

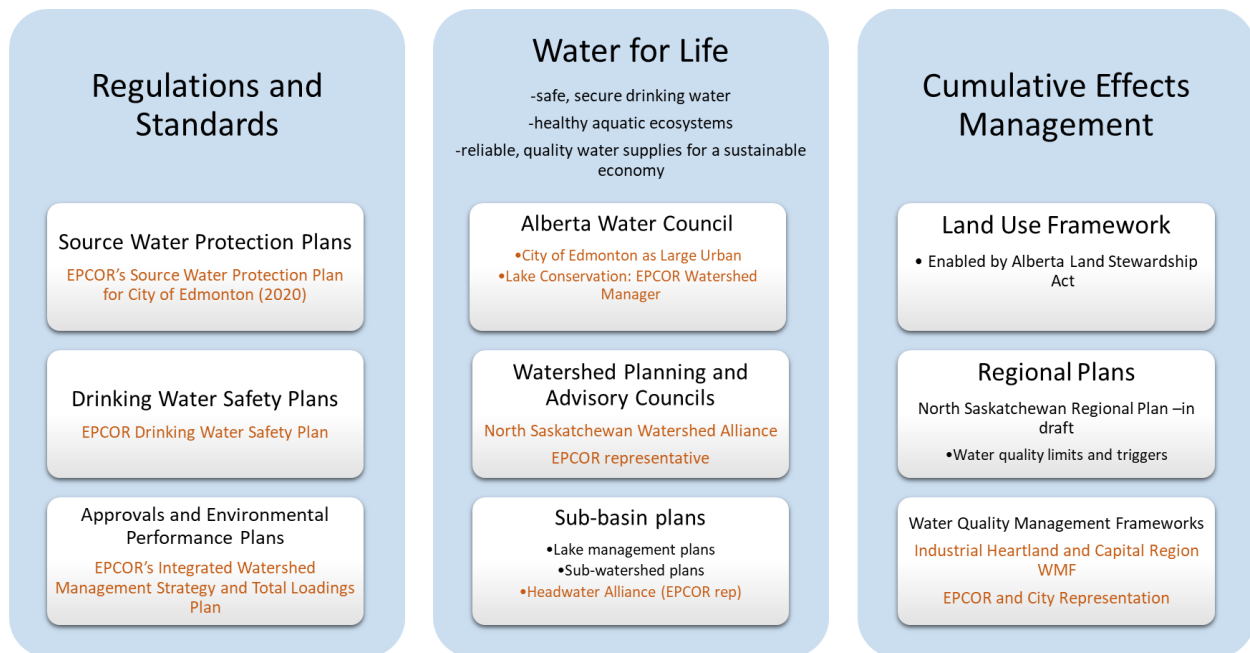
# **EPCOR and City of Edmonton Supported Watershed Management Initiatives in the NSR Watershed**

## **1. Background**

To provide insight into the need to develop a Headwaters Protection Strategy, EPCOR is providing this document to inform the current watershed management initiatives and involvement. Much of the following information is borrowed from the 2020 Source Water Protection Strategy and EPCOR's Integrated Watershed Management Study (in draft). It is our opinion that a City of Edmonton Headwaters Protection Strategy could be a simple document on how and why the City of Edmonton is integrating into existing management frameworks and initiatives. Watershed management is collaborative in nature and it is important to note the both the City and EPCOR have long been involved in watershed management and source water protection strategies in the NSR watershed, as described below. It should also be noted that municipal strategies for influencing land use decisions, including coal development, in the watershed are limited. The most effective strategy is likely providing input to the North Saskatchewan Regional Plan and any Management Frameworks that are established under the plan.

## **2. Current Governance Frameworks and Initiatives for the NSR Watershed**

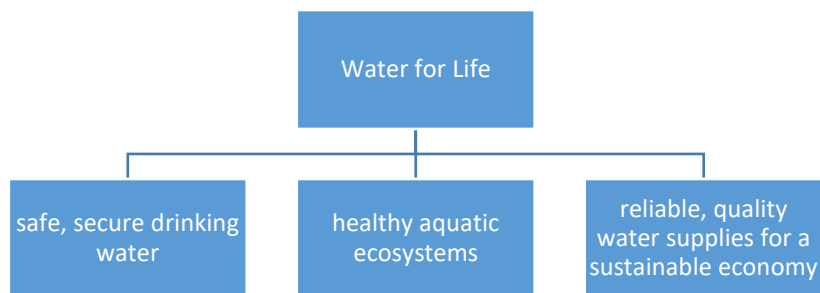
There are several frameworks and initiatives that strive to integrate land and water planning across Alberta (Figure 1). These initiatives continue to struggle with integration and therefore to foreword source water protection goals it is important to have a voice in each planning framework. Each initiative is described in more detail in the following sections but EPCOR and the City of Edmonton have consistently been involved at both the provincial and local shared-governance planning level. In addition EPCOR and the City of Edmonton have internal watershed management strategies for management cumulative impacts of the city's footprint on the NSR.



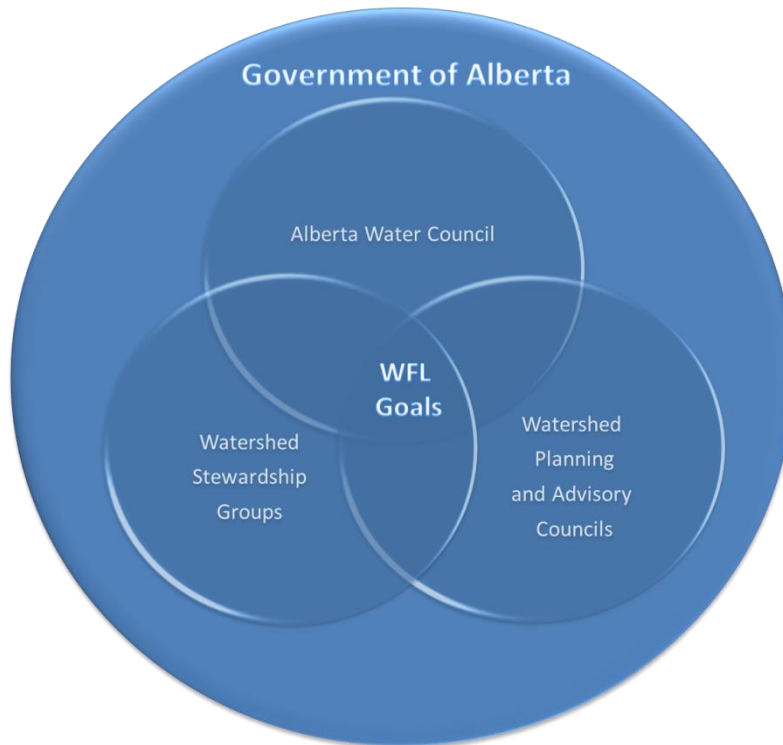
**Figure 1. Current Watershed Management Initiatives in Alberta**

### Water for Life Strategy

AEP's Water for Life (WFL) Strategy was introduced in 2003 and guides watershed and water management in Alberta under the guidance of three main goals (see below) and through knowledge and research, partnerships, and water conservation.



Three main partnerships exist under WFL and they have a shared accountability to achieve Water for Life goals. The first partnership is a provincial partnership with the Alberta Water Council (AWC). The AWC is a consensus-based partnership that provides timely and strategic advice to governments, industry, and non-government organizations towards achieving WFL goals and outcomes. The second partnership is regional partnerships with Watershed Planning and Advisory Councils (WPACs), who are designated leaders in watershed assessment and planning. EPCOR is engaged primarily at this level and, for Edmonton operations, engagement occurs through participation on the NSWA. Thirdly, there are local partnerships which occur with watershed stewardship groups. Watershed stewardship groups take community-level, on the ground action to safeguard our water sources. This section of the report will focus on the role of watershed planning and source water protection within the broader WFL strategy.



**Figure 2. Water for Life Roles and Responsibilities (modified from AWC 2008).**

In 2008, the Government of Alberta released a renewed Water for Life strategy and followed in 2009 with a *Water for Life Action Plan*, which supports the original goals and directions in the WFL strategy. The renewal emphasized partnerships and specifically highlighted working with the Alberta Water Council, Watershed Planning and Advisory Councils and watershed stewardship groups. The renewal was clear: Alberta’s water resources must be managed within the capacity of individual watersheds and to ensure safe, secure drinking water we must recognize our dependence on aquatic ecosystems as source water.

The Action Plan outlines a comprehensive strategy to protect our drinking water as a specific outcome. The strategy involves ensuring Albertans have timely access to information about drinking water quality in their communities and that drinking water infrastructure strictly adheres to emerging standards. Key actions from the original strategy, as they pertain to source water protection, include:

- Development of a waterborne disease surveillance system and the undertaking of waterborne contaminant research. Progress to date is minimal.
- An update of water quality programs to support source protection information and planning. Progress to date includes enhanced tributary monitoring as part of the WaterSHED program.
- Working with WPACs to incorporate drinking water source protection into watershed planning. Progress to date: support of the Alberta Water Council Source Water Protection Projects.

## Alberta Water Council

Incorporated as a not-for-profit society in 2007, the AWC is a multi-stakeholder partnership with twenty-four members from government, industry, and non-governmental organizations. Its primary task is to monitor and steward the implementation of Alberta's WFL strategy and to champion the achievement of its three goals. Recommendations on various aspects of water and watershed management are made to the provincial government, who then can choose to or not implement those recommendations into policy. Some key documents produced by the AWC which focus on watershed planning include: "Strengthening Partnerships: A Shared Governance Framework for Water for Life Collaborative Partnerships" and "Recommendations for a Watershed Management Planning Framework for Alberta". These documents were used to form current government policies in the WFL renewal and action plans and support sector-based approaches to watershed management.

In addition, project teams have been developed in the areas of water conservation, efficiency and productivity, healthy aquatic ecosystems, Alberta's water allocation transfer system, non-point source pollution, and riparian management and conservation. EPCOR has been involved on project teams through participation with the NSWA or other stewardship groups. EPCOR was involved in the formation of the AWC's "Guide for Source Water Protection Planning" (AWC 2020) which provides an overview of how drinking water providers in Alberta can begin voluntarily undertaking the creation of a SWPP. EPCOR is now co-chairing an AWC project looking to scope how a web-based toolkit could be made available to assist communities in creating source water protection plans.

## North Saskatchewan River Watershed Alliance (NSWA)

As the WPAC for the basin, the NSWA is mandated under WFL to complete State of Watershed reporting and to develop an Integrated Watershed Management Plan for the basin- which aligns with aforementioned WFL goals. Since its inception, an EPCOR staff member has been an active participant on the NSWA board and project teams.

The NSWA completed a "State of the North Saskatchewan River Watershed" in 2005, as well as a "Municipal Resource Guide" for communities in this watershed in 2006. In late 2005, the Alliance began work on developing an Integrated Watershed Management Plan (IWMP) for the basin, which was intended to set land use, water quantity, and water quality objectives for the basin. The plan was completed in 2012 (NSWA 2012b).

As a key part of the IWMP, a NSWA Technical Advisory Committee developed mainstem water quality objectives for the NSR. The final report: "Proposed Site-Specific Objectives for the Mainstem of the North Saskatchewan River" (NSWA 2010) set objectives for the NSR that helped guide watershed planning in the IWMP. The document promotes a "no further degradation in water quality" philosophy in the NSR. In areas, downstream of Edmonton, there is a call for improvement in water quality for some parameters.

Throughout the IWMP development, knowledge and data gaps were identified and a series of reports were completed to augment objective setting for the basin. The following key reports were completed:

Strawberry Watershed Riparian Area Assessment	2018
Modeste Watershed Riparian Area Assessments	2018
Preliminary Steps for the Assessment of Instream Flow Needs in the North Saskatchewan River Basin	2014
Vermilion River Watershed Management Plan	2012
Workbook Results: Integrated Watershed Management Plan for the North Saskatchewan River	2012
Discussion Paper for the Development of the IWMP for the North Saskatchewan River Watershed	2011
Economic Activity and Ecosystem Services in the North Saskatchewan River Basin	2010
North Saskatchewan River Basin Socio-Economic Profile	2010
Proposed Site-Specific Water Quality Objectives	2010
North Saskatchewan River Basin Overview of Groundwater Conditions, Issues, and Challenges	2009
Hydrodynamic and Water Quality Model of the North Saskatchewan River	2009
Cumulative Effects Assessment of the North Saskatchewan River Watershed using ALCES	2009
Cumulative Effects Assessment of the North Saskatchewan River Watershed Using ALCES	2009
Water Supply Assessment for the North Saskatchewan River Basin	2008
Climate Change Effects on Water Yield in the North Saskatchewan River Basin	2008
Current and Future Water Use in the North Saskatchewan River Basin	2007
Instream Needs Scoping Study	2007

Involvement with the NSWA will continue to provide an effective platform from which EPCOR can ensure effective and collaborative watershed management is achieved, with source water protection principles in mind. The City of Edmonton was on the NSWA Board up to 2019 and now is in an advisory role.

#### [Cumulative Effects Management and Land Use Framework](#)

The Government of Alberta enabled cumulative effects management on a landscape level with the release of the Land-use Framework (LUF) in December 2008, followed by the *Alberta Land Stewardship Act* (ALSA) in early 2009. The Land Use Framework is the overarching planning mechanism for Alberta's natural resources and is enforced through the ALSA, which supersedes all other provincial legislation. Regional plans, which are developed under LUF, present one of the first opportunities for a cumulative effects management approach. LUF has committed the province to taking a cumulative effects approach to environment management in seven designated regions. Regional Advisory Councils (RACs) will be established to help guide/set landscape level outcomes which will be included in Regional Plans. Consultation of Phase 1 of the regional plan for the NSR Watershed is complete.

Cumulative effects management requires integration amongst spatial scales – provincial, regional, sub-regional, local and site-specific. At present, AEP is developing Management Frameworks that

support regional plans under the LUF, including Water Quality Management Frameworks. Water quality management frameworks are place based and likely to be developed for the mainstem rivers and other priority areas. The Industrial Heartland and Capital Region Water Management Framework is an example of an existing place-based framework that takes a cumulative effects approach to land and water management. EPCOR is engaged in planning through the Water Management Framework for the Industrial Heartland and Capital region.

### Water Management Framework for the Industrial Heartland and Capital Region

The Water Management Framework (WMF) of the Industrial Heartland and Capital Region (AENV 2007) outlines specific environmental outcomes for the region and sets targets for sustainability and regional strategies for the tracking and management of air, water and land. The WMF for the Industrial Heartland and Capital Region Report is the result of consultation, collaboration, and planning for growth by AEP, industry, municipalities, municipal water and wastewater treatment facilities, and the NSWA. The key strategic objective is to develop a world class integrated water management system from the plan are to make Alberta a world leader in water and wastewater reclamation technology and to minimize the impact of “footprint” on the NSR by improving the quality of the water and ensuring water conservation practices are in effect. The WMF will be used to manage water quantity to ensure that sufficient water remains in the river to maintain aquatic life, support current and proposed industrial development, attain water quantity and quality targets, and move towards a minimal-loading discharge policy for return flows to the NSR. Updates on the Water Management Framework for the Industrial Heartland and Capital Region were completed in 2013 and 2016.

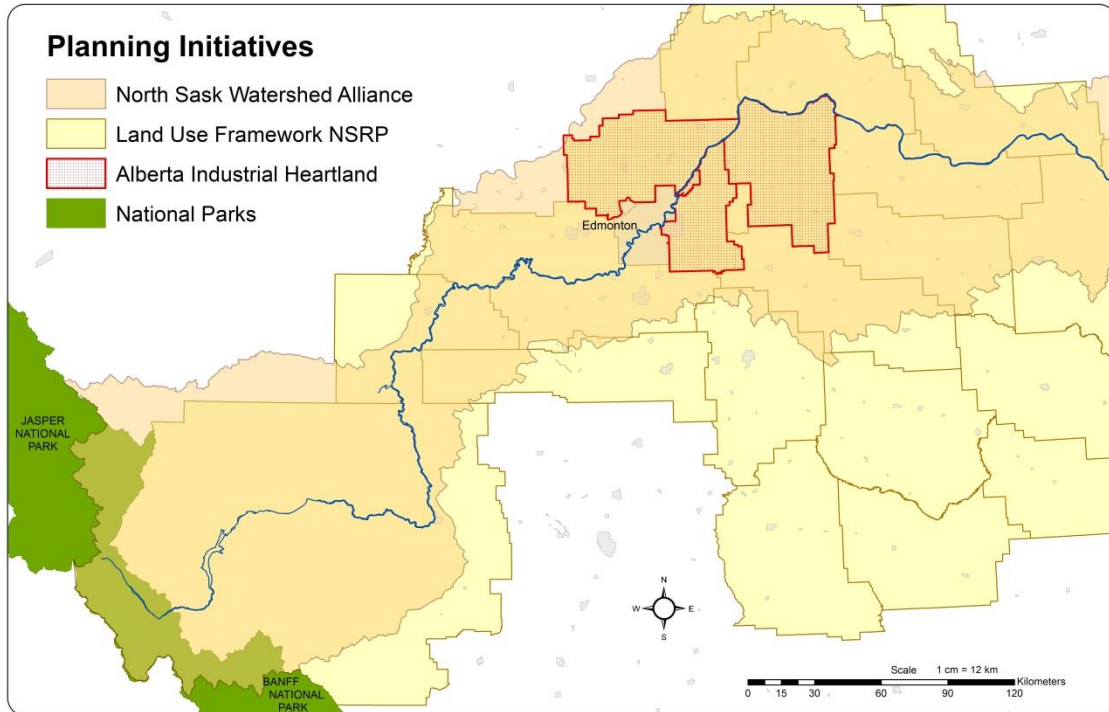


Figure 3. Planning Initiatives in the NSR Watershed

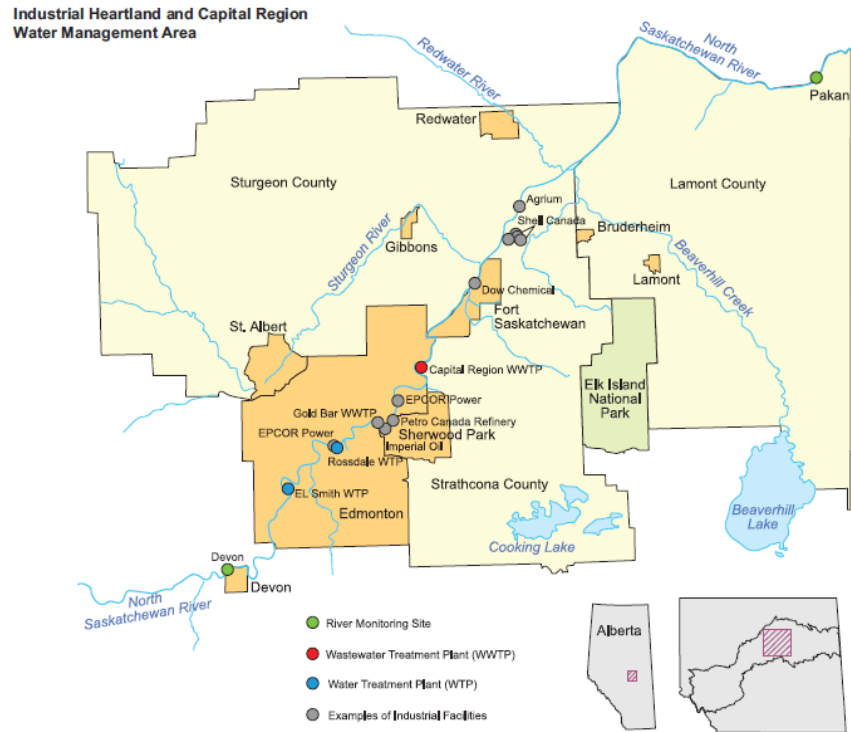


As part of this work, AEP has completed a multitude of water quality modelling and assessment projects and reports as found below:

Effluent Characterization Program for the Industrial Heartland and Capital Region	2015
North Saskatchewan River: Water Quality and Related Studies (2007 – 2012)	2014
Pilot Water Quality Objectives and Allowable Contaminant Loads for the North Saskatchewan River.	2013
The Water Management Framework for the Industrial Heartland and Capital Region – Five Years of Implementation.	2013
Investigations of Trends in Select Water Quality Variables at Long-Term Monitoring Sites on the North Saskatchewan River	2012
Guidance For Deriving Site-Specific Water Quality Objectives for Alberta Rivers.	2012
Synthesis of Recent Knowledge on Water Quality, Sediment Quality, and Non-Fish Biota in the North Saskatchewan River with Special Emphasis on the Industrial Heartland – Capital Region Water Management Framework Reach.	2011
North Saskatchewan River Water Quality Model: Alberta Environment Technical Report - Version 1.1.	2009
Analysis of Water Quality Trends for the Long-term River Network: North Saskatchewan River, 1977-2002	2005

Central to WMF is the publication of pilot maximum allowable loads for the Devon to Pakan reach of the NSR (AEP 2013). The goal of this was to ensure that water quality is maintained or improved in the NSR. As such pilot water quality objectives (WQOs) were established for the Industrial Heartland reach, inclusive of the river mainstem from Devon downstream to Pakan. The WQOs apply specifically to the long-term river network (LTRN) monitoring sites at Devon and Pakan sites, and are based on ambient in-stream concentrations, except where ambient concentrations exceed the most stringent federal/provincial water quality guidelines. Maximum allowable loads (MALs) were calculated from WQOs and provide a measure against which long-term changes can be assessed. It is expected that final WQO and MALs will be established over the next five years.

The WMF also completed an Effluent Characterization Program, which describes the monitoring and reporting requirements of point sources of industrial discharges entering the NSR in the Devon to Pakan reach. The goal is to have a better understanding of the relationship between effluent and surface water quality to better manage the cumulative effects to the NSR. This monitoring is continuing in 2020-2022. The next step of the WMF is to refine and use the results from the Effluent Characterization Program to manage effluents and the cumulative effects to water quality in the NSR through load apportionment.



**Figure 1. Industrial Heartland and Capital Region Water Management Area**

### EPCOR’s Watershed Protection Program

EPCOR’s Watershed Protection Program (WPP) has two primary goals: to ensure a safe, secure drinking water supply through the application of source water protection principles and to ensure minimal effects from operations on water quality and aquatic ecosystem health in receiving water bodies. EPCOR recognizes that SWPP is a critical first step in a multi-barrier approach for water utilities to protect both quality and quantity of water sources. Experience has shown the protection and proper management of the upstream watershed can improve or prevent deterioration of the quality of raw water entering treatment plants. Awareness of upstream activities also enables EPCOR to respond quickly to developing water quality issues within the watershed.

Watershed management is complex, particularly when multiple stakeholders affect land use and water quality in the upper reaches of the basin; as well when there are various landscape planning initiatives occurring at different levels of government. EPCOR’s WPP works within the existing watershed management and source water frameworks, at both the federal and provincial level. The WPP has four main focus areas: watershed planning, implementation of watershed plans and programs, monitoring and research, and education and awareness. Although these focus areas are interrelated, in general, the core of EPCOR’s WPP entails: developing watershed planning documents; supporting the outcomes of those plans through implementation programs; developing and supporting monitoring and research programs to measure changes in selected metrics; and garnering support from watershed stakeholders.



### EPCOR's Integrated Watershed Management Strategy

EPCOR is currently drafting an Integrated Watershed Management Strategy (IWMS) to manage total loading effects on the health of the NSR and to ensure source water protection for the Edmonton water supply in one unified watershed management program. The IWMS reviews the current state of planning, assessment, and implementation at multiple scales with the penultimate goal of a nested approach to watershed management. Integral to this approach is using established river outcomes to evaluate the impact of storm water, combined sewer, wastewater, and water treatment plant waste streams on the NSR and its tributaries. In this vein, once the relative influence of each source is understood the effectiveness of assessment programs and implementation and management decisions will also be evaluated. Where monitoring, modelling, or research is not adequate to determine relative contribution or effects on river or stream outcomes, recommendations will be made to fill those gaps. Although river outcomes provide the foundation from which to determine effects, we note that EPCOR is also grounded in a commitment to ensuring clean and abundant water supplies for EPCOR's WTPs and to also reduce the impact of discharges released to the NSR.

The IWMS will also guide and replace EPCOR Drainage's Total Loading Plan which was a 10 year old, continuous commitment to protect the regional watershed, comply with regulatory requirements and sustain the surface water quality by managing and limiting loadings from storm water and wastewater collection systems. 2019 marked the end of original 10 year Total Loading Plan and there was a need to reevaluate the established benchmark and align the Total Loading Strategy with EPCOR corporate strategic goals of preserving and sustaining Edmonton's environment and above all maintain a healthy river.

### EPCOR's Stormwater Integrated Resource Plan

To reduce flooding risks within the City of Edmonton, EPCOR developed the Stormwater Integrated Resource Plan (SIRP). SIRP is intended to reduce urban and riverine flooding events through capital and operational changes applying a risk ranking assessment based on hazards/risks related to: Health and Safety, Environment, Financial and Economic Impact and Social or Service Level impact. EPCOR developed the investment recommendations considering a mix of grey and green infrastructure components. On commercial or industrial land green infrastructure funding is targeted at highly impervious lots that are major contributors to storm collection system. The approximately \$1.6 billion capital program proposed through the SIRP can be classified into five themes of investment: slow, move, secure, predict and respond. Although flooding risk is the main driver of SIRP, it is expected that water quality improvements will be made through the implementation of green infrastructure and managing surface runoff at the source. Peak flow reduction and overall stormwater volume reduction will reduce impact on urban creeks, specifically reducing bank erosion and destruction of natural drainage ways as a result of land development.

The SIRP approach is to capture the stormwater volumes in dry ponds prior to reaching the storm trunk network to provide additional capacity in the pipes in the immediate path of the storm. The addition of Low Impact Development (LID) throughout the catchment area will reduce peak flow and further retain these volumes at the source and reduce the impact on the entire pipe network as storms travel across the community as well as impact on urban creeks and all natural drainage ways. The plan also includes tunnels, trunks and sewer separation in locations where, due to

configuration of the community, there is limited space to install additional ponds or LID components to fully capture the expected water volumes during a major storm event. Need for additional trunks/tunnels will be re-evaluated as we progress with SIRP implementation but currently the focus is to control and reduce the inflow and utilize the existing collection system to maximum through monitoring and control.

#### City of Edmonton

In 2012 the City of Edmonton published their River for Life Strategy (City of Edmonton 2012). The strategy committed to a number of policy objectives aimed at long-term protection of water quality of the North Saskatchewan River under its environmental strategic plan, The Way We Green (City of Edmonton 2011). At the time, the City of Edmonton's Drainage Services contributed to these objectives by developing a framework and 30 year strategic plan to reduce pollutant discharge within the watershed, with the ultimate goal of achieving net zero impact from human activities. The idea was that River for Life would take into account three discharge pathways: urban runoff from storm events, combined sewer overflows, and municipal wastewater and was intended to guide the City's efforts to reduce contaminants in each pathway in the short, medium and long term. The drivers to achieve net zero impact relied on watershed planning, municipal leadership, responding to regulations, ensuring infrastructure is resilient, investing in high value resources to reduce contaminant discharges, and being proactive and innovative. Since Drainage Services joined EPCOR in 2018, River for Life has come under EPCOR's umbrella and was reviewed as part of EPCOR's Integrated Management Strategy. EPCOR has incorporated the general intent of this strategy into its Integrated Watershed Management Strategy, which is currently in development, and River for Life is now a legacy initiative.

The importance of the NSR is highlighted in the City of Edmonton's Climate Resilient Edmonton: Adaptation Strategy and Action Plan (City of Edmonton 2018), and ConnectEdmonton Strategic Plan (City of Edmonton 2019), in terms of water quality and quantity for drinking water, as well the risk of potential river flooding.

#### Blackmud/Whitemud Creek Surface Water Management Group

The pace of development in the Edmonton-Leduc corridor has been increasing recently and the 1200 km<sup>2</sup> area is expected to be developed over the next 50 years. This development will place additional stresses on Blackmud and Whitemud Creeks, which have already been impacted by previous development. In order to determine the cumulative effects of additional stormwater discharges to these creeks, the Blackmud/Whitemud Surface Water Management Group was formed. Stakeholders participating included the Leduc County, the City of Edmonton, the City of Leduc, the Town of Beaumont, Strathcona County, and the North Saskatchewan Watershed Alliance. More recently EPCOR has been involved in this group.

The group completed the Blackmud/Whitemud Creek Surface Water Management Study which involved hydrologic, hydraulic and environmental analyses of the Blackmud and Whitemud Creek basins to develop a stormwater management strategy to accommodate future development in the basin (Associated Engineering 2017). As development continues in the Blackmud and Whitemud basins, the runoff rates and volumes will increase and it is expected that flooding, erosion, and declining water quality will result unless stormwater releases are managed. Historical release rates vary across the municipalities and range from 2 to 9 L/s/ha. The key objective of this project was

to prepare a Surface Water Management Plan (SWMP) in accordance with the Stormwater Management Guidelines for the Province of Alberta and the Alberta Wetland Policy, to ensure that cumulative effects on the watershed are understood and will be appropriately mitigated and managed. A final release rate of 3.0 L/s/ha was agreed upon by the group which will be achieved through a series of grey and green infrastructure projects through SIRP.

### Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems

In 2012, Alberta Environment and Parks revised the “Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems”. Part 2 of this revised document is titled “Guidelines for Municipal Waterworks” and includes a section on source water protection and highlighted the importance for municipalities to conduct source water protection planning.

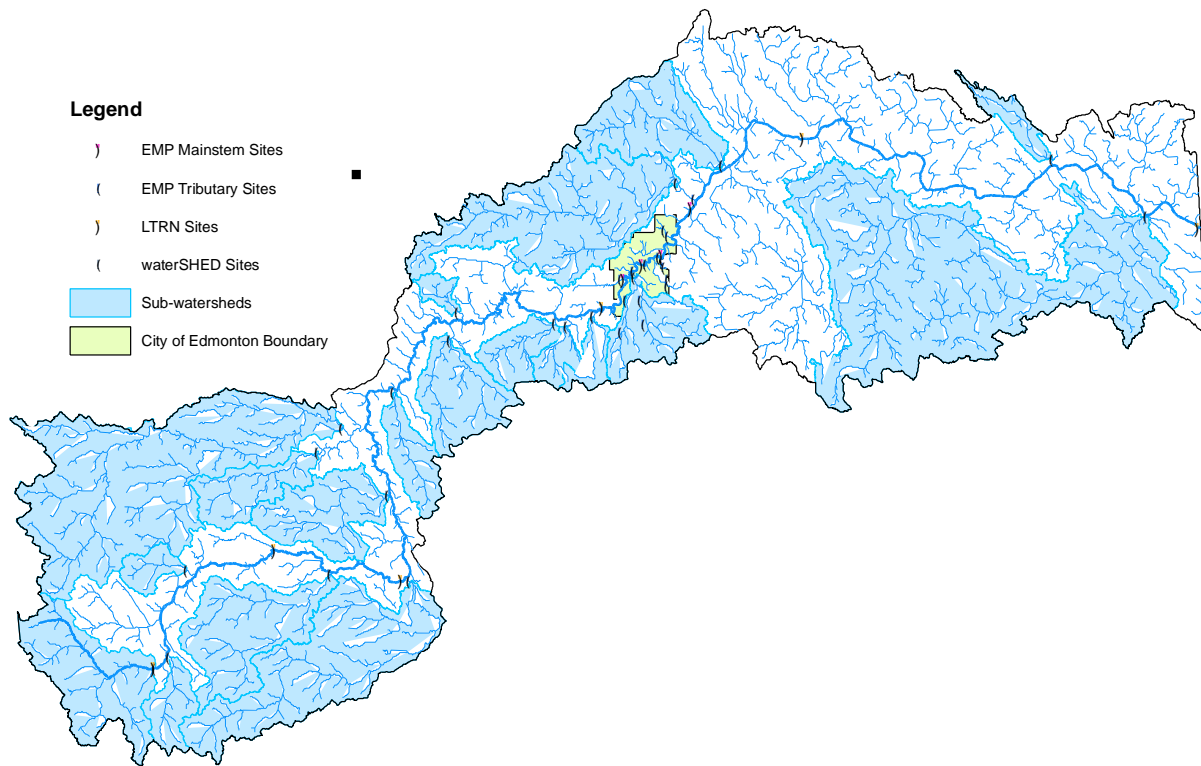
### Drinking Water Safety Plans

As part of the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, there is a requirement to complete Drinking Water Safety Plans (DWSP). These plans include a source to tap risk assessment. EPCOR completed its risk assessment in 2013, and the DWSP, including the action plan, was finalized in 2013. The risk assessment component for source waters has been incorporated the hazard and risk assessment in Section 3.5. EPCOR continues to reevaluate and reassess its DWSP annually.

## 3. Current Monitoring Programs for the NSR

This section describes the current monitoring programs that are used to characterize water quality in the North Saskatchewan River. These initiatives are supported by both the City of Edmonton and EPCOR and in some cases are a collaborative effort between other watershed stakeholders (e.g. WaterSHED program).

## Monitoring Program Summary



**Table 1. Current EPCOR/City of Edmonton Supported monitoring programs, scale of planning, and program purpose in the NSR Watershed.**

<b>Monitoring Program Title and Group</b>	<b>Scale</b>	<b>Purpose</b>
<b>waterSHED Monitoring Program</b>	Whole Basin	To characterize water quality, aquatic ecosystem health, and material flux in the NSR using five sites along the mainstem and paired flow and water quality sampling at 19 tributaries
<b>Environmental Monitoring Program (EMP)</b>	City of Edmonton Watershed	To quantify storm, wastewater, and CS loads and evaluate impact on the NSR through load assessment and sampling four intake points throughout and downstream of the City
<b>EMP Tributary Monitoring Program</b>	City of Edmonton Watershed	To characterize water quality in City of Edmonton urban creeks using upstream and downstream sampling design
<b>WWTP Effluent Characterization Program</b>	Point: Final Effluent of Gold Bar and	To screen effluent for potential exceedances of guidelines, to refine future monitoring programs,

	Alberta Capital Region WWTPs	and to assess inputs as they relate to river outcomes at Pakan.
<b>WTP Residuals Monitoring Program</b>	Point: At waste-stream discharge point at WWTPs	To assess event loads and the effect on near-field and far-field (Pakan) water quality
<b>River for Life Sampling Program</b>	City of Edmonton Watershed	To assess storm runoff from a variety of land uses to inform load predictions for stormwater load estimates
<b>LID Monitoring Program</b>	City of Edmonton Watershed	To determine health and function of LID features in Edmonton by monitoring eight sites for water quality, vegetation metrics and soil health.
<b>Storm system flow monitoring</b>	City of Edmonton Watershed	To determine storm volumes and understand flow dynamics throughout the system to reduce flood risks
<b>Storm Water Pond Monitoring</b>	City of Edmonton Watershed	To determine the efficiency of storm water management facilities in Edmonton through intake and outflow monitoring at five sites

### Basin-Wide Monitoring

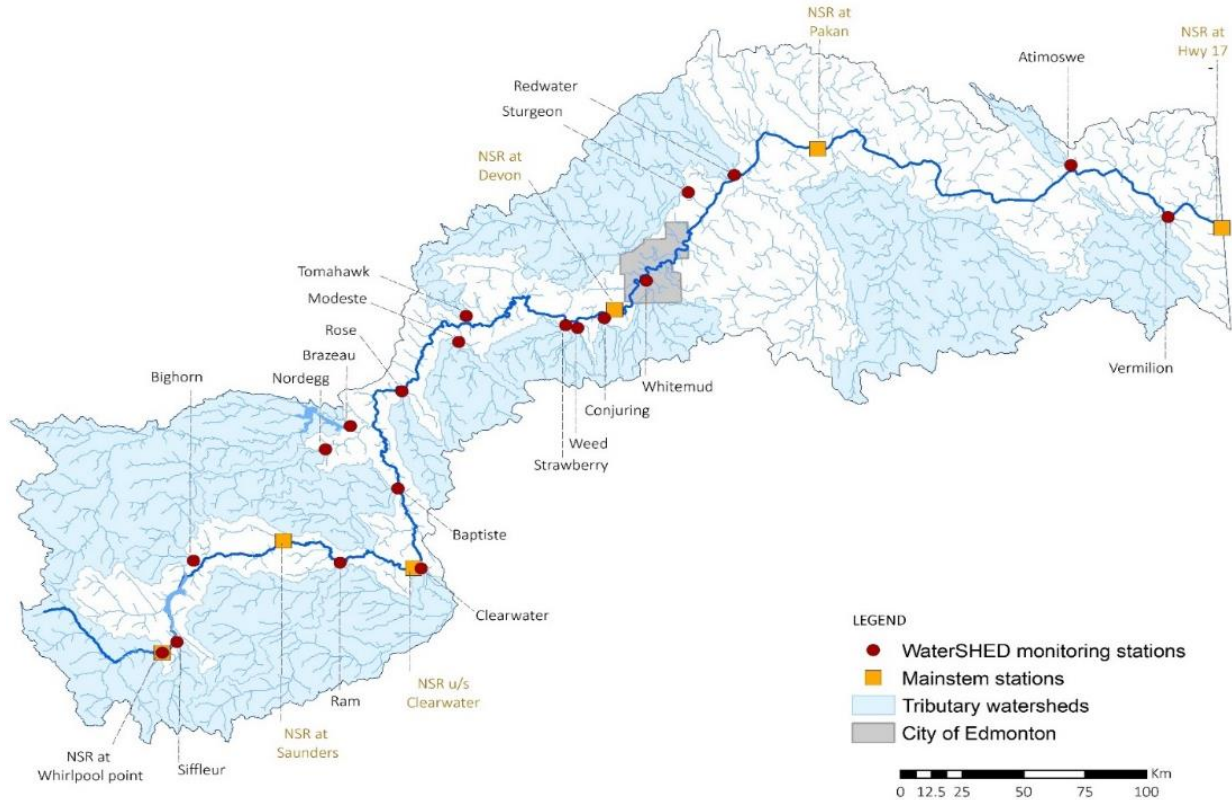
In 2010, EPCOR's Watershed Group spearheaded a Water Quality and Aquatic Ecosystem Working Group in Partnership with the North Saskatchewan Watershed Alliance to address monitoring challenges in the North Saskatchewan River basin. This group identified a need for a scientifically defensible, sustainably funded, long-term water quality and aquatic ecosystem health monitoring program for the North Saskatchewan River and its major tributaries. The goals of this program would be to: 1) allow the assessment of drivers of water quality and quantity; 2) understand the effects of continued land use change and population growth pressures; and 3) to inform planning at the regional, source water, and municipal scale. Although monitoring has occurred in the past it has been disjointed, project specific, and not comprehensive enough to meet the needs of those trying to balance land use decisions with maintaining water quality and quantity. A good summary of past monitoring data can be found [here](#).

In 2016, EPCOR Water Canada put forward a request for up to 1 million dollars per year for four years from the Edmonton Rate Payers for an environmental monitoring program for the North Saskatchewan River and this was supported by Edmonton City Council. The program was designed in 2018, monitoring and flow station installation began in 2019, and funding is guaranteed until the end of 2021. EPCOR hopes to get approval to continue monitoring through the next PBR cycle 2022-2026.

The monitoring program is based on a mass balance approach with paired water quality and quantity data and representative sub-watersheds were chosen based on hydrological response and watershed characteristics. In order to understand the link between watershed characteristics, climate, and water quality and quantity, the program is designed to be long term. To be useful it must capture inter-annual variability (wet and dry years) and seasonal variability (e.g. fast spring



melt) across headwater watersheds to parkland/agriculture dominated watersheds. And it must be paired with data in the North Saskatchewan River. To achieve this, it is expected that at least ten years of complete data is required with evaluation of the program after that date.



**Figure 5. WaterSHED monitoring program locations and tributary watershed areas.**

## City of Edmonton Watershed Monitoring

### North Saskatchewan River and Tributary Monitoring

Although there has been sporadic sampling of the NSR and its tributaries within the City of Edmonton over the years there are two programs that continue to provide long-term data. The first is the Edmonton Monitoring Program (EMP), formally run by City of Edmonton and now with EPCOR's Drainage and Water Canada Business Units, and the second is EPCOR's WTP Intake Monitoring Program.

The purpose of the EMPs river and creek monitoring program, which began in the late 90s, was originally to evaluate water quality as the North Saskatchewan River flows through the City of Edmonton and highlight areas of concern. In addition, the program aimed to characterize water quality in urban tributaries. The EMP program was designed to capture seasonal changes in water quality and characterize water quality during wet and dry periods. There was an assumption that during dry periods the influence of the City of Edmonton's footprint from stormwater would be minimal but the impact from the wastewater treatment plants would be more significant. The EMP program has evolved through the years and now has three main focus points: the quantification of loads to the NSR from the combined system and the storm system;



mainstem monitoring at four intake locations; and tributary monitoring, which has been enhanced in the last year. The program is executed by a consultant, who has varied over the years, and an annual report is completed. In this section we focus on the evaluation of the mainstem and tributary components of the EMP and the outfall load monitoring is discussed in the next section.

Intakes are located at E.L. Smith WTP which is (23 km downstream of Devon), Rosedale WTP (17 km downstream of E.L. Smith), Suncor (12 km downstream of Rosedale WTP and 4 km downstream of Gold Bar WWTP), and Dow Chemical (35 km downstream of Gold Bar and 16 km downstream of ACRWC WWTP).

EPCOR's Intake Monitoring Program at the WTPs is intended to inform WTP water production but due to its comprehensive nature in terms of location, parameters, consistency, and frequency over the last 40 years it has become an indispensable resource in terms of quantifying source water quality.

Some monitoring of the NSR and urban tributaries is conducted by not-for-profit NGOs. RiverWatch/CreekWatch collects samples from the NSR, and creeks within the City of Edmonton to engage citizen scientists to collect water quality data. Since 2013, RiverWatch has collected approximately 50 samples per year upstream and downstream of the Gold Bar WWTP. Sampling is restricted to May, June, September and October during periods of moderate to low flow to accommodate school groups. Parameters measured include, dissolved oxygen, ammonia, TP, turbidity, chloride pH, temperature. These parameters are measured using field HACH kits, with a small number of laboratory samples submitted to confirm HACH kit results. Similarly, several urban tributaries within the City of Edmonton have been monitored by CreekWatch since 2015, including: Wedgewood, Whitemud, Blackmud, Mill, Gold Bar, and Fulton. Samples are collected either by CreekWatch staff or by citizen scientists and are analyzed for the same parameters as RiverWatch. Between one and two dozen samples are collected each year, with effort varies among sites and years. While these sampling programs do provide valuable results, these are not typically integrated with results collected by trained staff and submitted to accredited laboratories. The North Saskatchewan River Keeper has also collected a small number of *E. coli* samples along the banks of the NSR in an attempt to measure recreational water quality.

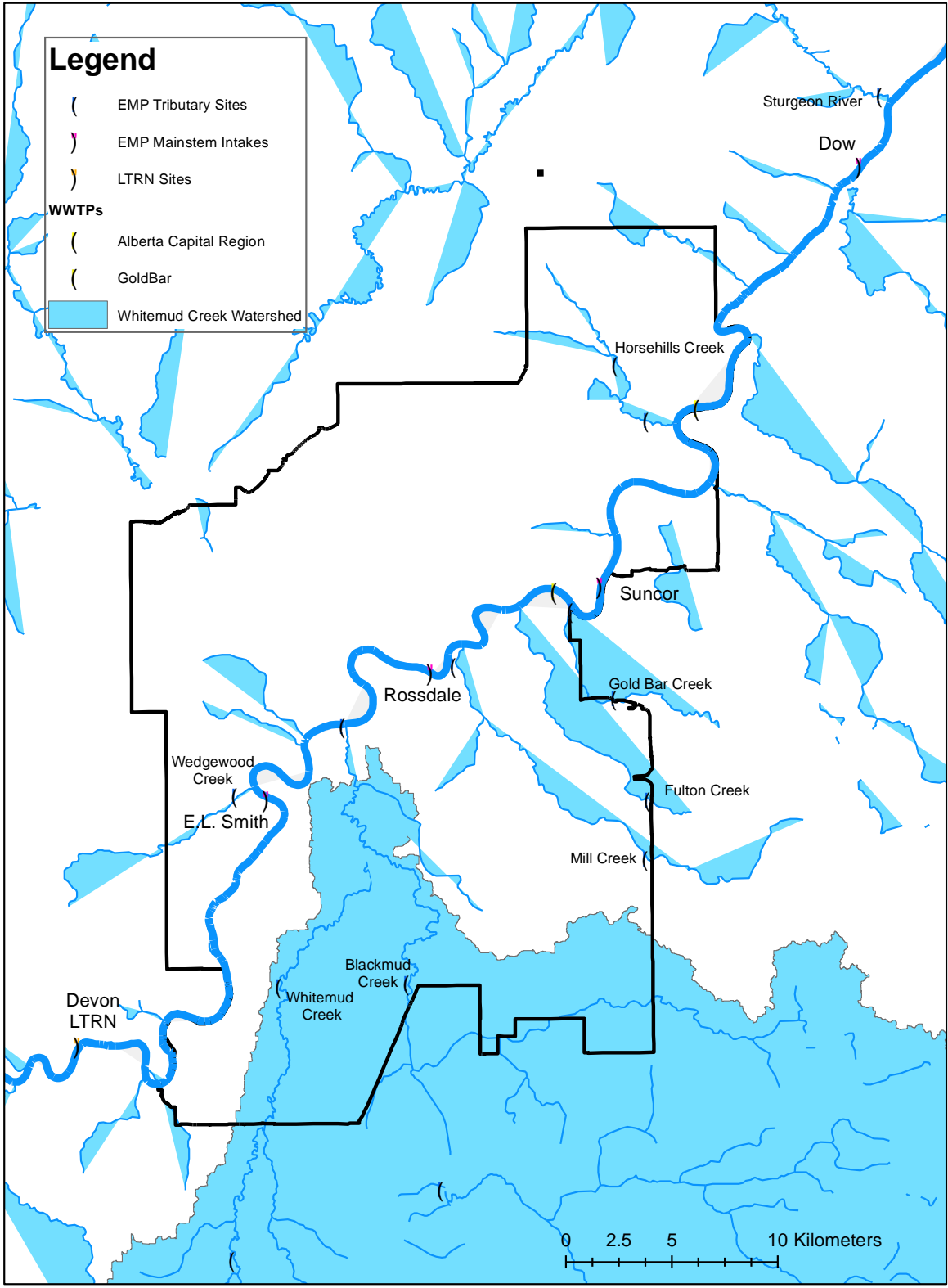


Figure 6. City of Edmonton Watershed tributary and mainstem NSR monitoring locations.

## 4. Modelling Initiatives

Modelling is a critical tool in watershed planning as it allows scientists and managers to predict how changes in watershed conditions will affect downstream river and stream conditions. These conditions can include both watershed metrics such as land use (e.g.. agricultural bmps), land cover (e.g. wetland areas, impervious surface), climate, along with point source discharges. Models can also be used to establish baseline conditions for watersheds that have been disturbed to help set sub-basin watershed outcomes.

The process for model selection depends on a number of factors including data availability, familiarity of the modeller, scale, and the question that model is trying to answer. In the North Saskatchewan River basin, numerous models have been developed and are currently in development. Each model has a particular application and development has largely been based on government priorities at the time, academic pursuits and grant availability, and management pressure (i.e. flooding risk).

Historically EPCOR has largely relied on partners to develop basin models to help determine drivers of water quality and quantity and address changes in watershed conditions. For source water, water quality for most of the year was largely driven by land use in the upper tributaries and precipitation patterns that were largely static; source water quality was not showing discernable trends. With the addition of Gold Bar WWTP and the stormwater collection system, combined with a potentially changing watershed due to climate change, there is an increasing urgency to develop an integrated model for the NSR basin that would meet the needs of all stakeholders. To meet this need, EPCOR's Watershed Team, launched a Watershed Modelling Working Group in early 2020. The first step was to identify what questions stakeholders were looking for a model to answer. The second step was to determine what models were available. This was done by a literature search and talking to various researchers that we have connected with through other projects. In July 2020 a "state of" modelling in the NSR webinar series was initiated by EPCOR's Watershed Group.

### **Modelling Workshop Summary**

Based on the presentations and discussions in the workshop, it was evident that there is little alignment or strategic direction of the modelling efforts in the basin. Each organization has their own model of choice, and there is little evidence of collaboration among organizations. There appears to be little *a priori* assessment of which models are the most appropriate to use, and the models used are typically based on which models the organization is familiar with, or where funding was available. Frequently, models appear to have been developed without attempting to address specific questions/outcomes. Lastly, many models lack a significant degree of calibration and validation, frequently due to data gaps, or that the models have not been reassessed with the new data that is available.

There are some efforts underway to align modelling. AEP has developed the Alberta Modelling Expert System (MES) which houses all the models in a searchable format that allows users to determine if any models have been completed for a specific area. Anil Gupta at AEP is

responsible for coordinating AEP's modelling efforts and is planning a more strategic approach with AEP's modelling, and has committed to be a part of the WaterSHED modelling working group.

EPCOR has some internal modelling capacity and is currently using Mike Urban to predict flood hydrology and flooded areas. There is a significant opportunity for EPCOR to expand its modelling efforts to include water quality. This expanded modelling effort would help inform total loadings and LID development. However, EPCOR would need to ensure that internal efforts and resources are aligned.

#### *Development of NSR Basin Modelling Strategy*

The modelling working group was tasked with developing a ten year modelling strategy for the NSR Basin. This work would begin with creating a document that contained a summary of stakeholder needs; state of current modeling; and a ten year modelling strategy with roles and responsibilities.

#### **Partners**

The key partners in developing a water quantity/quality modelling strategy for the basin are those who are currently using or require models to inform watershed management. This includes, but is not limited to, the Government of Alberta (AEP-Modelling Hub, AEP- Flood Forecast, AER, for example), North Saskatchewan Watershed Alliance, Industrial Dischargers, City of Edmonton, and EPCOR. There is also a wealth of knowledge and work in academia that focuses on model development and that work can inform watershed management and managers. Each organization is interested in modelling at differing scales and is currently supporting a range of different models and summarized in the tables below. Other municipalities in the NSR basin could also be leveraged as partners in achieving modelling outcomes; however, to date we currently have limited engagement with these municipalities on the topic of modelling.

#### *Modelling Assessment/Recommendations/Strategies*

Aligning modelling in the NSR basin is critical as there are limited resources and the ability to manage water quality and water quantity is dependent on the availability of predictive models. Water quality outcomes have been established and although the process is evolving, it is necessary to understand how land management will impact loads to the river/tributaries and water quality and quantity. Further, there needs to be nested alignment at the basin scale to the point source contributions. It is recommended that:

- EPCOR's Watershed Team continue to lead the development of a basin wide Ten Year Modelling Strategy with a focus on a nested approach
- EPCOR use the savings from the overall monitoring program cost reductions to employ a watershed modeler who will:
  - Develop a City of Edmonton Urban Watershed model with water quality and provide recommendations for the current monitoring programs
  - Use and inform AEP's EFDC river model and link the Urban Watershed Model into the model

- Work closely with the City of Edmonton and AEP on the LSCP upstream model to inform changes in source water quality
- Inform the development of Ten Year Modelling Strategy for the NSR
- Model land use change from climate change and development at both the urban and source water scales using the developed basin wide model
- Work closely with other EPCOR business units to use modelling expertise to implement total loadings management