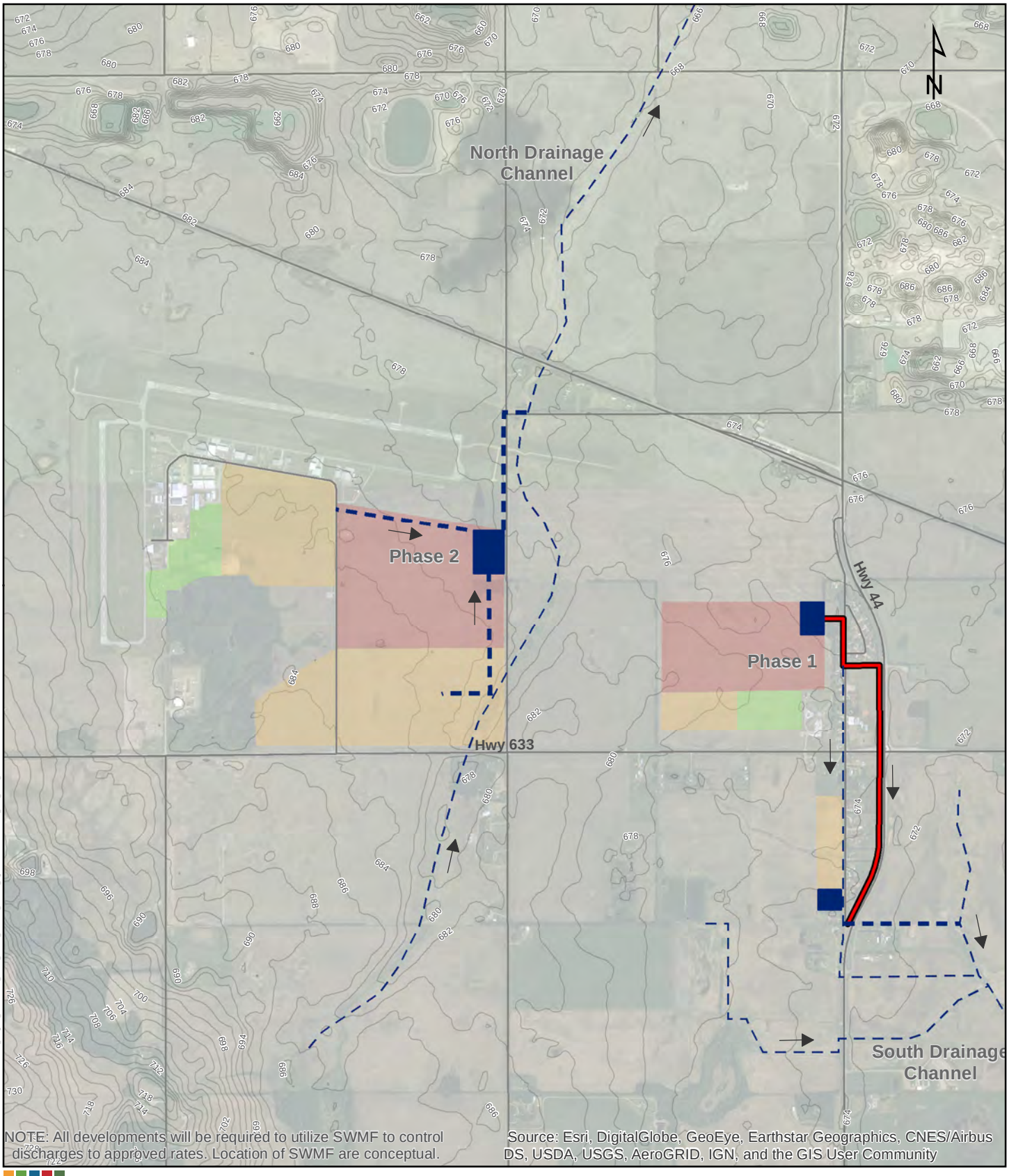
- 1 (2024)
- 2 (2034)
- 3 (2044)
- Road

0 125 250 500 750 m

CANA83-3TM114 1:25,000

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.8:
EXISTING AND PROPOSED STORMWATER NETWORK IN STURGEON VALLEY EAST & CFB EDMONTON



ISL Engineering and Land Services

0 100 200 400 600 m

CANA83-3TM114 1:25,000

- Storm Sewers
- Proposed Sewers
- Registered Ditches
- Existing Drainage Channels
- Proposed Drainage Channels
- Stormwater Management Facility
- Proposed SWMF
- Direction of Flow
- Storm Sub-Basin Boundary
- Lakes
- Rivers and Creeks

Growth Phase

- 1 (2024)
- 2 (2034)
- 3 (2044)
- Major Roads

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

FIGURE 7.9:
EXISTING AND PROPOSED STORMWATER NETWORK IN VILLENEUVE

8.0
Implementation Plan

8.1 Introduction

Sections 4 through 7 focused on proposed technical solutions to provide transportation, water, wastewater and stormwater servicing in response to population and growth projections. This section will build on these proposed technical solutions and develop a detailed strategy to implement these servicing concepts over time. The strategy needs to be flexible, adaptive and pro-active to overcome numerous challenges associated with implementing a master plan.

8.2 Transportation

8.2.1 Transportation Infrastructure Timing and Costs

Section 4.0 outlines the analysis for the existing and future transportation system, justifying the need for several studies in the near future. As a general statement, there are minimal infrastructure improvements needed in the future, except those resulting from changes to roadway classifications. Section 4.0 discusses several improvements based on changes to the roadway classifications, including roadway widening, dust abatement and surface improvements, but this information is not accurate until the classification system is consolidated as there are several classifications proposed/used in the County, including the system proposed in this study. The projected timing and costs for transportation infrastructure is shown in Table 8.1 for the three growth horizons. These projects should be completed by the identified phase.

Table 8.1: Transportation Infrastructure Project Costs

Category	Project / Study	High Level Cost ($M)	Notes
Planning Horizon: Phase 1 (2024)			
Capital Projects			
Studies	Funding Mechanism Study	0.10	See section 8.2.5 (additional studies) for details
	Sturgeon Road Functional Study	0.25	
	Transportation Master Plan	0.30	
	Transit Feasibility Study	0.05	
	Roadway Classification Consolidation Study	0.02	
Total Cost (million)		**$ 0.72**	**million**
Planning Horizon: Phase 2 (2034)			
Capital Projects	Cardiff Road East and Highway 28	0.5 / 2.0	Signal / Roundabout~
	Starkey Road and Highway 37	0.5 / 2.0	Signal / Roundabout~
	A – Sturgeon Road Widening (with Highway 28 intersection improvements) B - 127 Street Extension from AHD to Sturgeon Road (two lanes)	A – 31.0 B – 34.7	A - Geometric improvements and widening / B - Construct 127 Street Extension
Total Cost (million)		**$ 32.0/36.7**	**million**
Planning Horizon: Phase 3 (2044)			
Capital Projects	Range Road 230 and Highway 37	0.0	Monitoring
	Range Road 240 and Highway 28	0.0	Monitoring
Total Cost (million)		**$ 32.7/37.4**	**million**

~The type of intersection required should be discussed with Alberta Transportation.

8.2.2 Financial

This study focuses on transportation servicing requirements to support future population and employment growth in the County, as such; funding mechanisms to cover the costs of improving transportation infrastructure to support growth are needed. Options for consideration are provided for future reference, including:

1. Costs are covered through an off-site levy that is paid by the developer based on a per/hectare costs, at the time of the development. The off-site levy rate is based on detailed costs analysis of the required infrastructure to support the development basin benefiting from the infrastructure. The size/allocation on the benefiting basis is determined through an offsite levy study, through review of future growth areas and typically based on their boundaries. Infrastructure requirements are adapted from this study, except that detailed analysis of benefit to new development compared to existing development is conducted.
    a. Front-ending the costs of improvements even with an off-site levy can still be challenging. The following discussion points are provided based on different party's front ending costs.
        i. Option 1: Development front ends infrastructure and is paid back by subsequent developments.
        ii. Option 2: The County front ends the infrastructure and is paid by developments.
        iii. Option 3: No infrastructure improvements are constructed until there is sufficient off-site levy collected to cover the costs.
    b. Option 1 and 2, have similar financial risks to either party (development of County) as they rely on future developments to cover the up front costs of infrastructure and the risks are dependant on economic conditions, availability of other servicing (water, wastewater) and other factors beyond outside of the transportation subject area.
    c. Option 3, has less financial risks to both parties, but requires ongoing monitoring to ensure that existing transportation infrastructure can accommodate new development traffic. This option is reasonable, where there is spare transportation capacity available to accommodate a certain amount of growth.
    d. A benefit of an off-site levy is that it provides the development industry a clear indication of their financial responsibility for improvements and allows costs to be shared reasonably across a large benefitting area.
2. The traditional funding mechanism is servicing agreements, in which the development negotiates their share of the costs based on their benefit compared to existing developments. These types of agreements are simpler for smaller developments where there is a obvious benefitting party. Where there is a large development area and several benefitting parties it is more challenging, without a larger, detailed study.
3. Funding for larger, regionally significant projects, such as the construction of 127 Street likely requires collaboration at the regional level, including other benefiting municipalities and potentially Alberta Transportation. The EMRB conducts annual priority reviews of the transportation projects in the region and through collaboration amongst benefiting parties this is used to support provincial/federal funding applications.
4. Typical funding mechanisms for transit include allocation of general tax revenues for transit and cost recovery through ticket sales. At the regional level, Sturgeon County has signed on to an agreement to part of the Edmonton Region Transit Commission, which is a fairly new initiative (late 2018) and in the early phases. It is expected that through the commission funding for transit initiatives would be lobbied to the province and submitted to the federal government as part of funding requests through the public transit infrastructure fund (PTIF).

It is recommended that the County conduct further review of funding mechanisms, including the information provided above and any other information (not included) that is relevant. This section of the report is not an exhaustive inventory of funding mechanism as it is intended as a discussion point to justify further study.

8.2.3 Governance

Collaboration with Alberta Transportation: A substantial portion of the roadways in the County are regional/provincial highways in nature and are owned and operated by Alberta Transportation. These highways provide connectivity to/from the majority of the existing and future growth areas and generally the majority of improvements identified in this study relate to County roadway/Alberta Transportation highway intersections. As such, any roadway or intersection improvements to support future growth need to be planned, designed and constructed to Alberta Transportation standards. In addition, a permit from Alberta Transportation is required for new or changes to roadside developments within their highway control zone, which is 300m from a provincial right-of-way or 800 m of the centerline of a highway and public road intersection. Some municipalities may circulate proposed development plans to Alberta Transportation for information, outside of their control zone.

Future Technologies and Mode Shift: At the County level, recommended steps to support the development and application of transportation tools that reduce vehicular demand or improve roadway capacity as discussed in section 4.4, are as follows:

- Studying the feasibility of a transit service for the Sturgeon Valley area to determine location, phasing and capital funding requirements.
- Dedicating capital funding to further study the implications of other future technology to determine implementation strategies that could be incorporated into future major capital projects, including roadway widening and intersection improvement projects.
- Allow/coordinate testing of autonomous vehicles on County roads to further study the implications. A starting point is connecting with the University of Alberta, and/or the Canadian Autonomous Vehicles Centre of Excellence.
- Promotion of existing smart phone applications that provide ride-sharing services, including UberPool and future services yet to be developed.

8.2.4 Corridor Protection

Protecting roadway corridors includes identifying the ultimate right of way requirements to support the ultimate roadway needs and protecting or obtaining the right of way for future use. Sturgeon Road in the Sturgeon Valley requires widening to four lanes to support growth in the case that 127 Street is not constructed. The detailed analysis is in Appendix D.

Sturgeon Road requirements are as follows:

- **Option 1 (Without 127 Street):** Sturgeon Road requires four lanes, across the Sturgeon Valley area, potentially between City of St. Albert limits to Highway 28 (6 – 7 km length). Additional right of way is needed to protect for widening and the amount of right of way needed should assessed through a functional study. A transportation master plan should conduct a detailed assessment of whether Sturgeon Road widening is required across the entire Sturgeon Valley area.
- **Option 2 (With 127 Street):** Sturgeon Road is maintained as a two lane cross section.

8.2.5 Additional Studies

Transportation Master Plan

A detailed analysis of the existing and future transportation system, including subject areas not studied in detail or excluded in this study, is recommended. Several of these unstudied areas are noted in this report and are consolidated in this section for reference as follows:

- **Additional Study Intersections:** Certain intersections and areas are noted to likely required additional analysis include:
  - Future Major Employment Areas, including expansion of AIHA and SIP
  - TWP Road 544 and Highway 2;
  - Highway 44/Highway 633;
  - Range Road 270 and Highway 633 (if this becomes a main access).

- **Railways and Railway Crossings:** Sturgeon County's primary industries rely on rail (shown in Appendix C) to get products out to market. As such, a study reviewing the rail infrastructure within the county is recommended, including:
  - An inventory of the rail lines, rail crossings and an assessment of railway crossings at roadways using Transport Canada's Guidelines;
  - Planned future rail projects or expansions within the County to support growth.

- **Goods Movement Network:** Sturgeon County's economy is primarily driven by heavy industrial and agricultural sectors. Both sectors require specialized equipment that should be considered when designing and upgrading Sturgeon County's roadway network. Corridors expected to accommodate specialized equipment typically necessitates increased roadway widths and/or pavement upgrades to prevent premature deterioration of the roadway surface. A focused study on the types of specialized equipment expected on the Sturgeon County roadway network and their associated requirements is recommended in order to ensure Sturgeon County is able to continue supporting the heavy industrial and agricultural sectors. The following topics are suggested for this subject area, focus on the County's roadways (AT already maintains the provincial high/heavy load corridors):
  - An inventory of existing and future heavy industrial and agricultural equipment routes needed;
  - Review of routes to confirm accommodation of heavy/wide/long vehicles, including intersection requirements; cross section requirements, surface/subsurface needs;
  - Potential improvements or roadway maintenance program for areas with expected repeated specialized equipment traffic.

- **Local Intersections:** The infrastructure master plan focuses on key intersections that feed into population and employment areas, typically intersecting a highway. A study inventorying and assessing key local intersections is recommended to assess the County's roadway network at a more detailed level. Suggested topics include an inventory of key local and collector intersections, for both residential and industrial areas. Potential intersections include:
  - Main Street (Cardiff) and Range Road 251;
  - Sturgeon Road and Starkey Road;
  - Bellerose Drive and Starkey Road;
  - Sturgeon Road and Sturgeon Road (TWP RD 543A and TWP RD 543B).

Roadway Classification Consolidation

Consolidation of the existing 2011 roadway classification, the sustainable roads infrastructure study (SRIS) from 2017 and the recommended classifications provided in this study is needed. The final classification report should be relevant at the network level (Countywide) and suitable for application at the street level (individual roadway) for construction and maintenance purposes. Subject areas that could be included in the consolidated effort are as follows (but not limited to these):

- Identifying/confirming classification designations (local, collector, arterial, rural, suburban, etc.);
- Identifying/confirming daily volume, land use context (residential/industrial), roadway connectivity and other elements for identifying which type of classification is warranted;
- Identifying/confirming thresholds for dust abatement, paving and widening and applying these to each classification;
- Cross section elements for each classification, reflective of the information needed at the construction level, including detailed drawings, right of way widths, design speed, posted speed, access management requirements and other elements deemed necessary.

Transit Feasibility Study

The County should collaboration with neighbouring municipalities and the newly created regional transit commission to consider the possibility of a transit service. This is especially important in the Sturgeon Valley area, where population densities and proximity to nearby employment is an opportunity to warrant a transit service. A future park and ride service in Sturgeon Valley is likely needed in the future to support a regional transit service and the feasibility study should identify potential locations for this, for protecting land.

Sturgeon Road Functional Study

With or without 127 Street, Sturgeon Road is a major transportation route to the surrounding highway system. The extend of traffic demand on this roadway depends greatly on whether 127 Street is constructed, as it provides a major valve to let traffic move to/from the area. Sturgeon Road requires four lanes without 127 Street and several local intersection improvements to accommodate the four lanes function. Without 127 Street, Sturgeon Road still accommodates a significant amount of traffic volumes and requires several local intersection improvements. A functional study for Sturgeon Road will address the following subject areas:

- Future traffic demand (this could come from the transportation master plan);
- Consider potential options for widening;
- Consultation with stakeholders and the public;
- Consider existing and future developments;
- Active modes accommodation;
- Rail crossings;
- Utilities, stormwater management;
- Identify preferred option and ultimate right of way requirements;
- Staging;
- Costs.

8.3 Water

8.3.1 Water Infrastructure Timing and Costs

The projected timing and costs for water infrastructure is shown in Table 8.3 for the three growth horizons. This table excludes the local water distribution mains that would typically be constructed as part of the land development process.

Table 8.2: Water System Projected Costs

Category	Project / Study	High Level Cost ($M)	Notes
Planning Horizon: Phase 1 (2024)			
Capital Projects	Morinville Booster Upgrade	0.1	Timing and cost TBD
	SIP Reservoir	1.4	Timing TBD
	AIH Hwy 643 Water Main	6.5	
Studies	Water / Utility Master Plan	0.2	
	Data Collection & Analysis	0.1	Annual cost
Total Cost		**$ 8.3**	**million**
Planning Horizon: Phase 2 (2034)			
Capital Projects	Allin Ridge Reservoir	2.0	
	SIP Reservoir	1.0	
	Cardiff / RQB Booster Upgrade	0.2	Timing and cost TBD
	SV East & CFB Edmonton Main	1.5	New pipe from Allin Ridge Reservoir
Studies	Update Water / Utility Master Plan	0.2	
	Villeneuve Airport Servicing Study	0.1	
	Data Collection & Analysis	0.1	Annual cost
Total Cost		**$ 5.1**	**million**
Planning Horizon: Phase 3 (2044)			
Capital Projects	Allin Ridge Reservoir	6.2	
	Allin Ridge Supply Line	3.2	
	SIP Reservoir	0.8	
	Cardiff Reservoir	0.8	To provide full fire flows
	NL / ProNorth Reservoir	1.0	Timing TBD; to provide fire flows
	Villeneuve Reservoir	10.4	To provide full fire flows
	Riviere Que Barre Reservoir	1.8	Timing TBD
Studies	Update Water / Utility Master Plan	0.2	
	Data Collection & Analysis	0.1	Annual cost
Total Cost		**$ 24.5**	**million**

Notes:

1. Cost estimates exclude local distribution system that would be the responsibility of local developers.
2. Water reservoir costs are based on $2000 per cubic metre and include pumping costs
3. All residential growth areas are assumed to be upgraded with fire flow storage by the end of Phase 3 (2044)
4. Data collection and analysis includes purchase / upgrading monitoring equipment and staff time to analyze the data. High level costs are in the order of $0.1M per year.
5. Hwy 643 water main cost from 2019 Heartland Utility Servicing – Update Report.

Capital Region Northeast Water Services Commission Transmission System

The CRNWSC may need to upgrade its Redwater transmission mains to meet increasing water demands from the downstream water commissions and/or the AIH. The County needs to work with the CRNWSC and the AIH industries to monitor the increase in demands. Additional capacity could be supplied by increasing the pumping capacity at the CRNWSC On-line Booster Station. Future upgrading will be the responsibility of the CRNSWC, and thus is not shown in Table 8.3.

Morinville Line

The County is going to need more capacity in the Morinville Water Line than their agreement currently allows based on the overall system capacity of 100 L/s. This will require the booster pump at Oakmount Booster Station to be activated. The costs for activating this booster pump were not readily available and an estimated value of $0.1M is assigned in Table 8.3.

The timing of this increase in dependent on whether the County can lease additional capacity from Morinville and/or Legal. If additional capacity cannot be leased, then the County needs to initiate the Oakmount Booster Station upgrade as soon as possible.

Local Transmission Mains & Booster Stations

The only County transmission main that is projected to be needed within the growth horizon (2044) is the twinning of the Allin Ridge supply line. The remaining transmission mains can have their capacities' increased through the installation of booster pumps or upgrading of existing booster stations. The Cardiff / RQB booster station is expected to need upgrading within Phase 2 (2034). A detailed hydraulic analysis is required to confirm the upgrading timing for the local transmission mains / booster stations.

Reservoirs

The future water reservoir upgrading costs to service growth are shown in Table 8.3. The upgrading of the Cardiff, Villeneuve, ProNorth and RQB Reservoirs is set at the end of the growth horizon (2044) and is based on the need to provide fire flow storage for these communities. The upgrading costs for the Allin Ridge and SIP Reservoirs is based on growth and demand projections for each growth horizon, but do not reflect specific reservoir upgrading stages. The reservoir costs include pumphouse upgrading costs.

Sturgeon Valley East & CFB Edmonton

A new large diameter distribution main is needed to service Sturgeon Valley East and CFB Edmonton from the Allin Ridge Reservoir. As this main will be over 2km long and will open up a new development area, the costs for this pipe will presumably need to be front ended by the County and recovered through off site levies or similar mechanism.

8.3.2 Financial

The overall water system servicing existing and future Sturgeon County developments comes from the following sources:

1. CRNWSC transmission system upgrades by paid for by the Commission through its rate structure. There are no direct County costs for upgrading CRNWSC infrastructure.
2. Local water distribution system, including water mains, hydrants, etc. is funded by developers through the land development process. This is typically watermains 300mm and smaller.
3. Water system upgrades and expansion that are specific to growth areas are funded through off-site levies, which are charged to benefiting development areas on a per hectare basis. This typically includes water reservoir / pumphouse upgrading, local transmission mains and major water distribution mains larger than 300mm.

4. Water system upgrades that is not specific to a growth area is typically funded through the water utility, which is the County's Utility Services department. These upgrades can be due to hydraulic capacity constraints or physical condition, or a combination of both.
5. Industries in the AIH have the option of purchasing their process water privately. One industry is currently purchasing water from Atco, and it is expected that other industries will do so in the future based on their individual needs and the relative cost of raw and potable water.

8.3.3 Governance

As the County's Utility Services owns and operates most of the water infrastructure in the County, there are no significant governance issues moving forward.

The CRNWSC is responsible for planning and operating its transmission system. The CRNWSC works with the County's Utility Services department to coordinate both growth and day to day operations. One example of this coordination is the recent agreement between the County and the Commission to change the operation of a local transmission main to address operational issues with the County's SIP reservoir. The County is a member of the CRNWSC and thus is represented on the CRNWSC board.

The Morinville Line is jointly owned by the Town of Morinville, Sturgeon County and the Village of Legal. There is an agreement in place that addresses allocation of water use and allows for municipalities to lease capacity from each other. The agreement also addresses the terms for activating the booster pump at the Oakmont Reservoir when additional capacity is needed.

8.3.4 Corridor Protection

The following corridors should be protected for future linear water infrastructure:

- 127 Street / Range Road 250 from Edmonton City Limit to Allin Ridge Reservoir for future Allin Ridge Supply line.
- Connection between existing reservoirs and future development where existing pipes cannot meet future demands – e.g. fire flows from Cardiff Reservoir.

In addition, space needs to be protected adjacent to existing reservoirs to accommodate future reservoir expansion.

8.3.5 Additional Studies

Water Master Plan / Utility Master Plan

A detailed analysis of the water transmission, storage and distribution systems should be carried out in the near future. It could be conducted as a stand-alone water master plan or including wastewater as a utility master plan. There is an advantage of doing it as a utility master plan in that the population and water use / wastewater generation can be integrated.

There are three components of the water master plan for the County:

1. water transmission system analysis, including booster system requirements;
2. storage system analysis, with and without fire storage
3. local distribution system analysis

The proposed scope of work is listed below:

- **Transmission system analysis**
  - hydraulic modeling of the Morinville Line, including connections to Summerbrook, Northern Lights, Villeneuve, Cardiff, RQB, and Alcomdale;
  - estimate of average day and maximum (peak) day demands at all reservoirs for the proposed growth horizontal (presumably 2024, 2034 and 2044);
  - Determine if activation of the Morinville Booster pump will provide sufficient pressure to supply Northern Lights and Villeneuve, or if an in-line booster is needed on the 300mm Northern Lights supply line;
  - Determine when the Cardiff / RQB booster needs to be upgraded and what its upgraded capacity should be;
  - Determine how the Morinville / Northern Lights / Villeneuve transmission system needs will change with supply extended to the Villeneuve Airport to support growth; and
  - Hydraulic modeling of Allin Ridge supply line, and determine when it needs to be twinned, and the proposed pipe size.
- **Reservoir condition and capacity analysis**
  - Inspect condition of all County reservoirs;
  - Confirm available live storage capacity for all reservoirs;
  - Update / refine reservoir capacity analysis; and
  - Review / refine fire storage analysis, including assumptions on when each community will have adequate fire storage.
- **Local distribution system analysis**
  - Set up hydraulic model of existing communities and industrial areas (County to determine whether to include country residential or not);
  - Conduct hydrant flow tests including monitoring of pump pressures;
  - calibrate hydraulic model;
  - analyze existing distribution systems and determine upgrading needed for peak hour demands as well as maximum day demand plus fire flows (fire flows to be determined);
  - plan future water distribution system for growth areas; and
  - analyze future distribution system to confirm pipe sizes.
- **Site specific issues**
  - Determine if the Landing Trail connection to the Sturgeon Industrial Park should be oversized for future SIP growth including fire protection;
  - Review and update the AIH transmission / distribution system to determine if the proposed 400mm main on Highway 643 should be operated as transmission main (with the CRNWSC supplying water to industries' reservoirs) or distribution main (with County constructing reservoirs at the connection to the CRNWSC); and
  - Determine what water mains in Sturgeon Valley / CFB Edmonton should be front-ended by the County (due to high front end costs) to promote growth.
- **Asset management**
  - Identify the key design parameters associated with each infrastructure element – e.g. capacity, age, material;
  - Identify key operation and maintenance issues for each element – e.g. maintenance frequency, anticipated lifespan;
  - Determine the expected remaining lifespan of key infrastructure; and
  - Determine how the future capacity upgrades should be integrated with the condition upgrading / rehabilitation.

Villeneuve Airport Water Servicing Study / Utility Master Plan

Sturgeon County should work with the Edmonton Regional Airport Authority to update the Villeneuve Airport servicing report. The scope of work should include the above elements where applicable. The scope of work should also include an economic analysis comparing the current water supply to the airport with the County supplying the airport through the Hamlet of Villeneuve.

Review of Sturgeon County General Municipal Servicing Standards (GMSS)

The 2009 water servicing standards should be reviewed, either as a master plan or as part of an overall GMSS review.

Fire Protection Study

A detailed fire protection study was carried out for Sturgeon Valley that included hydraulic analysis, alternate fire protection measures (e.g. super tanker), and an assessment of the insurance costs for a “do nothing” option. This type of study could be expanded to other residential communities to determine if other options (supertanker, “do nothing”) would be preferable to expensive water system upgrades.

8.3.6 On-going Data collection and analysis

The data analysis phase of this study was impacted due to uncertainties in the breakdown in water use, including the truck fill volumes, major water users (e.g. industries, schools, arenas) and water losses. Consideration should be given to regularly reviewing and analyzing water use in the County. This may include:

- Record and document annual data in a way that is easily retrievable for future analysis, note when data is questionable;
- Document known population for each community that is connected - e.g. RQB and AFN;
- Document all large users and their monthly / bi-monthly / annual water use (e.g. Camille School in RQB, AIH industries);
- Document raw water use if possible; document interest in raw vs. potable water in AIH;
- Analyze truck fill data to help predict future demands; and
- Consider converting to electronic card system for truck fills to track water use.

8.3.7 Water Conservation

As outlined in Table 5.5, Sturgeon County’s current per capita use in urban communities (excluding truck fill volumes) ranges from approximately 130 to 300 L/c/d. The per capita water use is difficult to quantify accurately due to relatively low populations which can be influenced by local factors such as the continuing care centre in Villeneuve and the Camilla School in RQB. Based on the available data, it appears that several communities have the potential to reduce their water use through water conservation.

Water conservation includes both a reduction in daily water use and a reduction in water consumption during water shortages through demand management. Reducing daily water can be achieved through a combination of the following:

- Replacing older fixtures and appliances with more water efficient ones;
- Water conservation education programs;
- Operational and capital improvements to reducing leakage;
- Tiered rates for higher water users; and
- Rebate programs for toilets, rain barrels, etc.

To manage peak demands and water shortages within water systems, municipalities normally have in place water “restrictions” to prevent system from drawn down too quickly. As part of the Regional Water Customers

Group, members are required to reduce flows during times of high demands. Otherwise, as determined by EPCOR's reservoirs are operating bellow certain 65%, 50% and 35% capacity. Once these reservoirs reaches the levels identified, member users are required to enforce water restriction measures.

8.4 Wastewater

8.4.1 Wastewater Infrastructure Timing and Costs

The projected timing and costs for wastewater infrastructure is shown in Table 8.4 for the three growth horizons. This table excludes the local wastewater collection sewers that would typically be constructed as part of the land development process.

Table 8.3: Wastewater System Projected Costs

Category	Project / Study	High Level Cost ($M)	Notes
Planning Horizon: Phase 1 (2024)			
Capital Projects	Villeneuve Lift Station replacement	2.0	Further study needed
	Villeneuve Forcemain	0.5	Further study needed
	Villeneuve Lagoon Rehabilitation / Upgrade	4.0	
Studies	Wastewater / Utility Master Plan	0.2	
	Data Collection & Analysis	0.1	Annual cost
Total Cost		**$ 6.8**	**million**
Planning Horizon: Phase 2 (2034)			
Capital Projects	SV East & CFB Edmonton - Off-site Trunk	2.0	
	SV East & CFB Edmonton - Lift Station to START	4.0	Further study needed
	SW Sturgeon Valley Trunk to START	4.0	
	ProNorth Lift Station	2.0	Further study needed
	Villeneuve Airport Lift Station and Forcemain	3.0	Further study needed
Studies	Update Wastewater / Utility Master Plan	0.2	
	Villeneuve Airport Servicing Study	0.1	
	Data Collection & Analysis	0.1	Annual cost
Total Cost		**$ 15.4**	**million**
Planning Horizon: Phase 3 (2044)			
Capital Projects	SV East & CFB Edmonton - Lift Station and Forcemain	3.0	
	AIH 300mm West Forcemain	4.0	
Studies	Update Wastewater / Utility Master Plan	0.2	
	Data Collection & Analysis	0.1	Annual cost
Total Cost		**$ 7.3**	**million**

Notes:

1. Cost estimates exclude local collection system that would be the responsibility of local developers.
2. Cost estimates for lift stations were based on typical costs for the expected flow rates.
3. Data collection and analysis includes purchase / upgrading monitoring equipment and staff time to analyze the data. High level costs are in the order of $0.1M per year.

Alberta Capital Region Wastewater Commission (ACRWC)

The ACRWC is currently upgrading its St. Albert Regional Trunk Sewer (START) to address physical deterioration and capacity constraints. The capacity constraints are primarily driven by the larger connecting municipalities (e.g. St. Albert, Spruce Grove), with the Sturgeon County contributions being minor. The ACRWC Northeast Regional Trunk Sewer (NERTS) system is also being upgraded to accommodate growth from Sturgeon County (industrial) and the City of Fort Saskatchewan. The ACRWC is required to upgrade its transmission system to accommodate growth from its member municipalities, and thus no costs for START or NERTS upgrading are not shown in Table 8.4.

Alberta's Industrial Heartland Forcemain

The 350mm forcemain in Phase 1 (2024) has been designed and is not listed in Table 8.4. The 300mm forcemain along Township Road 560 and Range Road 224 is needed to accommodate growth in the Phase 3 (2044) growth area.

Sturgeon Valley

A detailed wet weather flow assessment of the Sturgeon Valley lift stations is needed to determine lift station upgrading needed to accommodate growth. It was not possible to determine if any of the lift stations in Sturgeon Valley will need to be upgraded within the growth horizon.

The only off-site wastewater trunk is the potential gravity trunk servicing Phases 2 and 3 to START. It will need to be extended east of Range Road 250 to connect to START at a lower elevation. Its estimated cost is $4million, with a portion of that potentially being local developer funded trunk.

The future Rivers Gate Forcemain to START is not included in Table 8.4 as it is not expected to be needed until after Phase 3 (2044). It is shown on Figure 6.9 to protect a corridor for the future forcemain.

Sturgeon Valley East and CFB Edmonton

To service the initial stage of proposed Sturgeon Valley East and CFB Edmonton area (Phase 2, 2034), a new lift station and 2km of off-site trunk will be required in addition to on-site wastewater sewers. A second lift station plus a forcemain will be needed to service the Phase 3 (2044) development.

ProNorth Industrial Park

While ProNorth is expected to start development within the first growth phase (2024), interim wastewater servicing is proposed at the initial stage of development. A new lift station is proposed for the second growth phase (2034), servicing Northern Lights and ProNorth to the Sturgeon Valley system via the existing 150mm Northern Lights forcemain.

Sturgeon Industrial Park

No off-site servicing is required for the Sturgeon Industrial Park as the projected growth can be serviced directly to the ACRWC NERTS system utilizing the existing County wastewater trunks.

Villeneuve

The Villeneuve Lift Station will need to be upgraded to accommodate future growth in Phase 1 (2024). The cost projection in Table 8.4 is based on replacing the existing lift station, however, it may be possible to upgrade the capacity of the existing lift station.

The Villeneuve Lagoon needs to be upgraded and rehabilitated as soon as possible. The capacity upgrading is needed as part of Phase 1 (2024).

8.4.2 Financial

The ACRWC will pay for upgrading its transmission system servicing Sturgeon County, including the planned upgrading of the START line.

The County will be responsible for upgrading the Villeneuve Lift Station and Forcemain, the Villeneuve Lagoon, and for any needed upgrades to the Sturgeon Valley lift stations. Where these upgrades are directly attributable to new growth areas, the costs associated with growth can be charged back to developers through off-site levies.

Developers will be responsible for constructing local sewers that service their developments. Where local sewers or trunks will service multiple developments, these costs can be shared through a variety of mechanisms (e.g. off-site levies, endeavor to assist, etc.).

8.4.3 Governance

The County's Utility Services owns and operates most of the wastewater infrastructure in the County, and no significant governance issues are anticipated moving forward.

The ACRWC is responsible for planning and operating its transmission system, including the ACRWC Morinville Pump Station and Forcemain, START and NERTS. As long as the County controls its wastewater flows to the ACRWC Level of Service (managing excessive wet weather flows), it can connect to the ACRWC system. The ACRWC works with the County's Utility Services department to coordinate day to day operations. The ACRWC are currently requesting its member municipalities to manage the levels of H2S entering the ACRWC transmission system.

The shared use of the County's AIH forcemain by multiple industries does introduce a potential risk to the County if industries were to pump at a higher pumping head and discharge rate. The higher pumping head could adversely affect other industries ability to discharge at their approved rate. This can be addressed by the County monitoring the pumping rates and/or heads at the connection points.

8.4.4 Corridor Protection

The following corridors should be protected for future linear wastewater infrastructure:

- Alignment of future 300mm AIH forcemain along Township Road 560 and along Range Road 244;
- Parallel to START to east of Range Road 250 to facilitate gravity servicing from SW Sturgeon Valley;
- Route between Rivers Gate Lift Station and START (exact alignment to be determined);
- Connection between Villeneuve Lift Station / Villeneuve Airport and Villeneuve Lagoon for future twinning.

8.4.5 Additional Studies and Investigations

Wastewater Master Plan / Utility Master Plan

A detailed analysis of the wastewater collection systems (including) and lagoons should be carried out in the near future. It could be conducted as a stand-alone wastewater master plan or including water as a utility master plan. There is an advantage of doing it as a utility master plan in that the population and water use / wastewater generation can be integrated.

The three main components of the wastewater master plan are:

1. Local collection system piping, including both gravity and low pressure;
2. Local lift stations and forcemain hydraulic analysis;
3. Lagoon capacity and condition assessments

The proposed scope of work is listed below:

- **Local distribution system analysis**
  - Potable water data analysis to estimate per capita wastewater generation;
  - Wastewater flow monitoring – dry and wet weather conditions;
  - Scope can be limited to growth areas only or all County wastewater systems;
  - Hydraulic analysis of existing piped system using either spreadsheet tool or hydraulic modeling software;
  - Use rainfall records and dry and wet weather flow monitoring data to calibrate the hydraulic model;
  - Analyze existing collection systems and determine if any upgrading is needed for the existing level of development;
  - Plan future wastewater collection systems for growth areas; and
  - Analyze future collection system to confirm pipe sizes.
- **Lift station and forcemain capacity analysis**
  - Inspect condition of all County lift stations;
  - Conduct pumping tests to confirm existing pumping capacity;
  - Establish existing pump curves and forcemain system curves;
  - Use existing dry and wet weather flow data to assess capacity of existing lift stations under current conditions;
  - Use future flow projections to analyze the capability of the existing system to accommodate growth;
  - Determine upgrading needed to accommodate growth, either pump upgrading, new forcemain or a combination of both;
  - Review forcemain minimum and maximum velocities; and
  - Determine the optimal upgrading option for accommodating future wastewater flows.
- **Lagoon assessment**
  - Determine annual wastewater flows to each lagoon;
  - Review Alberta Environment and Parks approval, noting any specific requirements;
  - Assess physical condition of lagoon and note any rehabilitation needs; and
  - Determine if upgrading is needed to address capacity constraints.
- **Site specific issues**
  - The allowable capacity of the proposed ProNorth Lift Station needs to be assessed considering the available capacity in the downstream Greystone, Bellerose and Rivers Gate Lift Stations; it may be necessary to either upgrade the downstream lift stations or divert the Northern Lights forcemain directly to the Rivers Gate Lift Station;
  - Staging of the Rivers Gate Lift Station to accommodate new growth needs to be determined, including medium term growth south of the Sturgeon River and potential long term growth north of the river;
  - The servicing concept for the southwest area of Sturgeon Valley needs to be determined, especially what areas can be serviced to START by gravity;
  - The East Sturgeon Valley / CFB Edmonton servicing concept needs to be reviewed to determine if the proposed growth areas and staging are optimal; and
  - The hydraulics of the Villeneuve shared forcemain needs to be reviewed considering existing hamlet and airport pumping operations, and upgrading of individual lift stations;
- **Asset management**
  - Identify the key design parameters associated with each infrastructure element – e.g. capacity, age, material;
  - Identify key operation and maintenance issues for each element – e.g. maintenance frequency, anticipated lifespan;
  - Determine the expected remaining lifespan of key infrastructure; and

- Determine how the future capacity upgrades should be integrated with the condition upgrading / rehabilitation.

Villeneuve Airport Wastewater Servicing Study / Utility Master Plan

Sturgeon County should work with the Edmonton Regional Airport Authority to update the Villeneuve Airport servicing report. The scope of work should include the above elements where applicable. The scope of work should also include a hydraulic analysis of the shared hamlet / airport forcemain.

Review of Sturgeon County General Municipal Servicing Standards (GMSS)

The 2009 water servicing standards should be reviewed, either as a master plan or as part of an overall GMSS review.

Inflow / Infiltration Study

The County may want to conduct an inflow / infiltration (I/I) study either as part of the wastewater / utility master plan, or as a standalone study. An I/I Study is different from a wastewater master plan in that it also focuses on the causes of I/I and potential solutions to reduce it, and not just determine the capacity upgrades needed to accommodate I/I. The key steps in an I/I study are:

- Rainfall and flow monitoring program;
- Assessment of peak wet weather flows;
- Investigation to causes of I/I, including smoke and dye testing;
- Determine best ways to address I/I, including measures to reduce I/I both on-lot and within the municipal collection system; and
- If it is not cost effective to reduce I/I, then determine ways to upgrade the collection system.

8.4.6 On-going Data Collection and Analysis

The data analysis phase of this study was challenging due to uncertainties in the magnitude of the peak wet weather flows in various parts of the wastewater collection system. In order to undertake the above wastewater master plan and an inflow / infiltration study, it will be necessary to monitor rainfall and peak wet weather flows at multiple locations in the wastewater system. The proposed monitoring system should installation and on-going operation and maintenance of the following monitoring equipment:

- Multiple rain gauges, especially near proposed growth areas;
- Flow monitoring at select gravity sewers;
- Flow monitoring at lift stations, and/or measure liquid level in lift station and pump run times.

It is suggested that the County try and coordinate the rainfall monitoring with the Cities of Edmonton (EPCOR), St. Albert and Fort Saskatchewan as they may have rain gauges that are in close proximity to Sturgeon County's growth areas.

The rainfall and flow monitoring data needs to be reviewed on a regular basis in order to confirm the validity of the data and the on-going maintenance needs. This can be carried out by County staff with specialty training, or it can be carried out by private contractors who supply and install the equipment.

8.5 Stormwater

8.5.1 Stormwater Infrastructure Timing and Costs

The projected timing and costs for stormwater infrastructure is shown in Table 8.5 across the three growth horizons. This table excludes the local stormwater collection systems and stormwater management facilities that would typically be constructed as part of the land development process on a quarter section by quarter section basis. The infrastructure listed in Table 8.5 focuses on the off-site servicing infrastructure to accommodate growth.

Table 8.4: Stormwater System Projected Costs

Category	Project / Study	High Level Cost ($M)	Notes
Planning Horizon: Phase 1 (2024)			
Capital Projects	ProNorth SWMF / Channel Upgrades	1.0	Order of magnitude cost
	SIP Existing Outfall Erosion Protection	5.0	Potential cost; further study needed
	Villeneuve 600mm diameter storm sewer	2.0	
Studies	Update Rural Drainage Master Plan	0.1	
	Update Stormwater Master Plan	0.2	Annual cost
Total Cost		**$ 8.5**	**million**
Planning Horizon: Phase 2 (2034)			
Capital Projects	AIH Existing Line 1 Drainage Channel	1.0	Order of magnitude cost
	ProNorth Drainage Channel	0.5	Order of magnitude cost
	Sturgeon Valley East Proposed 1.5km Trunk	3.0	
	Potential AIH Basin 5 & 6 Outfalls	10.0	Order of magnitude cost
	Villeneuve Airport Off-site Drainage Channel	0.3	
Studies	Update Rural Drainage Master Plan	0.1	
	Update Stormwater Master Plan	0.2	Annual cost
Total Cost		**$ 15.1**	**million**
Planning Horizon: Phase 3 (2044)			
Capital Projects	Potential AIH Basin 5 & 6 Outfalls and Channels	10.0	Order of magnitude cost
	Various Sturgeon Valley Outfall Channels	2.0	Further study needed
	Potential CFB Edmonton Outfall Channel	0.5	Further study needed
Studies	Update Rural Drainage Master Plan	0.1	
	Update Stormwater Master Plan	0.2	Annual cost
Total Cost		**$ 12.8**	**million**

Notes:

1. Cost estimates exclude local drainage system and SWMF that would be the responsibility of local developers.
2. All drainage channel and outfall costs are order of magnitude only and further study is needed to refine costs.

Alberta's Industrial Heartland

The proposed north drainage channel in Basin 7 (Line 1) is needed to service the south part of Phases 2 and 3, and will need to be installed prior to development in that part of Basin 7.

Similar drainage channels and outfalls to the North Saskatchewan River will be required within Basins 5 and 6 to service the proposed growth in the rest of the AIH. Specific servicing plans will need to be prepared prior to development of the proposed growth area.

Cardiff

No off-site stormwater infrastructure is required if an evaporation pond can be used for stormwater management.

ProNorth

A drainage channel will be required for the proposed SWMF, servicing the new development areas in ProNorth. The downstream channel from the existing ProNorth SWMF to Carrot Creek will also need to be upgraded. The costs shown in Table 8.5 are order of magnitude only.

Sturgeon Industrial Park

The storm trunks connecting the SIP SWMF would typically be constructed as part of the land development process and thus the costs are not included in Table 8.5.

An additional study is needed to determine what erosion protection measures are needed on the existing outfall to the North Saskatchewan River. The costs could be in the same order of magnitude as the Line 3 outfall constructed in Basin 7 of the AIH. An order of magnitude cost of $5million is shown in Table 8.5, but the costs could be considerably lower.

Sturgeon Valley

Further study is needed to determine the costs for the stormwater outfalls to the Sturgeon River from both the southwest Sturgeon Valley and Sturgeon Valley East / CFB Edmonton. Most of the proposed outfalls are expected to be relatively short and shallow. The only significant stormwater outfall is the proposed trunk west of Sturgeon Valley East, which will require 1.5km of large diameter trunk (Cutbank Lake to an unnamed tributary of Sturgeon River) according to the Sturgeon Valley Area Servicing Concept Overview (Sameng, 2013). The order of magnitude cost for this trunk is $3 million.

Villeneuve

The only proposed off-site stormwater infrastructure is a 1.5 km long, 600mm diameter storm sewer connecting the proposed SWMF with the South Ditch. The order of magnitude cost for this storm sewer is $2 million. Further studies may determine that alternate servicing options are feasible with lower servicing costs.

8.5.2 Financial

Developers will be responsible for constructing local storm sewers and SWMF to service their land. Where trunks or SWMF service multiple developments, these costs can be shared through a variety of mechanisms (e.g. off-site levies, endeavor to assist, etc.).

The County will typically be responsible for constructing the major off-site stormwater infrastructure, as the costs are beyond what individual developments or industries can absorb. Where off-site infrastructure is directly attributable to new growth areas, the costs associated with growth can be charged back to developers through off-site levies.

One challenge that the County may have is where downstream erosion protection is required due to a combination of existing and future development, where the need for erosion protection was not identified when the existing developments were approved. In this case, the County would only be in a position to collect off-site levies for the undeveloped portion of the drainage basin.

8.5.3 Governance

Stormwater is different from water and wastewater in that it is currently managed by three different departments within the County: Engineering, Transportation and Utility Services. As a result, there is no one authority responsible for planning, operating and overseeing stormwater. The County should consider integrating all aspects of stormwater into a stormwater utility.

It was noted that several industries in the AIH and SIP have constructed their own SWMF on their private lots to manage their flows to the County ditches and watercourses. As a result, the key design parameters (e.g. storage volume, freeboard, outlet rate) are not readily available. In future, the County should consider taking ownership of future SWMF so that it can operate them based on constraints within the County's downstream drainage system. The County could also evaluate the merits of taking ownership of the SWMF that are currently on private industrial sites.

8.5.4 Corridor Protection

Based on the available information, the following corridors should be protected for future stormwater conveyance facilities:

- Lines 1 and 2 for Basin 7 of the AIH along Township Roads 555 and 560, and along Range Road 221.
- Further study is needed to determine the alignment of drainage channels and outfalls within Basins 5 and 6 of the AIH.
- Subject to more detailed study of the Hamlet of Villeneuve, the alignment of the storm sewer and drainage channel connecting to the South Ditch should be protected.
- Subject to more detailed study of the southwest part of Sturgeon Valley, the alignment of the storm sewer outfall to the Sturgeon River adjacent to River Lot 56 should be protected.
- The natural watercourse draining the CFB Edmonton lands east of Highway 28 should be investigated and protected if necessary. This watercourse currently transverses several private parcels of land.
- Consideration should be given to protecting the proposed alignment of the drainage channel west of Range Road 225 in the Sturgeon Industrial Park approximately 800m north of Township Road 552.

8.5.5 Additional Studies and Investigations

A detailed stormwater master plan should be carried out for the entire County to address the issues raised in this study. However, given the size of the County and the mix of large rural areas and localized residential and industrial developments, a conventional stormwater master plan may not be appropriate.

It is recommended that the County undertake two inter-related master plans:

- A drainage master plan with a focus on rural drainage issues within each river or creek watershed area; and
- A stormwater master plan that focuses on the new and existing development areas and the stormwater infrastructure needed to support growth.

Rural Drainage Master Plan

The scope of the rural drainage master plan should include:

- Mapping of existing drainage basin boundaries at the watershed and sub-watershed level;
- Determining the predevelopment flow rates based on similar nearby gauged watersheds (has been completed for parts of the County);
- Documenting historical rural / agricultural flooding and drainage challenges, including an assessment of whether they are natural events or have been influenced by human activity (e.g. agriculture practices blocking on natural drainage routes);
- Documenting rural drainage improvement projects undertaken by the County, noting where drainage easements have been registered;
- Identifying where additional drainage improvements are needed to minimize impacts on agriculture, transportation or other developments (e.g. Manawan Canal);
- Determining where new drainage easements need to be registered;
- Determining potential impacts of new residential or industrial developments on existing rural drainage systems (e.g. Villeneuve to local drainage channels).

Stormwater Master Plan

The scope of the development focused stormwater master plan should include:

- Assessment of existing drainage system, including:
  - Local issues such as cross-lot drainage;
  - Assessment of existing stormwater drainage channels and outfalls;
  - Determine any needed upgrading to convey additional stormwater runoff volumes;
- Determine design SWMF discharge rates, including whether very low rates should be used to address downstream constraints (e.g. erosion), or if it is more cost effective to construct downstream drainage channels and outfalls to accommodate predevelopment rates);
- Mapping of existing and proposed drainage basin boundaries at the local level (typically 10ha to 1000 ha);
- Documenting all available design parameters for existing SWMF;
- Develop stormwater servicing options for proposed development areas, including general location of SWMF, the alignment of stormwater outlets to creeks and rivers, and downstream constraints (e.g. erosion, wetlands, land acquisition);
- Determine where urban storm servicing (i.e. storm sewers) is not feasible due to topographic constraints;
- Consider the following site specific issues:
  - Determine if an evaporation SWMF is feasible for Cardiff or if an off-site outfall is needed;
  - Assess the existing SWMF at ProNorth Industrial Park and determine if it can be expanded to accommodate future growth; also assess condition and capacity of existing drainage outfall to Carrot Creek to determine if upgrades are needed;
  - Conduct a detailed assessment of the downstream channel / watercourse to the North Saskatchewan River to determine if erosion protection measures are needed to support increased annual runoff volumes;
  - Refine SWMF basin boundaries in southwest Sturgeon Valley; assess capacity of existing watercourses to convey increase runoff volumes to the Sturgeon River;
  - Review and refine the drainage concept for Sturgeon Valley East, including the proposed 1.5km trunk (Cutbank Lake to an unnamed tributary of Sturgeon River);
  - Review the proposed drainage concept for CFB Edmonton, including the downstream impacts of discharging stormwater through the natural watercourse;
  - Review the elevation (normal and high water levels) of the Villeneuve Airport SWMF relative to the adjacent North Drainage Channel to determine land needed for SWMF and outfall location to channel;

- Assess the options for draining the proposed Hamlet of Villeneuve SWMF to the South Drainage Channel, and steps needed to protect the corridor for future construction;
- Detailed stormwater master plan for Basins 5 and 6 of the AIH.

To support the County's on-going development with discharge to existing watercourses, consideration should be given to setting up an erosion monitoring program on the existing watercourses that discharge to the North Saskatchewan River. This would allow the County to demonstrate to Alberta Environment and Parks that the use of existing steep watercourses for stormwater discharges are being monitored to confirm the applicability of the proposed unit discharge rate.

8.6 Plan Updates / Performance Indicators and Monitoring

8.6.1 Infrastructure Master Plan (IMP) Updates

The IMP should not be viewed as a static document. As a result, it will be important to review the plan on a regular basis. Periodic reviews are necessary due to changes that could occur in development patterns, technological advancements, financial considerations, environmental impacts and other issues. These issues could result in potential adjustments to the timing/cost of any recommended infrastructure improvements. A complete update/review of the IMP should be undertaken approximately every 5 years to ensure that it remains relevant and effective.

It is possible that the IMP may require a major update within a 5-year timeframe. However, accelerating a comprehensive review/update should only occur in the event a 'major' disruptor emerges. This could include unexpected events such as an environmental crisis, governance restructuring, and major financial opportunities or constraints, among others. In the absence of such drastic events, any changes are most likely to be incremental and thus a 5-year review/update frequency should be sufficient.

8.6.2 IMP Monitoring

In order to gauge or determine the impact of the recommended improvements to the Sturgeon County infrastructure system, it is important to track the performance of each infrastructure theme and develop indicators, alongside targets, to measure their effectiveness.

A proposed performance measurement framework containing a list of indicators is illustrated in Table 8.5. For the IMP, many long-term targets (Years 2024 / 2034 / 2044) associated with each infrastructure performance indicator will require additional consultations and ultimately approval from Council. While it is recommended that monitoring of these indicators should ideally occur on an annual basis, it is also recognized that a number of these indicators will require increases in data collection efforts. Sturgeon County will need to determine whether these are realistic and achievable due to the level of additional resources that would be required.

Additional performance indicators/targets may also be established in any future plans/studies that follow the IMP. These studies may include more specialized transportation/utility master plans, municipal development plan updates, area structure plans, and other initiatives. Future iterations of the IMP could expand on those performance indicators proposed for this initial plan.

The following Table 8.6 proposes an initial performance measurement framework for the IMP:

Table 8.5: Initial Performance Measurement Framework

Theme	Performance Indicator	Potential Implications	Potential Data Source	Potential Responsibility
Transportation	AM/PM Peak Level of Service D or better	Social (Road Safety); Environmental (Emissions); Economic (Goods Movement)	Sturgeon County/ Alberta Transportation	Engineering; Transportation Services
	Transit mode share (Valley and other nodes)	Social (Road Safety); Environmental (Emissions); Social Equity	Future Regional Transit Service Commission	Planning and Regional Services; Community Services
	Number of Carpools/Other Ridesharing	Social (Road Safety); Environmental	Ride matching Service Provider; Major Employer	Planning and Regional Services
Water	Per Capita/Person Daily Water Demand	Environmental	Census information/meter reading	Utility Services
	Number of Heavy Industrial Operations Using Non-Potable Process Water	Environmental	Major industries; any development applications	Utility Services
	Percentage of Residential/Employment units with urban fire flow protection	Social (Community Safety)	Development applications/building permits	Utility Services; Planning and Regional Services; Development Services
	Percentage of water demand from truck fill operations	Environmental	Truck fill station readings; overall meter readings	Utility Services
Wastewater	Per Capita/Person Daily Wastewater Generation	Environmental	Meter/flow readings	Utility Services
Stormwater	Percentage of Stormwater Recycled for Non-Potable Purposes	Environmental	Sturgeon County/Potential EMRB MRSP Recommendations	Planning and Regional Services; Development Services; Utility Services; Engineering
Land Use Planning/ Development	Number and Type of New Dwelling Units	Social; Economic; Environmental	Development applications/building permits	Planning and Regional Services; Development Services
	Population Growth	Economic; Environmental	Sturgeon County Census/Statistics Canada	Planning and Regional Services; Development Services
	Economic Development Growth	Economic	Development applications/building permits	Economic Development; Planning and Regional Services; Development Services

APPENDIX A
Traffic Forecasting Details

Traffic Forecasting Details

The follow described the detailed methodology for forecasting future traffic demand at each study intersection in the Sturgeon County Infrastructure Master Plan.

- Trip generation rates, trip distribution and land use inputs are described in the main
- The below applies only to the 2044 horizon, additional forecasting may be needed depending on the do nothing results
- There are several sections – Rural intersections (non-local growth inputs), Rural intersections (Hamlet growth inputs), Sturgeon Industrial Park and Sturgeon Valley
- Certain intersections and areas are noted to likely required additional analysis as there was no existing traffic volume found or unable to find these at the time of writing, including
  - Alberta Industrial Heartland intersections
  - Sturgeon Industrial Park (Highway 28A and TWP Road 552)
  - TWP Road 544 and Highway 2
  - Highway 44/Highway 633
  - Range Road 270 and Highway 633 (if this becomes a main access)
  - These are suggested additions to be complete for the final report.

Rural Intersections (non-local growth)

Highway 28 and Range Road 240 (Bon Accord)

- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth (bon accord growth) not an input

Highway 28 and Range Road 224 (West of Redwater)

- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth (Redwater) not an input

Township Road 570 and Range Road 224

- Not an AT Highway, but functions as a county connector
- No local growth, but assumed AT's 2.5% growth per year linear as this intersection connects between two highways

Highway 28 and Range Road 232 (Fedorah)

- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth (Fedorah) not an input

Highway 37 and Range Road 240

- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth not an input

Sturgeon Industrial Park Intersections

Employment growth = 1563

Highway 825 and RR 223C

- Growth based on 60% of employment growth subtract growth to/from west at Range Road 230
- Volume and in/out split is distributed north/south only
- No AT BG growth

Range Road 230 and Highway 37 to the South

- Growth based on 40% of employment growth using this intersection and heading to Highway 37 (this traffic will not go to/from Highway 825)
- Volume and in/out split is distributed east/west using existing traffic counts
- No AT BG growth

Range Road 231 and TWP Road 552

- Growth based on increase in east/west traffic from industrial growth in the park (east of Range Road 230)
- No AT BG growth

Rural Intersections (Growth Hamlets)

Highway 633 and Range Road 270A (Villeneuve Airport)

- Growth = employees from business = 216
- Growth = employees from hanger = 105
- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth (Airport) added only at this intersection (assuming this is the only primary access, not Range Road 270)
- In/out split and distribution based on existing turning movements
- Local growth from Villeneuve not added (assumed to be accounted for by AT growth % and/or captured by new local trips

Highway 633 and Range Road 265 (Villeneuve)

- Growth = 349 new dwellings
- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Assumed 85% growth on the north side and 15% growth on the south side
- Local growth (Villeneuve) added,
  - Volumes too low to estimate in/out split and distribution
    - used in/out from ITE, In/Out = 25/75 (AM), 63/37 (PM)
  - Applied east/west distribution from range road 270 A intersection (volumes to)
- Local growth from airport not added (assumed to be accounted for by AT growth % and/or captured by new local trips

Highway 37 and Ste Anne Trail (Calahoo)

- Growth = 45 dwellings total for Calahoo
- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Split total growth 50/50 per intersection
- Local growth (Calahoo) added, in/out split and distribution based on existing turning movements at Range Road 275 (volumes to low to use St. Anee Trail volumes)

Highway 37 and Range Road 275 (Calahoo)

- Growth = 45 dwellings total for Calahoo
- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Split total growth 50/50 per intersection
- Local growth (Calahoo) added, in/out split and distribution based on existing turning movements

TWP Road 554 and Highway 44 (Rivere Qui Barre)

- Growth = 21 dwellings
- Growth location not provided, assumed to be all west side of highway
- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth added, in/out split and distribution based on existing turning movements

TWP Road 554 and Highway 28

- Growth = 461 dwellings in Cardiff
- Assumed 40% of Cardiff growth uses this intersection
- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth added using the rural trip rate, in/out splits and distribution based on existing traffic counts

TWP Road 554 and Highway 2

- Growth = 461 dwellings in Cardiff
- Assumed 60% of Cardiff growth uses this intersection
- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth added using the rural trip rate, in/out splits and distribution based on existing traffic counts

Highway 37 and Range Road 244 (Namao)

- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Local growth (Namao) added and distributed based on existing turning movements

Sturgeon Valley Growth

Growth = 3576 dwellings

May shows growth on the east side of Highway 28, but our understanding is that the growth is only within the Valley area (not CFB).

Distribution from report:

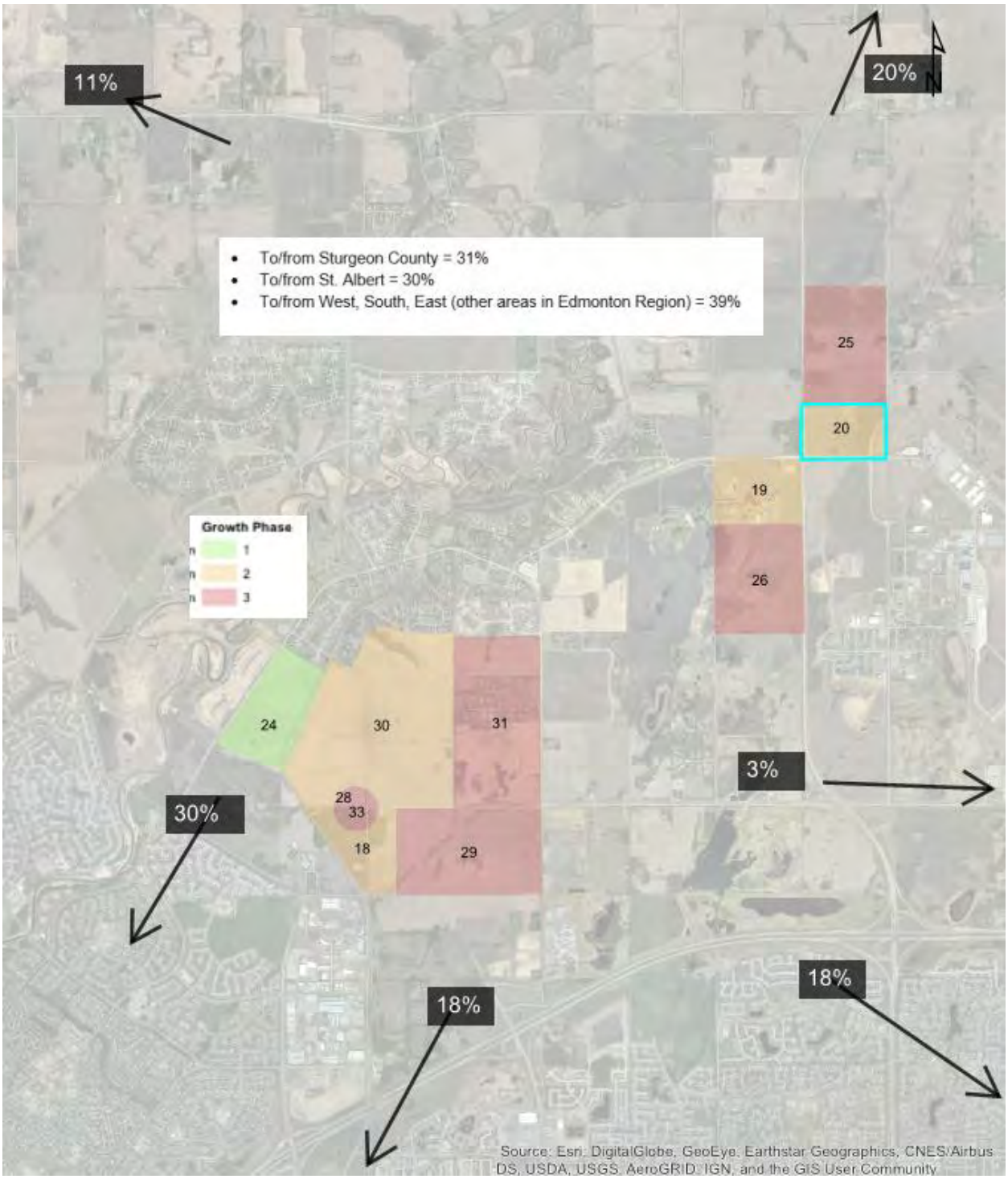
- To/from Sturgeon County = 31%
- To/from St. Albert = 30%
- To/from West, South, East (other areas in Edmonton Region) = 39%

Highway 28 and Sturgeon Road

- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
- Captures the following (without 127 Street)
  - 39% of traffic volumes (without 127 Street), heading to/from Edmonton region – except a small amount on Valour Avenue (3%)
    - Traffic is to/from south
  - 15% of traffic volumes to/from county
    - Traffic is to/from east
- Captures the following (with 127 Street)
  - 6% of traffic volumes (without 127 Street), heading to/from Edmonton region – except a small amount on Valour Avenue (3%)
    - Traffic is to/from south
    - 30% uses 127 Street
  - 15% of traffic volumes to/from county
    - Traffic is to/from east

Highway 37 and Starkey Road

- Increased highway through movements by 2.5% per year linear growth rate (consistent with AT requirements)
  - Captures the following:
    - 16% of traffic volumes to/from county
      - 5% to/from east
      - 11% to/from west


11%
20%
To/from Sturgeon County = 31%
To/from St. Albert = 30%
To/from West, South, East (other areas in Edmonton Region) = 39%
25
20
19
26
Growth Phase
1
2
3
24
30
31
28
33
18
29
3%
30%
18%
18%
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

APPENDIX B
Traffic Signal Warrant Analysis

Traffic Signal Warrant Analysis

The following is table is a summary of the traffic signal warrant analysis conducted at intersections with insufficient levels of service in the Phase 3 (2044) scenario. The traffic signal warrant considers six hour in total: two for AM peak, two for PM peak, and two for the midday. There are two conditions that would indicate signalization is warranted: traffic volumes on the minor road are more than 75 vehicles per hour and the cumulative traffic warrant points calculated by the worksheet, W, is equal to or higher than 100. The table below summarizes the results of the traffic warrant analysis. The traffic signal analysis worksheets for the intersections are provided in the following pages.

Minor Road	Major Road	Warrant Score	Warranted (Yes/No)
Cardiff Road East	Highway 28	115	Yes
Range Road 230	Highway 37	59	No
Range Road 240	Highway 28	37	No
Starkey Road	Highway 37	117	Yes

AT - Traffic Signal Warrant Analysis

Main Street (name)	Highway 28	Direction (EW or NS)	EW
Side Street (name)	Range Road 240	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Enter Comments about the analysis here.

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	AT
City:	Sturgeon County
Analysis Date:	2019 Mar 21, Thu
Count Date:	2017 Jan 01, Sun
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 28	WB		1			1		10,000	2
Highway 28	EB		1			1		10,000	2
Range Road 240	NB				1				
Range Road 240	SB				1				

Are the Range Road 240 NB right turns significantly impeded by through movements? (y/n) n

Are the Range Road 240 SB right turns significantly impeded by through movements? (y/n) n

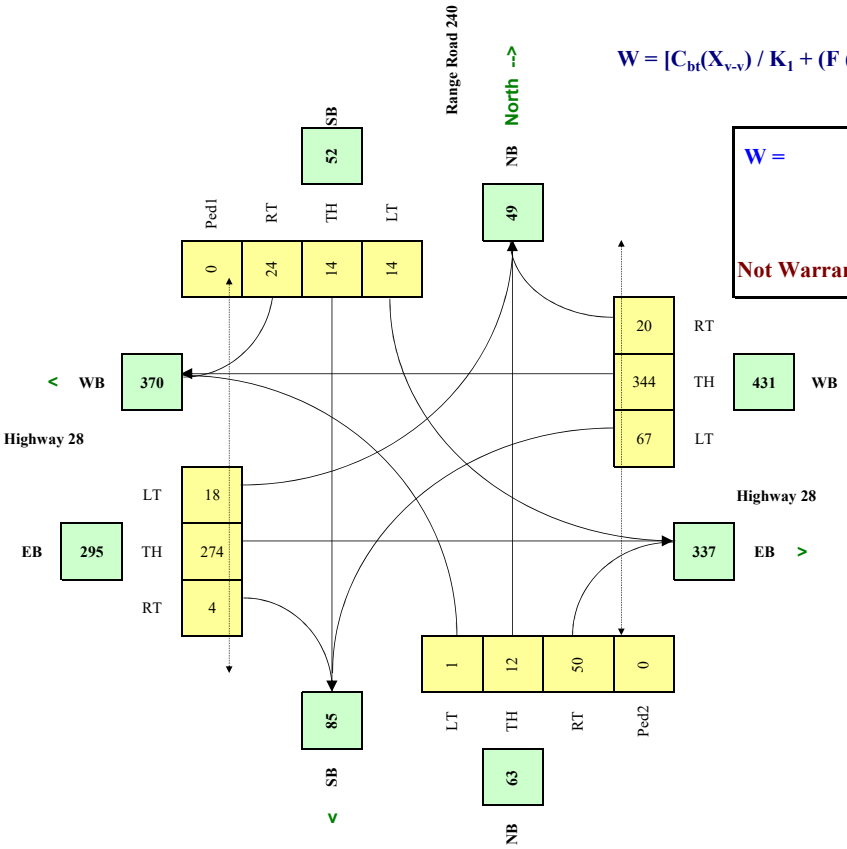
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 28	EW	60	3.0%	n	
Range Road 240	NS			n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
press 'Set Peak Hours' Button to set the peak hour periods	2	12	49	32	30	49	125	450	46	25	358	8				
	2	12	49	32	30	49	125	450	46	25	358	8				
	0	2	9	2	3	4	12	61	4	3	48	1				
	0	2	9	2	3	4	12	61	4	3	48	1				
	2	21	91	7	10	19	64	522	10	25	416	2				
	2	21	91	7	10	19	64	522	10	25	416	2				
Total (6-hour peak)	8	70	298	82	86	144	402	2,066	120	106	1,644	22	0	0	0	0
Average (6-hour peak)	1	12	50	14	14	24	67	344	20	18	274	4	0	0	0	0

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	37	37	0
		Veh	*Ped*

Not Warranted - Vs<75

RESET SHEET

AT - Traffic Signal Warrant Analysis

Main Street (name)	Highway 28	Direction (EW or NS)	NS
Side Street (name)	Cardiff Road East	Direction (EW or NS)	EW
Quadrant / Int #		Comments	Enter Comments about the analysis here.

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	AT
City:	Sturgeon County
Analysis Date:	2019 Mar 21, Thu
Count Date:	2017 Jan 01, Sun
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 28	NB	1				1		10,000	1
Highway 28	SB	1				1		10,000	1
Cardiff Road East	WB				1				
Cardiff Road East	EB				1				
Are the Cardiff Road East WB right turns significantly impeded by through movements? (y/n)							n		
Are the Cardiff Road East EB right turns significantly impeded by through movements? (y/n)							n		

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,500
Central Business District	(y/n)	n

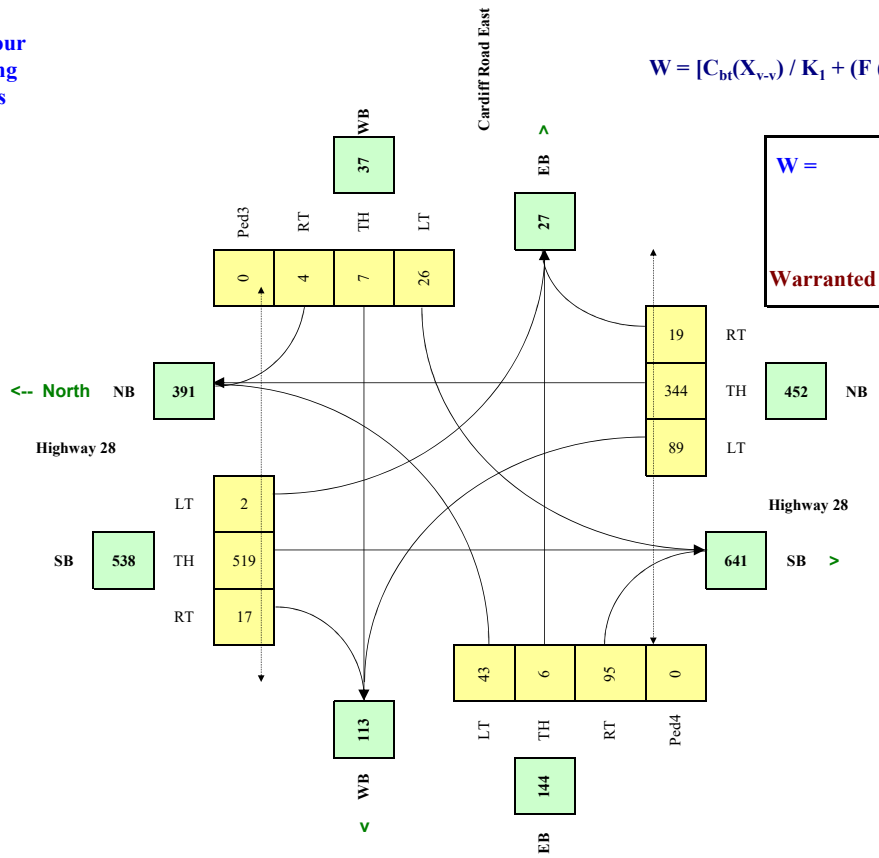
Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 28	NS	100	3.0%	n	
Cardiff Road East	EW			n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
6:30 - 7:30	52	283	3	3	905	17	62	3	8	17	2	248				
7:30 - 8:30	52	283	3	3	905	17	62	3	8	17	2	248				
11:00 - 12:00	16	61	3	0	92	3	5	1	1	8	1	17				
12:00 - 13:00	16	61	3	0	92	3	5	1	1	8	1	17				
4:00 - 5:00	199	689	50	2	561	31	12	17	2	103	16	20				
5:00 - 6:00	199	689	50	2	561	31	12	17	2	103	16	20				
Total (6-hour peak)	**534**	**2,066**	**112**	**10**	**3,116**	**102**	**158**	**42**	**22**	**256**	**38**	**570**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**89**	**344**	**19**	**2**	**519**	**17**	**26**	**7**	**4**	**43**	**6**	**95**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p}) L) / K_2] \times C_i$$



W =	115	115	0
		Veh	*Ped*

Warranted

RESET SHEET

AT - Traffic Signal Warrant Analysis

Main Street (name)	Highway 37	Direction (EW or NS)	EW
Side Street (name)	Range Road 230	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Enter Comments about the analysis here.

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	AT
City:	Sturgeon County
Analysis Date:	2019 Mar 21, Thu
Count Date:	2017 Jan 01, Sun
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 37	WB					1		10,000	1
Highway 37	EB		1					10,000	1
Range Road 230	NB								
Range Road 230	SB				1				

Are the Range Road 230 SB right turns significantly impeded by through movements? (y/n) n

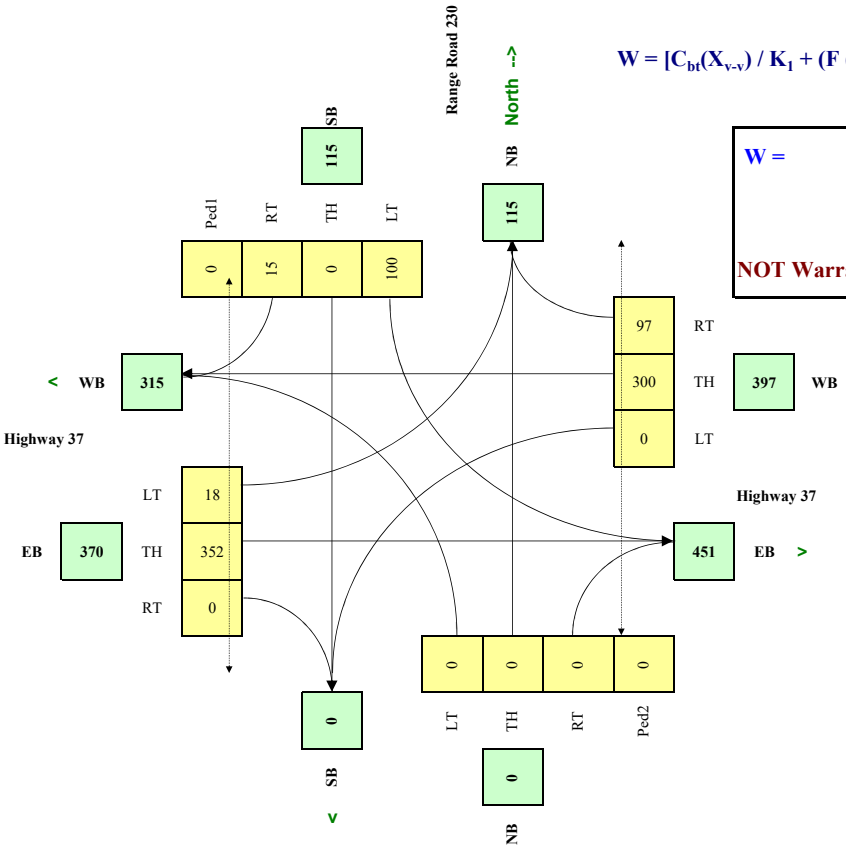
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	5,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 37	EW	100	3.0%	n	
Range Road 230	NS			n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
press 'Set Peak Hours' Button to set the peak hour periods	0	0	0	129	0	6	0	336	135	47	608	0				
	0	0	0	129	0	6	0	336	135	47	608	0				
	0	0	0	18	0	3	0	53	17	3	62	0				
	0	0	0	18	0	3	0	53	17	3	62	0				
	0	0	0	152	0	36	0	510	140	4	385	0				
	0	0	0	152	0	36	0	510	140	4	385	0				
Total (6-hour peak)	**0**	**0**	**0**	**598**	**0**	**90**	**0**	**1,798**	**584**	**108**	**2,110**	**0**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**100**	**0**	**15**	**0**	**300**	**97**	**18**	**352**	**0**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p}) L) / K_2] \times C_i$$

W =	59	59	0
		Veh	*Ped*

NOT Warranted

RESET SHEET

AT - Traffic Signal Warrant Analysis

Main Street (name)	Highway 37	Direction (EW or NS)	EW
Side Street (name)	Starkey Road	Direction (EW or NS)	NS
Quadrant / Int #		Comments	Enter Comments about the analysis here.

for Warrant Calculation Results, please hit 'Page Down'

CHECK SHEET

Road Authority:	AT	
City:	Sturgeon County	
Analysis Date:	2019 Mar 21, Thu	
Count Date:	2017 Jan 01, Sun	
Date Entry Format:	(yyyy-mm-dd)	

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 37	WB	1		1		1		10,000	2
Highway 37	EB		1				1	10,000	1
Starkey Road	NB				1				
Starkey Road	SB				1				

Are the Starkey Road NB right turns significantly impeded by through movements? (y/n) n

Are the Starkey Road SB right turns significantly impeded by through movements? (y/n) n

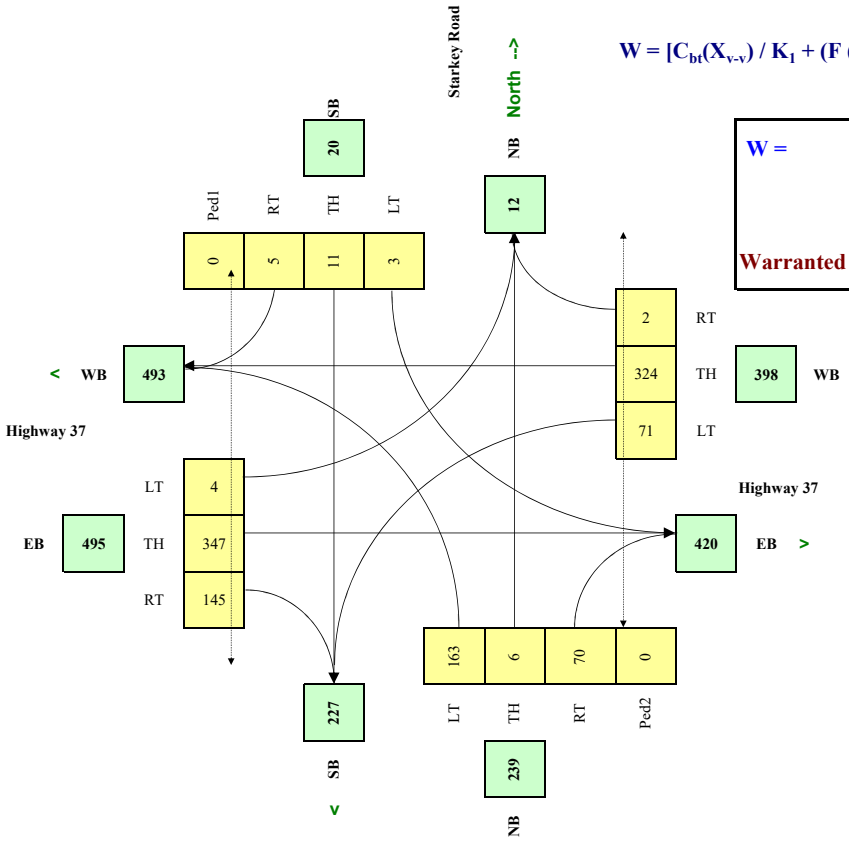
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	14,200
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 37	EW	100	3.0%	n	
Starkey Road	NS			n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
press 'Set Peak Hours' Button to set the peak hour periods	260	4	118	4	28	13	42	372	1	3	544	148				
	260	4	118	4	28	13	42	372	1	3	544	148				
	29	1	12	1	2	1	13	57	0	1	61	26				
	29	1	12	1	2	1	13	57	0	1	61	26				
	201	13	80	4	4	2	159	544	5	7	436	260				
	201	13	80	4	4	2	159	544	5	7	436	260				
Total (6-hour peak)	**980**	**36**	**420**	**18**	**68**	**32**	**428**	**1,946**	**12**	**22**	**2,082**	**868**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**163**	**6**	**70**	**3**	**11**	**5**	**71**	**324**	**2**	**4**	**347**	**145**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F(X_{v\text{-}p}) L) / K_2] \times C_i$$

W =	117	117	0
		Veh	*Ped*

Warranted

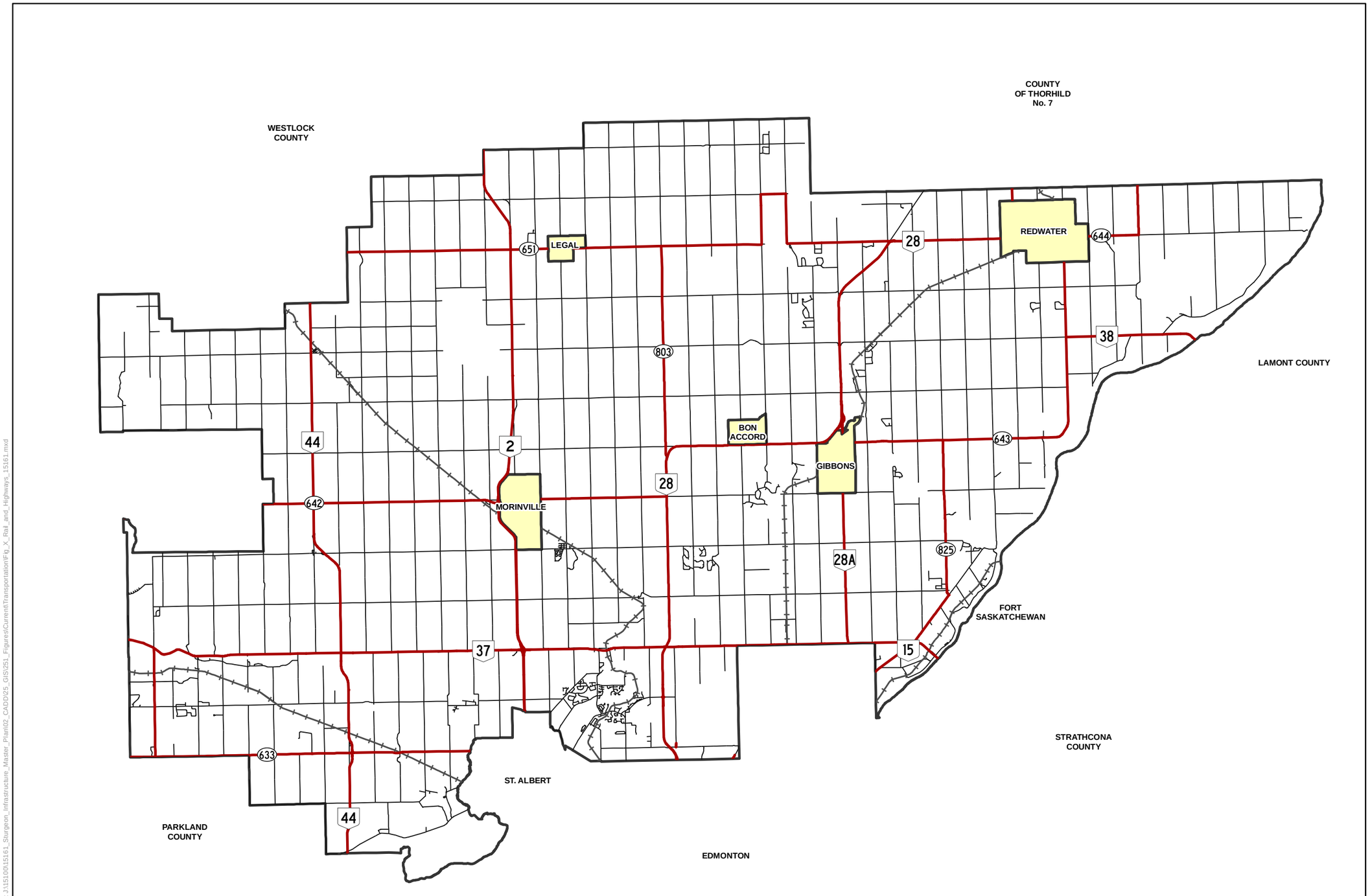
RESET SHEET

APPENDIX C
Railway Infrastructure

STURGEON COUNTY INFRASTRUCTURE MASTER PLAN

APPENDIX C:

RAILWAY INFRASTRUCTURE



Existing Highway

Existing Road Network

Rail Main Line

Neighbouring Municipality

Sturgeon County

0 1.5 3 6 9 12 km

1:250,000 NAD 1983 CSRS 10TM AEP Resource

Credits:

ISL Engineering and Land Services

Sturgeon County

Date: 2019-05-02 Document: J:\15100\15161_Sturgeon_Infrastructure_Master_Plan\02_CADD\25_GIS\251_Figures\Current\Transportation\Fig_X_Rail_and_Highways_15161.mxd

APPENDIX D
Lane Requirement Calculation

Sturgeon Road and 127 Street Lane Requirements

The number of lanes required for a roadway segment can be calculated using the United State's Federal Highway Administration's (FHWA) following calculation:

$$N = \frac{DDHV}{PHF \times MSF_i \times f_{HV} \times f_p}$$

Where:

- N = Number of lanes per direction required. This often results in a decimal, which is rounded up to the nearest whole number to ensure all traffic is accommodated.
- DDHV = Directional Design-Hour Vehicle Volumes. For this study, the peak hour peak direction volume is used.
- PHF = Peak hour factor, assumed to 0.92 to be consistent with the Synchro analysis.
- MSF_I = Maximum service flow rate for LOS i. For this study, the service flow rate for LOS D, 1800, is used.
- F_{HV} = Heavy Vehicle Factor, assumed to be 0.925.
- F_p= Road user familiarity adjustment factor, assumed to be 0.95 (95 percent of drivers use the roadway regularly).

Scenario	Phase	DDHV	N (number of lanes per direction)	Twinning Required
Option 1: Sturgeon Road (Without 127 Street)	1	710	0.50	No
	2	1,598	1.34	Yes
	3	2,404	1.71	Yes
Option 2: Sturgeon Road (With 127 Street)	3	1,106	0.72	No
Option 2: 127 Street	3	1,298	0.92	No