EPCOR WATER SERVICES

WASTEWATER INTEGRATED RESOURCE PLAN: A NEW WAY OF PLANNING

2023 Summary Report

Published: January 8, 2024

A four-panel art piece depicting the symbiotic relationship between the magpie and the buffalo and the deep roots these creatures have with Edmonton's river valley adorns the air quality monitoring station near the Gold Bar Wastewater Treatment Plant. The installation was created by local artist Matthew James Weigel in September 2022.

LAND ACKNOWLEDGEMENT

As a company that operates across Turtle Island, also known as North America, EPCOR recognizes that its work takes place on the traditional territories of Indigenous Peoples. We respectfully acknowledge the significance of the lands and waters our utilities are situated on and by, including the diverse histories, languages, and cultures of the many First Nations, Métis, and Inuit Peoples, whose presence reaches back to time immemorial.

Several of our Canadian operations reside on territory that is covered under Treaties, which were entered into by First Nations peoples and the Crown. In particular, our headquarters in Edmonton, and both of the city's water treatment plants, are located on the banks of the North Saskatchewan River, found in the heart of Treaty 6 territory – the traditional lands of the Blackfoot, the Cree, the Dene, the Nakota Sioux, the Saulteaux, and later the Métis.

EXECUTIVE SUMMARY

WHAT IS THE WASTEWATER INTEGRATED RESOURCE PLAN?

Integrated Resource Planning (IRP) is the iterative long-range planning approach used by EPCOR for regulated water and wastewater operations in Edmonton. The Wastewater IRP (WWIRP) provides a summary of strategies and planning principles for Edmonton's sanitary and storm systems, including our Gold Bar Wastewater Treatment Plant (WWTP) and Clover Bar Solids Management Facility.

The result is an evolving path forward for building, operating and maintaining a municipal wastewater collection and treatment system (pipes and plants) that meets or exceeds all regulatory requirements, and helps ensure the continued provision of safe, reliable utility services to a growing population.

An Evolution in Planning

Edmonton is a thriving city, to which more than one million people call home. The safe distribution, collection and treatment of its water and wastewater are vital to its continued growth and development.

Yet city growth also impacts how water moves across and through our landscape. Development (both at the city's edges and due to infill intensification) leads to an increase in hard surfaces and an increase in stormwater runoff. Population growth also results in increased wastewater generation. More people means more water entering the sewer system that must be safely treated before it can be returned to the North Saskatchewan River. Minimizing adverse impacts to the water cycle from the growth of our city is critical to protecting the integrity of our source water and the surrounding river valley.

Sewer systems of the past were designed to move water away from developments as quick as possible using traditional grey infrastructure investments based on historical water use and rainfall patterns. Wastewater treatment facilities were built to remove "waste," and treatment was considered the end point in the planning cycle.

Yet we cannot simply blame old design. Given changing customer expectations and water use trends, the city's new growth strategy, and the impacts of climate change, it's no longer prudent to focus solely on long-term plans with fixed infrastructure investments. We need to be innovative in our approach to planning and consider adaptive and flexible solutions that address current social, environmental and economic conditions. Traditional and siloed water management approaches do not address the realities of the 21st century. Through the integration of its sanitary, stormwater and treatment utilities into a single entity, EPCOR is well-positioned to manage the Capital Region's water system in a sustainable, holistic and cost-conscious manner that considers the entire water cycle.

Historical Planning Approach

Traditional master planning approaches narrowly focused on addressing growth through capacity-driven infrastructure upgrades. Our master plans had a multi-decade outlook and focused on the trunk network. Little consideration was given to changing how our customers interact with the wastewater system, shifting flows regionally or focusing on alternative one water management strategies in local catchment areas. This has resulted in a network of very deep and large sewer trunks servicing Edmonton that are difficult to inspect, clean and maintain. Corrosion and odour issues have resulted in failures of the trunk system that require costly repairs.

Wastewater treatment was also driven by growth objectives and increased regulatory requirements focused on removing nutrients from water before being discharged back to the North Saskatchewan River.

Further, planning for our water cycle components was disparate. The water system was planned by the water business unit, while the wastewater system was planned by the wastewater business unit. This siloed organizational structure stifled projects with multiple benefits and rather than prevent issues upstream, it proposed fragmented interventions

How Are We Thinking Differently?

The One Water planning model is the industry leading approach to overcoming water related challenges. One Water is both a holistic way to approach water management and a practical, systems-based approach to meet complex issues.

EPCOR's goals are to maximize the use of our existing infrastructure by optimizing and enhancing the system. We are also reframing the concept of wastewater treatment into the paradigm of resource recovery.

Key focuses of the new strategy include:

- Modular, right-sized solutions that can be scaled up with time according to new information like growth projections and the impacts of climate change.
- Slowing the entry of stormwater into the combined system and attenuating the peaks, by replicating and recreating natural systems hydrologic and ecologic function through the installation of green infrastructure.
- Increasing the focus on inflow and infiltration reduction to increase capacity of the system and improve operational reliability at the wastewater treatment plants.
- Concentrating on customer-focused solutions including conservation and efficiency and down spout disconnects.
- Investments to increase our situational awareness of the system.
- Situational awareness investment to increase our visibility of the system.
- Increasing regional collaboration between EPCOR and ARROW Utilities to balance sanitary flows in the region.
- Recognizing the value of all water. Future strategies for the Gold Bar and Clover Bar facilities focus on resource recovery - extracting valuable nutrients and energy from wastewater, promoting sustainability.
- Shifting our focus to Sanitary Planning Areas (SPAs) and implementing improvements to local sanitary systems and parcel based solutions versus solutions focused primarily on the trunk system.

Sanitary Planning Areas (SPA): How We Prioritize Collection System Upgrades

While wastewater flow is indifferent to local boundaries, there are catchment areas that can be used to break the system into more manageable areas for investigation and project prioritization.

The city has been delineated into 23 SPAs to focus planning more locally, and five SPA locations have been prioritized for capital and operational investment activities including:

- Situational awareness improvements
- Improved wet weather flow management
- Odour and corrosion management
- Asset risk reduction
- Capacity enhancements

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EDMONTON IS A ONE WATER CITY

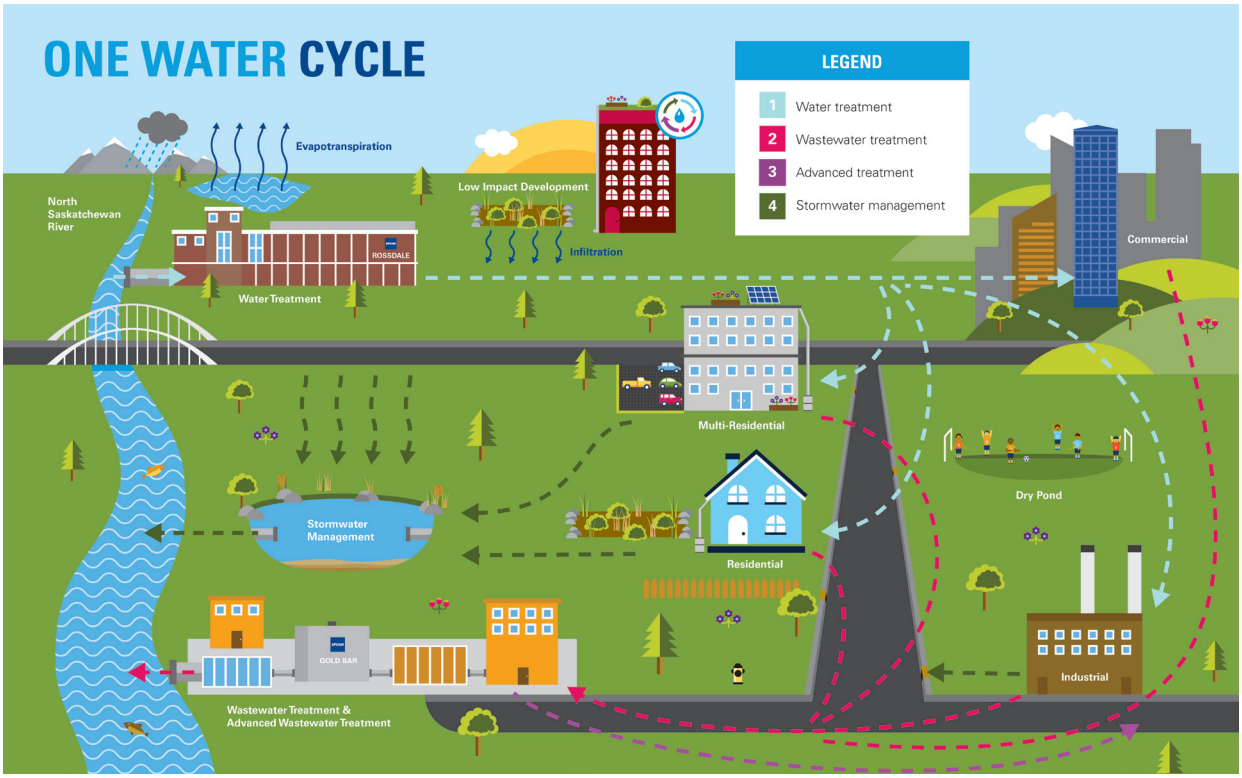
This report summarizes EPCOR's integrated approach to strategic planning as a One Water Utility for Edmonton's sanitary and storm systems, including our Gold Bar WWTP and Clover Bar Solids Management Facility.

Edmonton is a thriving city of more than one million people that require clean, safe, and reliable water, wastewater and storm services. Water is vital to the environmental, social and economic sustainability of the city and its safe distribution, collection and treatment are key components of the overall municipal water cycle.

Edmonton is also fast growing and has ambitious targets to transition future growth to increase infill development in strategic nodes and corridors balanced with historical outward-focused growth.

City growth impacts how water moves across and through our landscape. Development (both at the city's edges and due to infill intensification) leads to an increase in hard surfaces and an increase in runoff. Population growth also results in increased wastewater generation. More people contribute more water into the sewer system to be safely treated before it is reintroduced back into the North Saskatchewan River.

Minimizing negative impacts to the water cycle from the growth of our city is critical to ensuring quality and quantity of the North Saskatchewan River. With the integration of sanitary, stormwater and treatment utilities as a single entity, EPCOR is well-positioned to manage Edmonton's municipal water system in a way that considers the entire water cycle and develops a more holistic, sustainable and affordable utility.



OUR COMMITMENT TO ONE WATER

"We cannot solve our problems with the same thinking we used when we created them."

- Albert Einstein

The water industry has unavoidable needs. Climate change, affordability, aging assets, increasing regulatory/customer requirements, changing water use patterns and growing urbanization, are complex water management issues that require innovative solutions. To overcome these challenges, we needed to change our perspective and approach.

In 2020, the strategic planning areas of the Drainage and Water Business Units merged to form the One Water Planning group. In 2023, the entire organization transitioned to a One Water model.

One Water is the industry leading planning approach to overcoming water-related challenges. It is an outcome of EPCOR's recognition that the water cycle is circular and interconnected, therefore our planning should also be interconnected. Rather than focus on fragmented interventions, we need to prevent issues upstream by using integrated water management strategies.

The underlying characteristics of One Water include:

The mindset that all water has value: from the water resources in our ecosystem, to our drinking water, wastewater and stormwater.

Edmonton has a **circular wastewater economy** and we need to approach planning decisions with a **systems-based mindset** that encompasses the full water cycle.

Non-traditional, right-sized solutions such as green infrastructure.

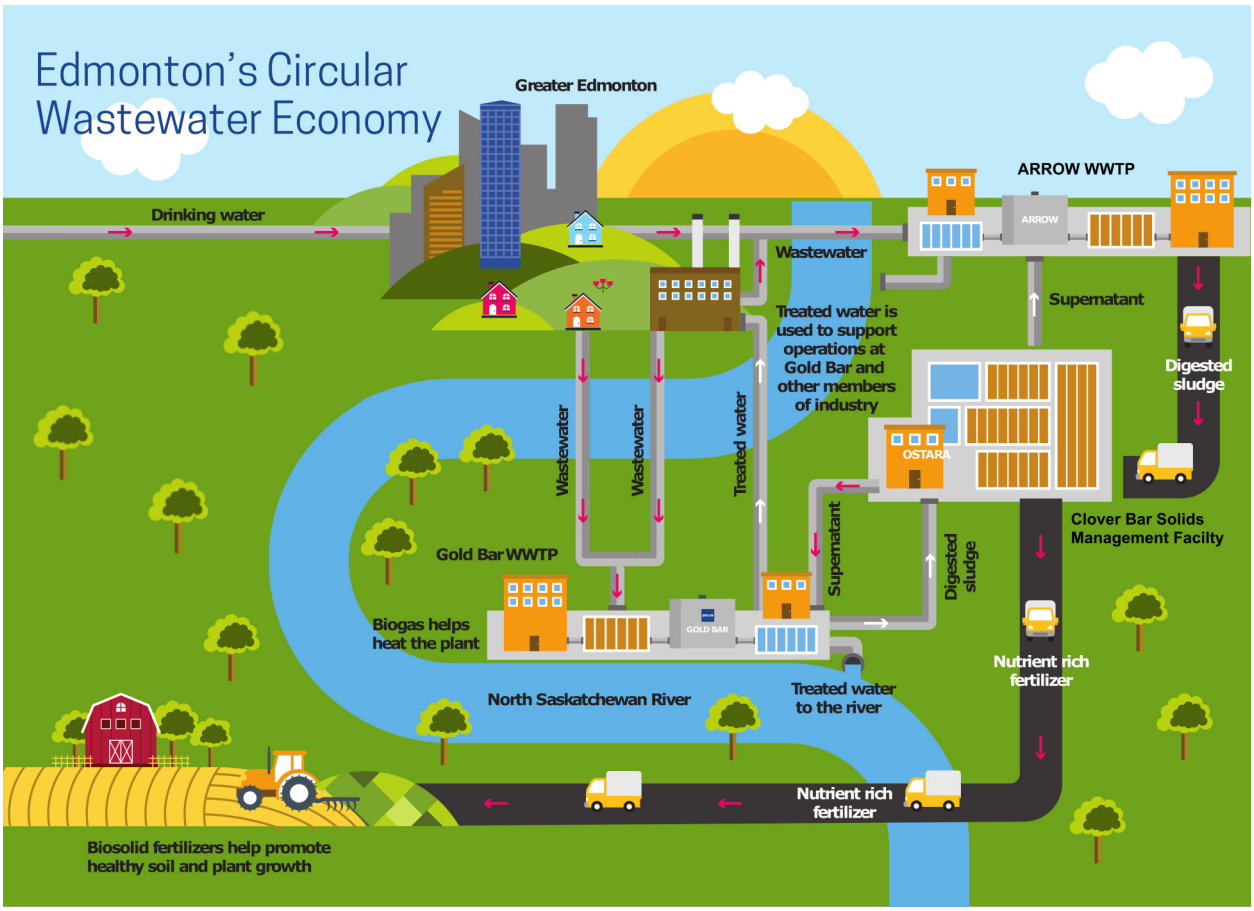
Focusing on achieving multiple benefits; water related investments should provide economic, environmental and societal returns.

Relying on partnerships and stakeholder inclusion.

By employing systems-based thinking to plan the entire municipal water cycle, we are able to break down traditional planning silos, seek water management strategies with co-benefits and implement innovative solutions for the future.

What is One Water?

An integrated planning and implementation approach to manage finite water resources for long-term resilience and reliability meeting both community and ecosystem needs.



One Water Management Approaches with Systems-Based Co-Benefits

Strategic focus	Wastewater	Biosolids	Stormwater
Rain & Stormwater Reuse	✓		✓
Nature-Based Solutions	✓		✓
Water Conservation & Efficiency	✓		✓
Inflow & Infiltration Reduction	✓		✓
Decentralization & On-Site Treatment	✓	✓	✓
Risk-Based Asset Management	✓	✓	✓
Watershed Management & Source Water Protection	✓	✓	✓
Monitoring & Data Collection	✓	✓	✓
Nutrient Removal and Recovery	✓	✓	
OSS & FOG Management	✓	✓	✓

HOW WE PLAN: INTEGRATED RESOURCE PLANNING

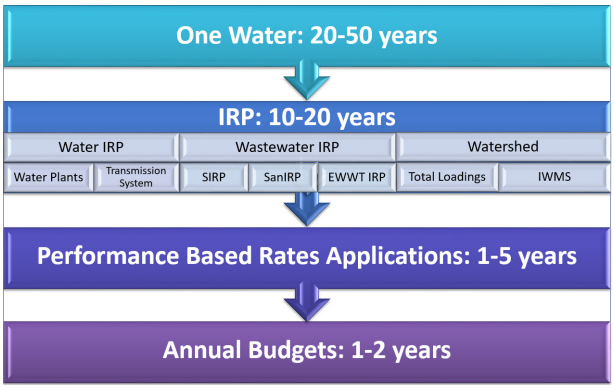
Our Strategic Objectives

- **Support future growth and redevelopment of the city as it grows to 2 million people**
- **Build a financially and environmentally sustainable wastewater system**
- **Provide resilient wastewater services**

EPCOR's 2024 WWIRP initiates the capital planning process for Edmonton's wastewater collection and treatment operations. It outlines a path forward for building, operating and maintaining a municipal wastewater collection and treatment system that meets or exceeds all regulatory requirements, and helps ensure the continued provision of safe, reliable utility services to a growing population.

EPCOR has successfully utilized the Integrated Resource Plan (IRP) long-range planning approach for the drinking water system since the 1990's and the Gold Bar Wastewater Treatment Plant since 2015.

The Stormwater Integrated Resource Plan (SIRP) was published in 2019, and work is currently occurring to finalize a Sanitary Integrated Resource Plan (SanIRP).



EPCOR's IRPs employ a flexible and holistic approach to long-term planning that anticipates risks, as well as adapts and mitigates against new and emerging threats, helping ensure greater operational, environmental and financial stability.

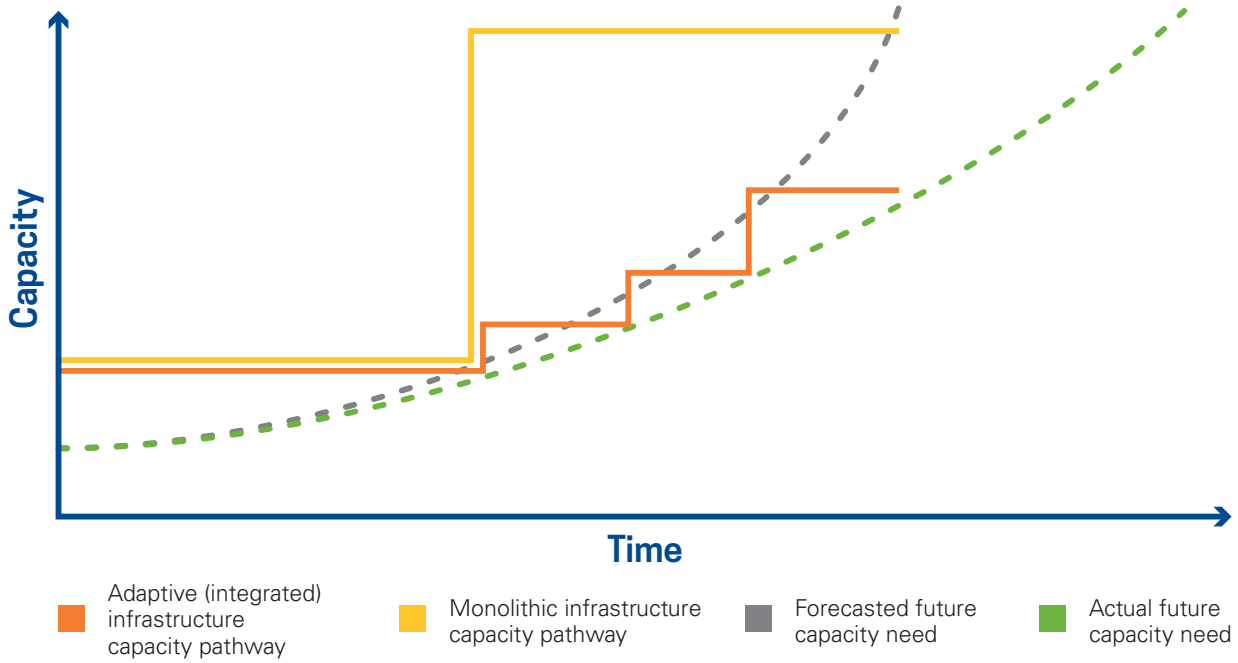
EPCOR's IRPs focus on strategies over a 10-20 year planning horizon. These strategies inform the identification of projects for our performance-based rates applications with the City of Edmonton (3-5 years). One Water bridges, synchronizes and looks for intersectional opportunities of the various IRPs and has a 20-50 year outlook.

Through the IRP process, the identification of capital projects are balanced to:

- Manage future growth needs
- Minimize risk throughout the system (and increase reliability, resilience and sustainability)
- Meet or exceed regulatory/health, safety and environment (HSE) requirements
- Achieve efficiency/performance improvements

Supporting Growth Through Incremental Enhancements

In an uncertain environment, unnecessary infrastructure or infrastructure that is not fit for purpose is more likely to be avoided through planning that focuses on building for actual needs instead of anticipated needs. Integrated Resource Planning creates pathways to deliver smaller incremental enhancements along shorter planning horizons and encourages leveraging approaches from across the water cycle. This allows EPCOR to make prudent and timely infrastructure investment decisions, while remaining flexible and adaptable to changing environmental, economical and social conditions.



Traditional master planning narrowly focuses on addressing growth through capacity-driven infrastructure upgrades. Alternatively, Integrated Resource Planning aims to ***maximize the use of our existing infrastructure*** through:

- Influencing our customers' water use and wastewater generation behaviours through initiatives such as, conservation and efficiency.
- Promoting the concept of stormwater storage on private property through green infrastructure.
- More effectively managing storm flows entering the wastewater system.

Due to increased water use efficiency by customers, and our new approach of influencing storm flow management, growth is not projected to be the primary driver of capital expenditures in the near-term.

Resilience is a Requirement

Resilience has always been a priority for EPCOR due to the significant public health impacts that can result from the interruption of sanitary or water service. Recent record-breaking heatwaves, flooding and wildfires have highlighted the importance of building resilient infrastructure in the face of a changing climate. Adaptation to climate change impacts is essential for any long-range plan.

The ability to predict future conditions decreases as the planning horizon increases. With climate change, city growth changes, digital transformation, regulatory updates and changes to customer behaviours on going; designing infrastructure to encompass the full range of potential operational needs 75 years from now is not viable. The uncertainty of a changing future requires us to be adaptive and agile in managing internal and external risks.

The transition to Integrated Resource Planning to ensure future resiliency requires several major shifts in planning, construction and long-term operational strategies including:

- A focus on infrastructure accessibility to ensure regular inspection, maintenance and refurbishment.
- Shorter planning timeframes and the avoidance of multi-generational project timelines.
- High situational awareness capacity through system monitoring and data analysis support.

What does resilience mean for wastewater infrastructure?

For the wastewater conveyance and treatment system, resilience is considered to be the ability to handle uncertainty and adapt to future change.

The Gold Bar Wastewater Treatment Plant

EPCOR'S ROLE AS A WATER UTILITY

WHO WE ARE

EPCOR provides safe and reliable water treatment and delivery, as well as wastewater collection and treatment to Edmonton residents. We also provide water service to a number of regional customers. The planning, building, operating and maintaining of our plants, reservoirs, pipes, tunnels, pump stations and stormwater management facilities is facilitated by more than 1,300 employees working on all aspects of the water cycle.

OUR PARTNER: ARROW UTILITIES

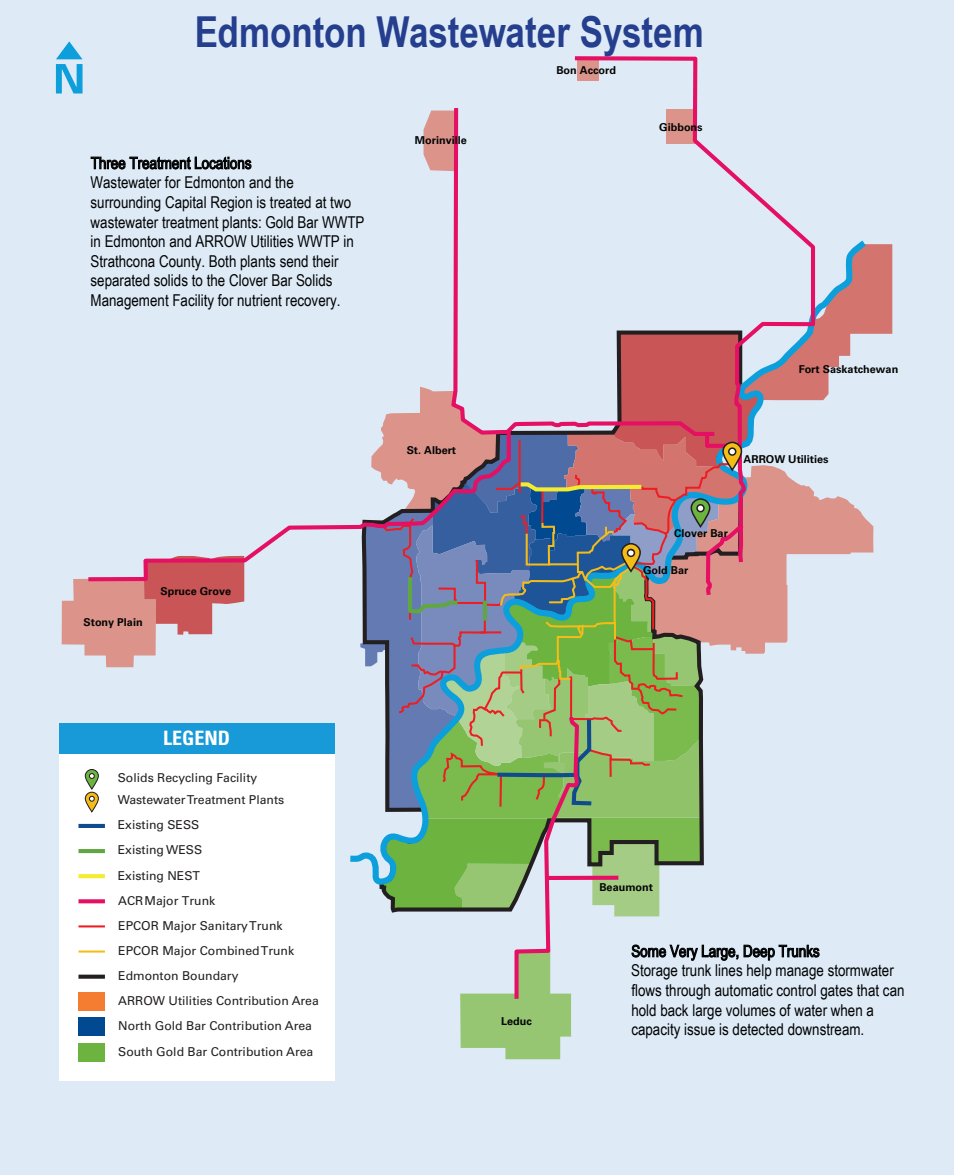
We work with our partner ARROW Utilities (formally the Alberta Capital Region Wastewater Commission) to provide resilient wastewater services to the Edmonton region.

THE WASTEWATER UTILITY AT A GLANCE

A Shared Effort

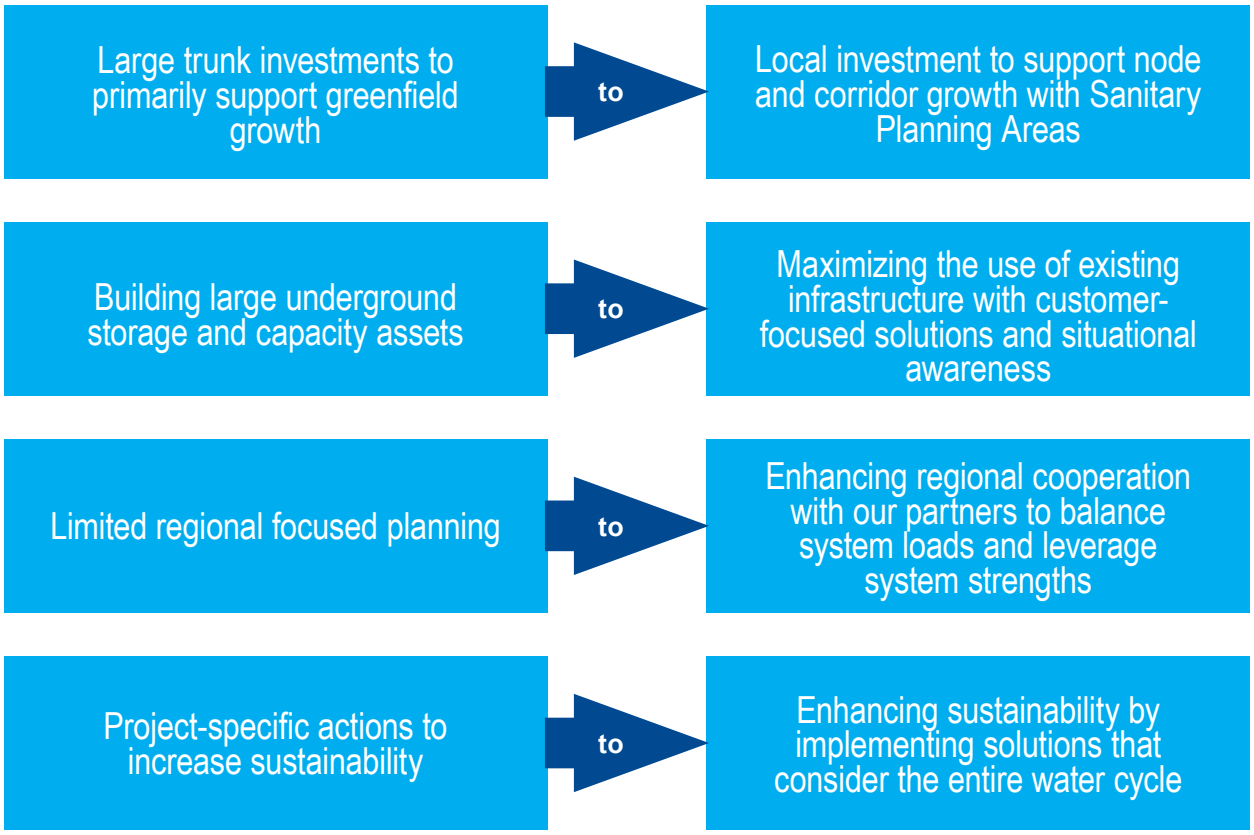
Wastewater collection and treatment in the Capital Region is shared between EPCOR and ARROW Utilities. EPCOR sends wastewater from nearly 30,000 customers in northeast Edmonton to ARROW Utilities for treatment. In return, wastewater from the City of Leduc and Beaumont is sent to the Gold Bar WWTP.

The flow "balancing" partnership provides for more responsible infrastructure investments by avoiding the construction of overly-long and costly sewer lines - helping ensure operating costs per customer remain reasonable.



WASTEWATER IRP: THINKING DIFFERENTLY

One Water identifies and takes advantage of the interconnections in the water cycle to develop more holistic solutions for the water utility and provide water and wastewater services that are more affordable, resilient and sustainable. The 2024 Wastewater Integrated Resource Plan (WWIRP) prioritizes four key measures for improving system planning across the entire wastewater collection and treatment system.

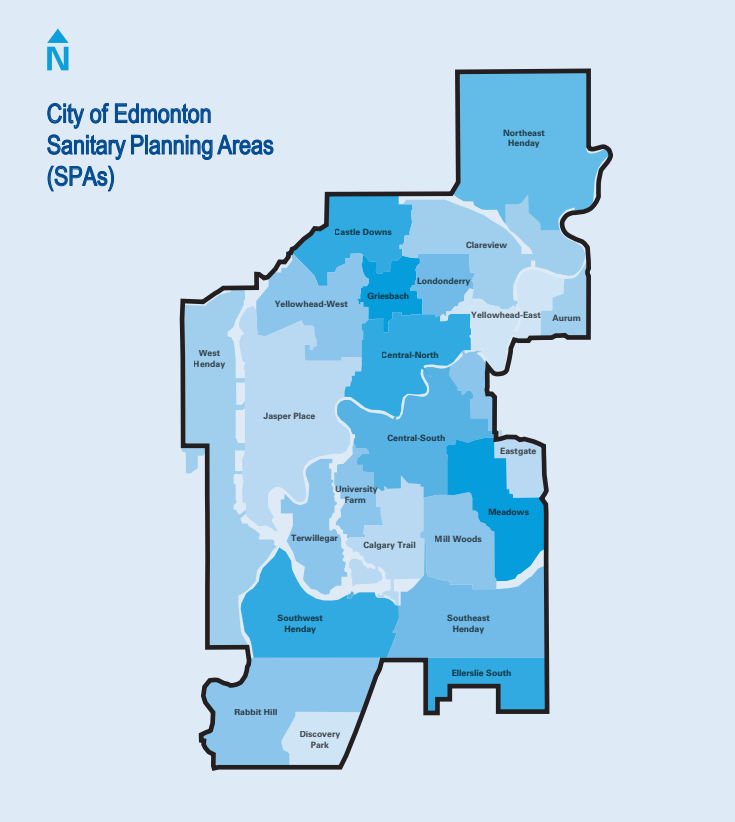


LOCAL INVESTMENT TO SUPPORT GROWTH USING SANITARY PLANNING AREAS

Previous long-term planning for the growth of the wastewater system assumed outward growth with static development in mature areas. Planning priorities focused largely on building big, deep trunks to connect the “new” areas at the city’s peripheries to the “already built” infrastructure servicing the city’s core.

Edmonton’s City Plan has ambitious targets to transition future growth to increase infill development within defined nodes and corridors, balanced with historical outward-focused growth.

Planning for this shift in growth requires EPCOR to look inwards towards areas where the wastewater infrastructure is already in place.



To accommodate this changing growth paradigm, EPCOR has shifted away from a master plan process that dictated growth requirements primarily through large trunk projects. In its place, are the SPAs which divides the city into 23 planning regions. The SPAs identify initiatives above the trunk sewer system and serves to track issues critical for the safe operation of the wastewater system, while also ensuring future needs are met.

The SPAs detail and quantify issues that affect both the capacity and reliability of the wastewater system including:

- Identified capacity limitations in the sewer trunk and local system.
- Sources of uncontrolled or unwanted stormwater entry.
- Odour and corrosion issues.
- Asset risk issues.

The SPAs support recommendations for capital and operational investment opportunities for:

- Situational awareness improvements.
- Improved wet weather flow management.
- Odour and corrosion management.
- Asset risk reduction.
- Capacity enhancements.

The SPAs identify the trigger points and conditions that controls when asset investment decisions must be made in a region and backs it up with investment in monitoring. This represents a shift from strict forecast driven decision making to hybrid process that includes situational awareness as one of the key drivers.

MAXIMIZING THE USE OF EXISTING INFRASTRUCTURE AND CUSTOMER FOCUSED SOLUTIONS

The way customers interact with their water and wastewater system, has always had an impact on operational effectiveness and the cost of service. Shared benefits across the entire water utility can be gained from changing customer interactions.

Customer Driven Capacity Enhancements: Water Efficiency

EPCOR recognizes that the capacity needs of its wastewater collection system and treatment plants are being met because of the major advancements in water use efficiency made by its customers. Customer behaviours in this area have enabled the utility to reduce project scopes, or deferring project starts, and even eliminating some infrastructure projects entirely.

Since 2020, the following benefits can either be partially or fully attributed to customers being more efficient with their water use:

- A reduction of between $90M to $100M in capital costs for trunk line capacity enhancements in south west Edmonton (West Henday and Southwest Henday SPAs).
- Cost reductions of between $0.25M to $2.0M each for new sewer pump stations in commercial or industrial areas.
- Contributing to enabling the Gold Bar WWTP to maintain its existing site foot print and fence line.
- Sewer overflow events not increasing in line with population growth.

Water use efficiencies have enabled cost and non-quantifiable benefits for most capacity driven projects and processes across the water utility. The scope of total future realized benefits is hard to fully conceptualize. EPCOR is currently reviewing future projects with potential capital costs totaling more than $300M where it is expected a significant portion of the cost can be offset due to water efficiency.

Reducing the Cost of Handling Wastewater

Oils, grease, rags and wipes all negatively impact the operability of the collection and wastewater treatment system. The improper disposal of these items is resulting in a need for increased cleaning frequency, is causing damage to equipment and pumps, can effect treatment efficacy and is leading to higher waste disposal costs.

Inflow and Infiltration (I&I) Reduction

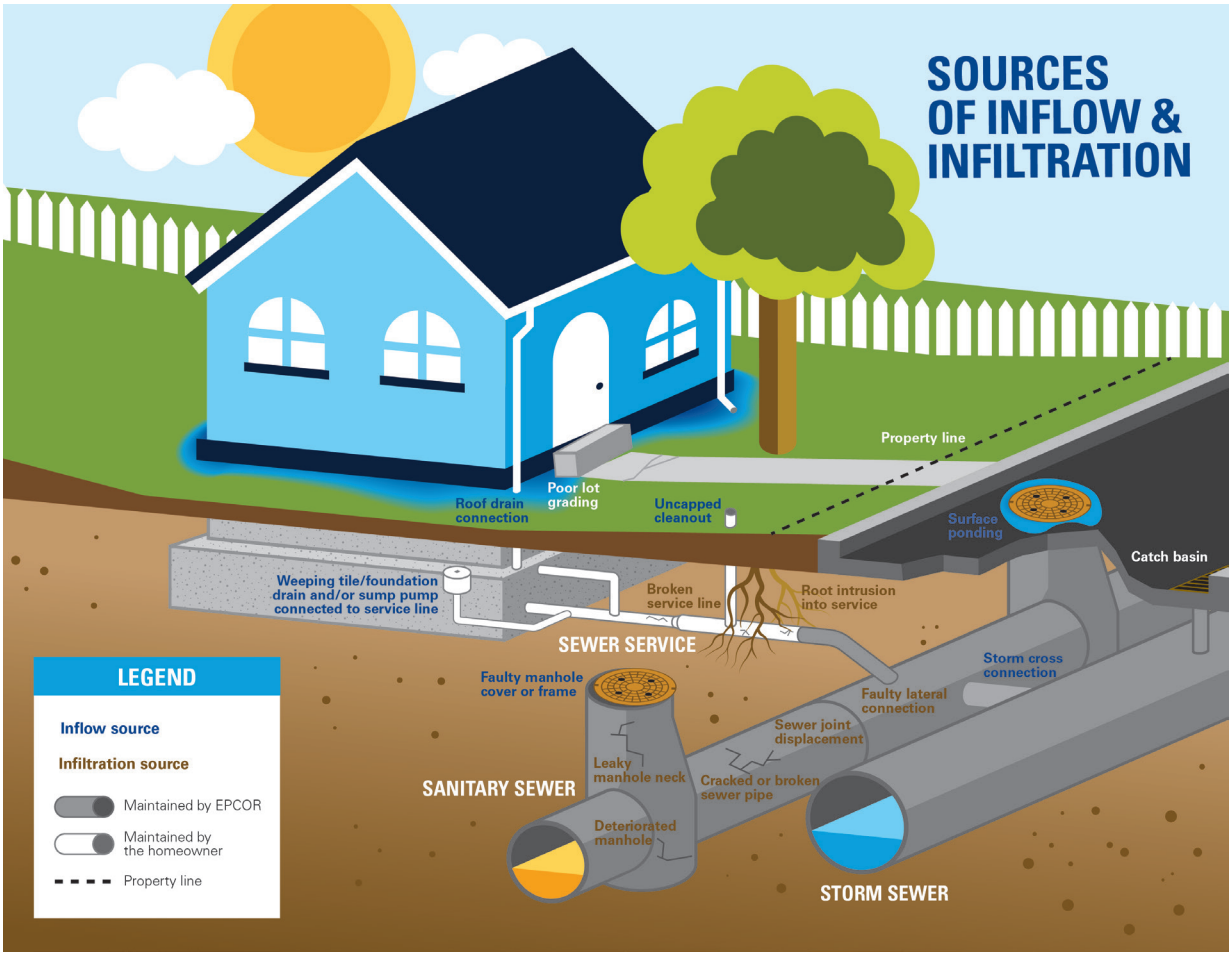
As part of Stormwater Integrated Resource Plan (SIRP), EPCOR has invested in reducing public inflow and infiltration.

EPCOR will now engage with customers to achieve similar progress in reducing stormwater contributions from private properties.

By some estimates, over 40% of the wet weather flows received by the sanitary sewer system come from private property. The implementation of stormwater management principles that store and slow water flows will help manage system capacity in these more constrained areas.

EPCOR is already working with its commercial and industrial customers to integrate modern stormwater management practices at their sites. Moving forward EPCOR will develop programs for engaging with residential customers to reduce wet weather contributions from sources such as downspout connections and repairing damaged service pipes. These actions will be used to help defer, reduce or eliminate large capacity investments across the water cycle.

Priority areas for 2025-2027 include Calgary Trail, Castle Downs, Jasper Place, Millwoods and Yellowhead-West SPAs. These areas are being prioritized based on their known high contributions to system wet weather flows.



Inflow and infiltration, often abbreviated as I&I, is any water that enters the sanitary sewer system from any source other than customer use. I&I is often classified as “wet weather flow” when sizing sewer pipes.

Inflows are flows from stormwater entering the sanitary system during storms or snow melt events. On private lots, inflows often enter through sagging manholes in parking lots, improperly connected downspouts, drains or catch basins.

Infiltration are flows from ground water entering the sanitary system through cracks, breaks or joint failures in the sewers servicing the lot.

INCREASE SITUATIONAL AWARENESS

EPCOR is prioritizing enhancing situational awareness to improve operational effectiveness, strategic planning, project planning and provide critical emergency support.

Situational awareness is being advanced across the entire wastewater collection and treatment system by installing real-time flow, air quality and operational monitoring instrumentation. Data dashboards and real-time analytics platforms are then used to provide accessible and actionable decision support for the entire water utility.

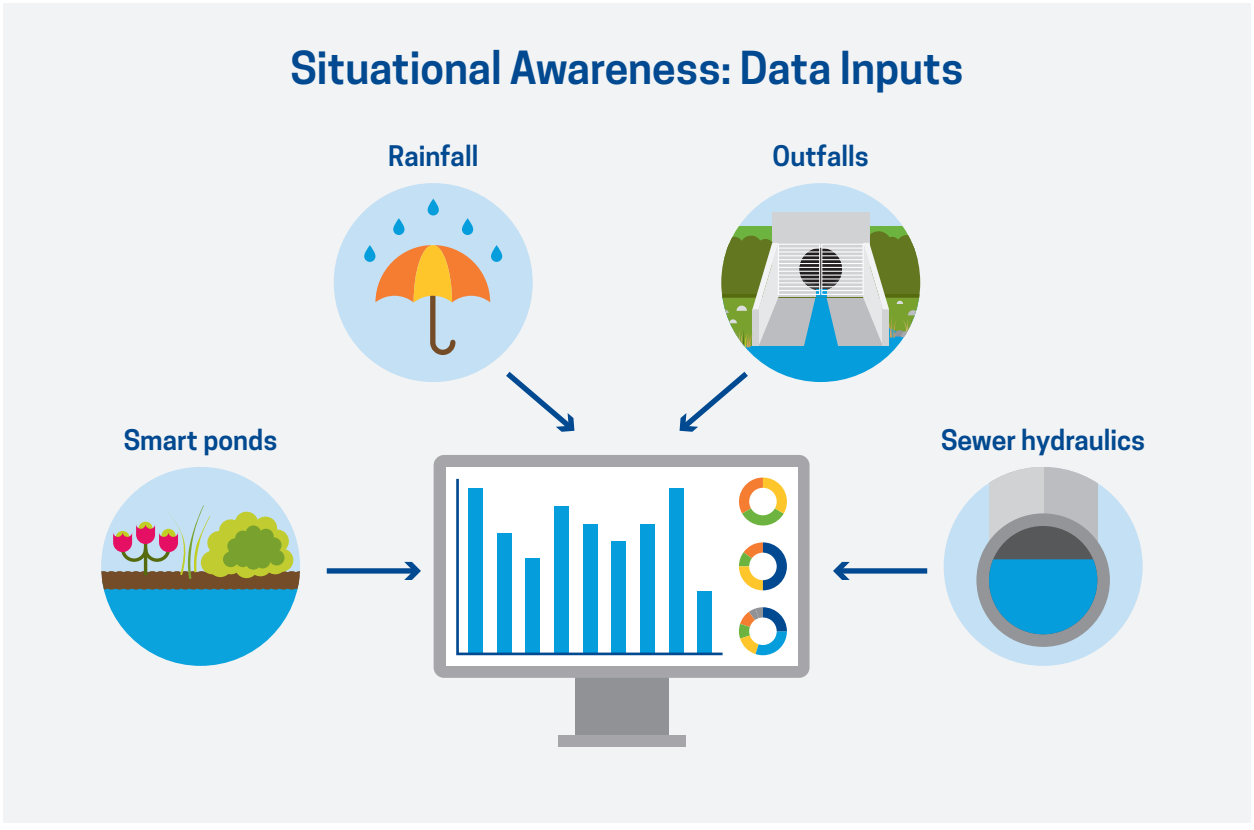
City-wide permanent monitoring will support future growth in multiple ways:

1. Provide direct and timely data on trunk capacity utilization.

2. Support I&I reduction efforts to gain back trunk capacity by identifying areas with high stormwater inflows.

3. Provide opportunities to effectively implement real time storage and flow diversion actions across the entire system to the benefit of the Gold Bar and ARROW WWTP and collection system during storm events.

4. Reducing the risk of basement flooding and sewer overflows by implementing enhanced monitoring and smart systems at stormwater management facilities and outfalls.



WORKING WITH OUR PARTNER

EPCOR works collaboratively with ARROW Utilities to deliver reliable and resilient wastewater services to Edmonton and the capital region.

Rather then build out extensive lengths of trunk infrastructure, ARROW Utilities sends wastewater from the cities of Leduc and Beaumont to EPCOR to be treated at the Gold Bar WWTP. Likewise, EPCOR sends wastewater from many communities in northeast Edmonton to ARROW Utilities for treatment at their wastewater treatment plant.

Multiple additional opportunities to manage flows between the Utilities have been identified and are actively being investigated to maximize the operational resiliency of the wastewater collection and treatment operations. The full scope of opportunities have been broken into three categories:

1) Operational diversions at existing flow control facilities
Using existing gates and pump station assets, flows are transferred between utilities with no additional capital investment.

2) Capital improvements of less than $5M
For some assets that flow above or directly adjacent to trunks delivering wastewater to ARROW Utilities, small investments to construct drop structures or junctions can allow for transfers of flow.

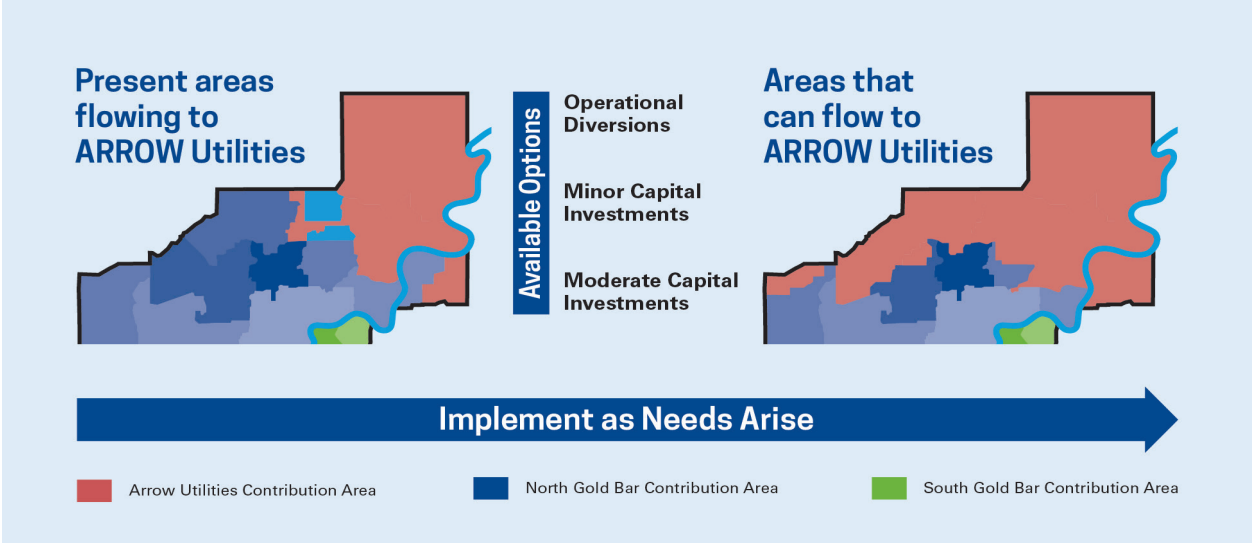
3) Capital diversions of more than $5M but less than $20M)
In some areas it is technically feasible to transfer flow by extending existing force mains or building new gravity mains over distances of less than 350 metres.

It is currently estimated that an additional 25,000 m3/day of wastewater could be managed between the utilities depending on the need.

There are multiple benefits to balancing flows between utilities including:

- Optimizing trunk capacity investments
- Reducing loading at the Gold Bar WWTP
- Providing a means to redirect flow to support maintenance and rehabilitation
- Capacity for expanding smart flow management routines in the future

Increased regional collaboration follows the principals of integrated planning to provide system flexibility in order to quickly and effectively adapt if future conditions deviate from what was first predicted.



ENHANCING SUSTAINABILITY

Total Loadings

Total loadings to our rivers and waterways includes discharges from the Gold Bar WWTP, our combined and storm systems. EPCOR and its partners have a commitment to not increase the loads of priority contaminants to the North Saskatchewan River as the city grows. Through investments in green and grey infrastructure through SIRP as well as targeted reduction in inflow and infiltration, the targets of the total loadings plan can be fully realized.

Resource Recovery

Resource recovery plays a pivotal role, particularly in the context of wastewater management that encompasses sanitary and stormwater flow, along with the collection systems and treatment facilities. The traditional approach of treating wastewater in isolation is evolving towards a more integrated and collaborative framework.

Wastewater treatment plants function as facilities for environmental protection, but also are now seen as hubs for resource extraction. Future resource recovery initiatives within our network will look at opportunities within the broader water cycle and not be limited by systematic or plant boundaries.

With this approach the Clover Bar Solids Management Facility is longer thought of as an endpoint in treatment, but an essential part of the overall one water cycle. By working in close collaboration with ARROW Utilities, the emphasis moving forward is on unlocking the potential of biosolids as valuable resources.

This shift aims to recover essential elements from wastewater and to foster sustainability by reducing waste and maximizing the utility of resources across the one water system.

Kennedale Outfall

KEY PLANNING DRIVERS

EPCOR's planning is informed by a thorough analysis of various drivers in the areas of resiliency, quantity, quality and affordability. The IRP process examines the status of these drivers in the Edmonton service area and presents strategies for the safe and reliable provision of services to accommodate growth while explicitly addressing the need for greater resilience. Notable drivers discussed below include climate adaptation, sustainability, asset management, corrosion and odour, city plan, water use trends, regulations and affordability.

CLIMATE ADAPTION: WILDER, WETTER, DRIER WEATHER

The effects of climate change are already being observed in the Edmonton region, through increasing temperatures and more frequent, and intense storms. The projected climatic changes for the city pose multiple risks for the wastewater collection and treatment system. Larger storms, prolonged heat waves, freezing rain, high wind events and increased urban-wildland fires can lead to service disruptions and failures.

Overland flooding is the highest climate risk for the Edmonton sanitary system, and a variety of initiatives have been initiated including increasing green hectares city-wide, widespread construction of Low Impact Developments (LID) especially in areas of intensifying development, and increasing adoption of water retention features such as rain gardens on residential properties.

River flooding is also a recognized risk and the Gold Bar WWTP is investing in flood protection to ensure it can continue to provide reliable service into the future.

SUSTAINABILITY

As part of EPCOR's commitment to becoming a leader in sustainability, the company produces an annual Environment, Social and Governance (ESG) performance update. EPCOR's environmental measures and targets includes progress on key initiatives to transform operations to protect the North Saskatchewan watershed and address challenges brought on by climate change.

EPCOR's ESG scorecard has two reportable environmental targets of major relevance to the Wastewater IRP, **Target E1: Net Greenhouse Gas Emissions: Towards Net Zero and Target E2: Protect River Quality.**

Net Greenhouse Gas Emissions: Towards Net Zero

EPCOR is implementing projects that move the utility closer to its goal of reducing net Scope 1 and 2 greenhouse gas emissions by 50% in 2025, and 85% by 2035, compared to 2020 emissions.

In the wastewater utility, Scope 1 sources of emissions include nitrous oxide emitted during the waste treatment process, natural gas used in building heating, and vehicle fuels. Scope 2 emissions include grid-purchased electricity, which is used primarily for wastewater pumping and treatment.

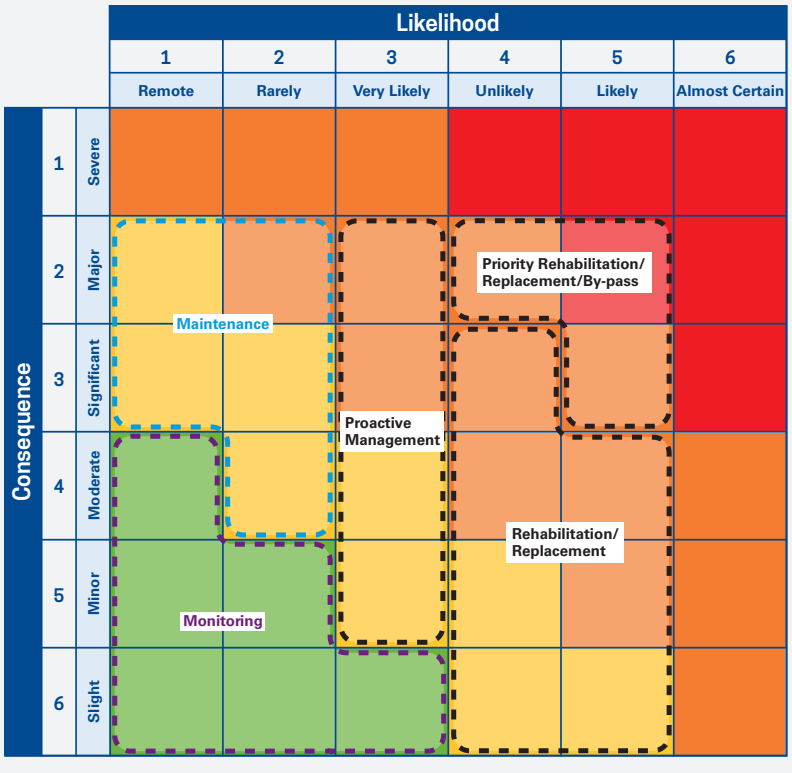
Protect River Water Quality

EPCOR is committed to protecting the water quality of the North Saskatchewan River. Driven by the Integrated Watershed Management Strategy (IWMS) and Total Loading Plan, a major goal for EPCOR is to have no increasing trend for Total Suspended Solids (TSS) into the river from drainage, water and wastewater treatment operations. However, TSS is just one indicator of river water quality. To provide a more complete assessment of water quality and river health, EPCOR is expanding its measures for discharge characterization. Driven by the targets laid out in the Total Loading Plan, we will also report to Alberta Environment and Protected Areas discharge levels of phosphorus, ammonia, nitrate, chloride and E. coli, with the overall objective being no degradation of water quality in the North Saskatchewan River.

ASSET MANAGEMENT

EPCOR employs a Risk Management Framework to prioritize expenditures and the allocation of resources to minimize adverse impacts to public health and safety, environment, reputation and finances. Assets are assigned risk rankings that reflect their potential for adverse impacts by considering the assets likelihood of failure and its corresponding impact or consequence. Along with other considerations, such as community needs, growth requirements, equity, environmental sustainability and business needs, the risk rankings help to define the maintenance, rehabilitation and replacement priorities across the city.

There will be a continued focus on reliability / life cycle requirement driven projects in the future, reflecting an increasing number of assets projected to reach end of service life. A continued focus on inspections of critical assets is also included to assess current condition and likelihood of failure.



The risk of failure for an asset is based on its highest **likelihood of failure (LOF)** and **consequence of failure (COF)**.

Actions which can reduce risk include:

- Inspections
- Cleaning
- Preventative and Predictive Maintenance
- Rehabilitation and Repairs
- Enabling Asset Bypassing
- Emergency Response Plan
- Action selection are driven by the nature of the risk for the asset.

CORROSION AND ODOUR

Hydrogen sulfide gas is a problematic chemical created in sewer systems when wastewater is allowed to stagnate. The chemical causes corrosion and odour issues which have increased in severity as water use has decreased city-wide. The odour nuisance from hydrogen sulfide gas and corrosion it causes to our assets are both serious issues that affect the overall resiliency of the utility. EPCOR introduced the Corrosion and Odour Reduction (CORe) strategy in 2019 to mitigate odour nuisance and protect assets from corrosion. The strategy employs four programs, **Prevent** (inspections, cleaning and rehabilitation), **Optimize** (pump station and syphon improvements), **Control** (sewer ventilation) and **Monitor** to implement capital and operational improvements across the city.

GROWTH

City Plan

The Edmonton City Plan, approved by city council in December 2020, is the long-range growth strategy planning document that emphasizes infill densification as Edmonton grows to a population of two million people.

The City Plan aims to add 600,000 new residents into Edmonton's redeveloping areas and add 50% of new units through infill with significant portions of the future growth being achieved by developing a network of growth nodes and corridors within Edmonton's current boundaries.

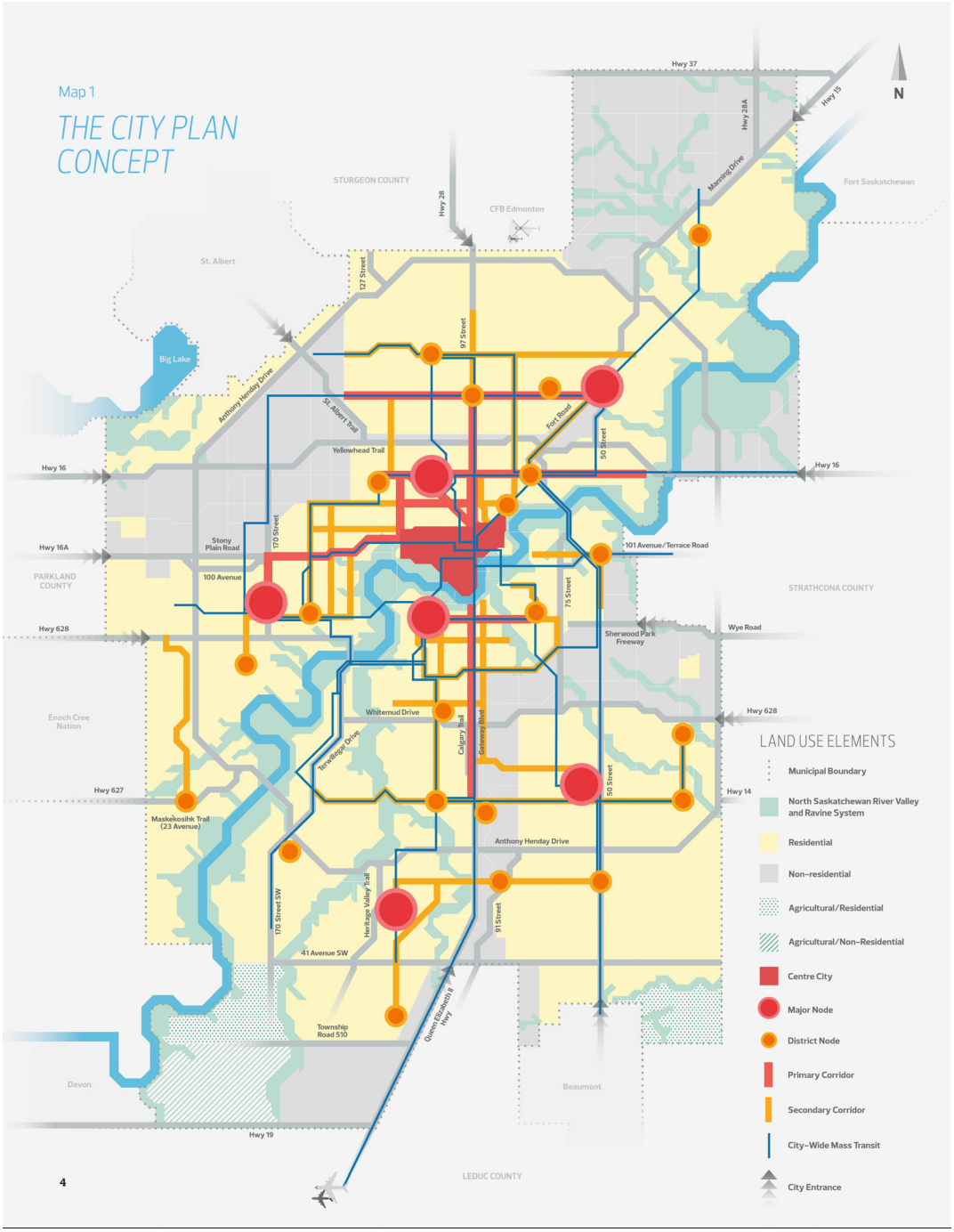
EPCOR is committed to delivering wastewater services in alignment with the City Planning goals.

BIG CITY MOVES STRATEGIES	
Strategy Targets	**How the Wastewater IRP Aligns**
Greener as We Grow Continue to develop a healthy city while protecting and enhancing our land, air, water and biodiversity.	• Manage the impacts of climate change on assets. • Improving energy and water efficiency across our operations. • Building green infrastructure to enhance biodiversity, provide critical habitat for pollinators and expand the tree canopy. • Introducing distributed stormwater storage throughout the city to slow runoff to the North Saskatchewan River and its tributaries, restoring a more natural hydrology. • Examine stormwater use as an alternate supply. • Investigate the viability of increased on-site and external industrial reuse applications for reclaimed water. • Wastewater treatment as facilities for environmental protection as well as hubs for resource extraction. • Upgraded biogas utilization as fuel for on site heating and/or power generation and minimize waste through flaring. • Reduce odour nuisance from facilities handling wastewater.
A Rebuildable City Continuously reimagine and rebuild what our city will be to adapt to a changing future.	• Maximize the use of existing infrastructure. • Manage wet weather inflows to increase capacity and support infill goals. • Modernizing design metrics to minimize oversizing sewer assets. • Expand infrastructure capacity in priority nodes and corridors.
Inclusive and Compassionate Improve equity, end poverty, eliminate racism and make progress towards Truth and Reconciliation.	• Developing equity and affordability initiatives. • Indigenous partnerships and programs are embraced. • Continued improvements to efficiency in operation to monitor and respond more rapidly to customer impacts that affect quality of life.
Catalyze and Converge Become a creative and entrepreneurial hub. Support culture and create beautiful and smartly designed urban spaces.	• Review infrastructure investment goals along nodes and corridors. • Investment check-ins to facilitate infill and intensification. • Working closely with the City of Edmonton through stormwater investments (dry ponds, LID) to enhance public spaces.
A Community of Communities Housing, recreation, schools and employment that are accessible to all forms of transportation.	• Projects and objectives incorporate equity/affordabilty values. • Build infrastructure to support a wider diversity of local services.

Nodes and Corridors

Nodes and corridors is a concept within the City of Edmonton City Plan that focuses redevelopment. The goal is to provide densification and support more diverse employment opportunities within key areas of the city.

Nodes and corridors are areas within the already developed city where EPCOR is planning for growth and increased service needs. Considerations that are being taken into account include changes to surface permeability, increased wastewater generation in smaller areas and the reliability of pre-existing assets serving the nodes or corridors.



Water Use Trends

In 2021 EPCOR released the Water Use Trends and Design Guidelines discussion paper which provided updated design guidance for water use city wide. The report compiled water use trends by customer type by aggregating and analyzing water use records for every customer.

City-wide, water meter records show sustained reductions per customer in water use across all sectors over the past 20 years. In 2023 EPCOR, in partnership with the development community and the City of Edmonton, updated the design standards to reflect current usage patterns.

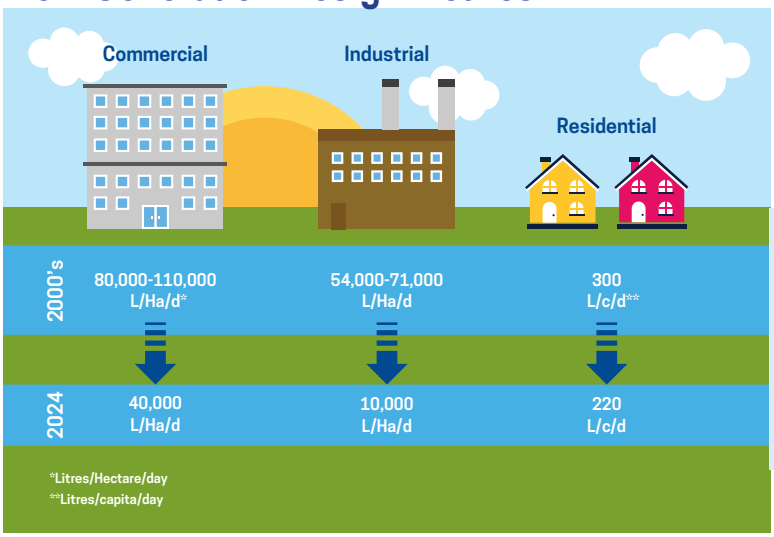
Understanding water use across the city is critical for ensuring that water and wastewater assets are appropriately sized and are not built pre-maturely. In addition to reducing unnecessary capital expenditures, right-sizing assets also improves their reliability. Properly sized pump stations have lower operational and energy costs and properly sized sewers limits wastewater stagnation reducing the prevalence of sewer odours and reducing damage from corrosion

Historically, plant and trunk upgrades have been primarily driven by the notion of inadequate capacity to support growth. Due to the increased water use efficiency of EPCOR's customer base, and the more widespread implementation of storm flow management in the system, growth is not projected to be the primary driver of capital expenditures in the near term.

Water Efficiency at Home
Residential water consumption per customer is decreasing city-wide as existing residences retrofit and refurbish aging appliances and as new more water efficient residential homes are built in our developing and mature neighborhoods. On average, residential water use is at 176 L/capita/day (L/c/d) across the city, however in new homes average water use is 160 L/c/d thanks to modern water efficient appliances.

Water Efficiency Everywhere
Improvements in water efficiency are not limited to residential customers. Water consumption is declining across commercial and industrial sectors as new technologies and practices enable more efficient water use. Design metrics formulated 20 years ago no longer apply for commercial and industrial developments. These areas now use between four to eight times less water depending on industry type.

Flow Generation Design Metrics



The flow generation metrics used to inform design and construction planning were published in January 2024 to reflect the decrease in water use by commercial, industrial, and residential customers.

REGULATORY

A key driver of the WWIRP is the need to meet current and emerging regulatory requirements. A variety of federal and provincial acts, regulations, guidelines and policies govern the delivery of wastewater services in Edmonton.

City of Edmonton

The City of Edmonton regulates and enforces provisions relating to sanitary combined and surface drainage in Bylaws 19627 and 18100. The city also approves rates, fees charges and conditions for water, wastewater and collection services provided by EPCOR through Bylaw 19627 through performance based regulation.

Government of Alberta

The environmental regulatory requirements for EPCOR's wastewater collection and treatment systems are set out in the *Environmental Protection and Enhancement Act* Approval (#639-03-07) issued by Alberta Environment and Protected Areas (AEPA) in 2015. This 10-year approval sets monitoring requirements for both the combined sewer systems and the Gold Bar WWTP discharges. The approval specifically requires that EPCOR implement a Total Loadings Management Plan (the "Total Loadings Plan") in coordination with the ARROW Utilities and as authorized in writing by AEPA. Total loadings refers to the annual mass of total suspended solids (TSS) released to the North Saskatchewan River from all sources and includes loads from the Gold Bar WWTP effluent and bypasses, combined sewer overflows and the storm sewer system. The guiding principle of the Total Loadings Plan is to have no net increase in TSS loadings to the North Saskatchewan River in order to achieve the long-term goal of no net degradation of the North Saskatchewan River relative to the 2000-2008 time period.

Government of Canada

Federal regulatory involvement is achieved primarily through the *Canadian Environmental Protection Act* (CEPA 1999) and the *Canadian Navigable Water Act.* CEPA is environmental legislation aimed at preventing pollution and protecting the environment and human health. Any development with potential impacts to either must follow processes set out by CEPA. The *Canadian Navigable Waters Act* concerns any work that interacts with the North Saskatchewan River.

Future Regulatory Considerations

AEPA will continue to be the main regulatory agency overseeing standards and approvals for the foreseeable future. A near term regulatory requirement from AEPA is the objective to capture and treat wastewater and run-off from any controllable sources. Planning is already underway to initiate programs to assess and mitigate impacts on the receiving streams and river from any controllable source through the Integrated Watershed Management Strategy (IWMS).

The IWMS expands upon the source water protection plan to meet EPCOR's committed to prevent pollution and reduce environmental impacts that affect aquatic ecosystems in which it operates. The guiding principal is to improve or maintain water quality in the North Saskatchewan River and its tributaries both upstream and downstream of EPCOR's operations.

Load management practices and targets are being updated under the IWMS to align with updated growth scenarios. The goal remains to maintain a "no further degradation" policy for any updated total loadings targets.

AFFORDABILITY

Water and wastewater services are essential, but the cost of these services is growing.

By considering one water principles, including investing in conveyance and treatment enhancements, maximizing the use of our existing infrastructure by reducing I&I and prudently investing in asset rehabilitation, alternative nature-based water management solutions and encouraging responsible water use, wastewater management becomes more economical.

A DEEPER VIEW: PIPES AND PLANTS

SEWER SYSTEM OVERVIEW

Edmonton's sanitary system safely collects, stores and conveys more than 300 million litres of wastewater per day from nearly 430,000 residential, commercial and industrial service connections. The wastewater flows to the Gold Bar WWTP or ARROW Utilities where it is cleaned and either returned to the North Saskatchewan River, or provided to industrial customers to support operations.

The scale of the system is expansive with over 4,200 km of sanitary and combined pipes, 81 wastewater pumping stations and hundreds of active and passive wastewater storage areas across the city with the capacity to store more than 300,000 cubic metres of wastewater.

The collection system in the city's downtown core and surrounding neighbourhoods stores and conveys both sanitary and storm wastewater through 850 km of combined pipe. The combined sewer system in these areas collects water from both individual properties and catch basins on the street. The city discontinued construction of combined sewer lines in the 1960s, which is why this system is typically only found in older, more central areas of the city.

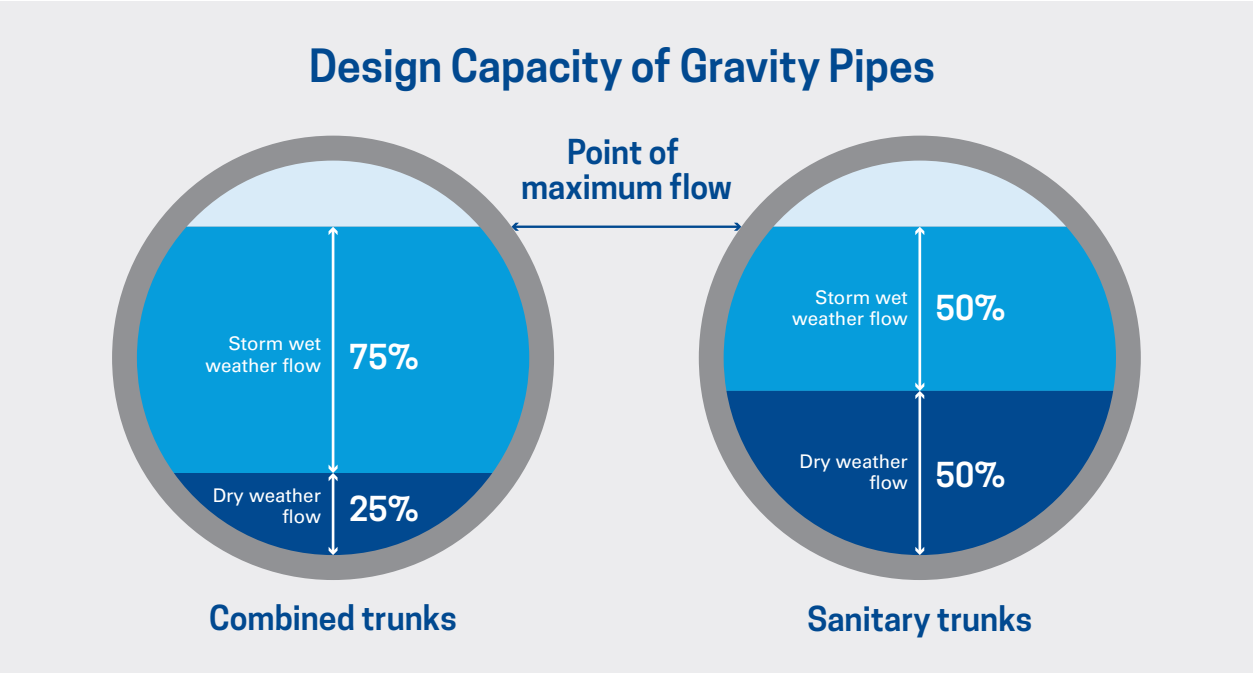
The Wastewater Collection System

- 1.2 Million Customers
- 3,350 km of Sanitary Pipe
- 850 km of Combined Pipe
- 81 Pump Stations
- 6 River Crossings

Combined and Sanitary Sewers: Both Sized for Storms

Combined Sewers are sized to convey both wastewater collected from customers as well as incoming storm flows collected directly from catch basins. While a storm event may be short in duration, they deliver large volumes of water. To prevent backups, a combined sewer pipe usually needs to dedicate around 75% of the usable space in the pipe for storm flows.

Sanitary Sewers do not collect stormwater directly from catch basins and are meant to only receive wastewater from customers. However the sewers are still sized with storm flows in mind. Through a process called inflow and infiltration, it is common for some stormwater to enter a sanitary sewer. Stormwater can enter through manhole lids, improperly connected household downspouts and through asset deficiencies such as cracks. In practice, nearly half of the capacity of a sanitary pipe is reserved for the additional flows introduced by a storm event.

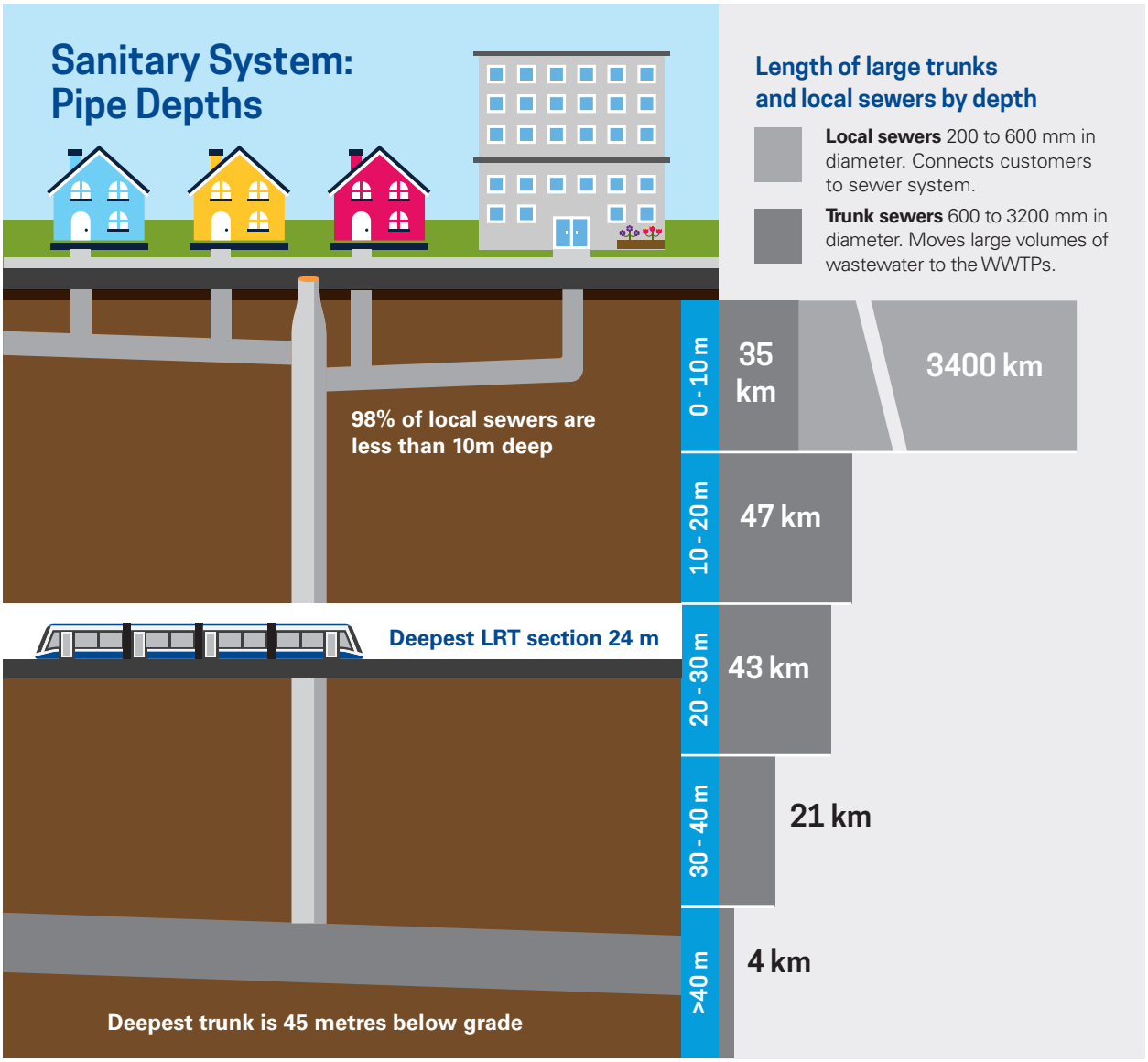


A System of Shallow Collectors and Deep Trunks

Sewer pipes can also be categorized as local sewers or trunks.

Local Sewers (also called collector sewers, mainlines and sometimes even laterals) collect wastewater from customers at the street level. These pipes are smaller in size and make up the majority of the sewer collection network. They are also comparatively shallow with most collector pipes being less than six metres below the surface. Because they are shallow and built with regularly spaced access points, collector pipes are relatively easy to inspect clean and rehabilitate.

Trunk Sewers, are larger sewer pipes that collect and then convey the wastewater received from all of the local sewers. Because Edmonton has a relatively flat topography but a deep ravine and river valley system, the sewer trunks serving the city are especially deep. Nearly half of the large trunks (bigger than 1.2 metres in diameter) are more than 20 metres below the ground and the deepest trunk reaches a depth of 45 metres. Because of the depth and large volumes of water carried by trunks, they are challenging to access, inspect, clean and rehabilitate.



SANITARY INTEGRATED RESOURCE PLAN

EPCOR is currently working to finalize a Sanitary Integrated Resource Plan (SanIRP). The SanIRP is the first IRP for the sanitary and combined sewer collection system. This plan will use the SPA concept to provide a path forward for building and operating a municipal wastewater collection system that provides reliable long-term service in a city transitioning to growth through infill development while exceeding operational, environmental and financial performance expectations.

SanIRP will feature four main areas of focus within each SPA:

Integrated Trunk Planning:

Transitioning trunk capital investment plans into an integrated planning framework using Sanitary Planning Areas (SPAs) to identify growth drivers and capacity trigger points. Capital and operational investment is driven by the planning areas targeted level of service, identified capacity constraints and their measured wet weather performance.

Capacity Recovery Locally:

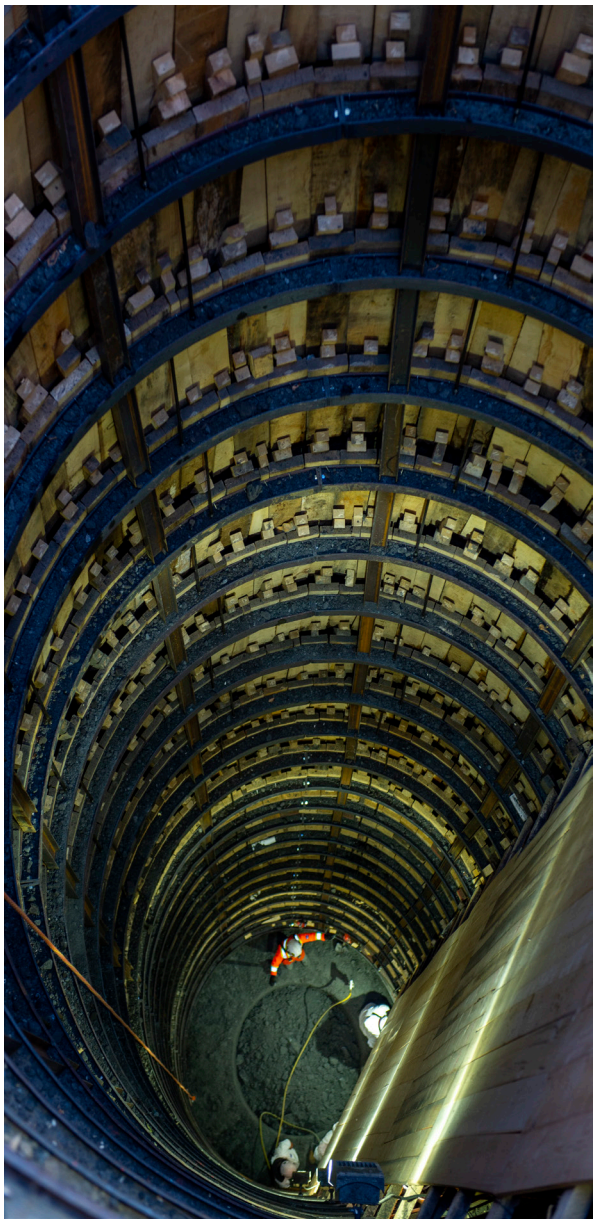
Gaining capacity in the collection system by engaging customers, leveraging the Stormwater Integrated Resources Plan (SIRP), and making focused investments on inflow and infiltration prevention to reduce wet weather flows.

Asset Management Synergies:

Aligning corrosion, odour and by-pass investments with the asset management program and practices.

Situational Awareness:

SanIRP and SIRP share a city-wide situational awareness plan that installs enhanced flow, air quality and operational monitoring across the combined, sanitary and storm collection systems enabling more responsive planning practices across the entire water cycle.



Access Manhole Shaft

STRATEGIC FOCUS

Integrated Trunk Planning

Traditional water planning approaches have been historically used for sewer trunk design. This approach ensures the delivery of adequate service under the widest foreseeable envelope of future operational conditions. This has often resulted over-sized, underutilized infrastructure that is prone to operational failures.

Continuing traditional approaches in trunk design have become unsustainable as the number of future unknowns has multiplied. A further challenge is that traditional trunk design has left a legacy of large, deep assets with poor accessibility. These deeply buried assets can not be easily modified, upgraded or retrofitted. EPCOR has approached this challenge by creating Sanitary Planning Areas (SPAs) which uses integrated planning concepts to holistically evaluate the service needs of an area and develop solutions that are more resilient to future change. The SPAs detail the conditions and necessary actions to achieve both growth and resiliency through an integrated planning approach.

Actions of particular importance for integrated trunk planning includes:

- **Shorter project timeframes with a shift to incremental enhancements**
  Rather than building assets today for the capacity needs of the city 75 – 100 years from now, actions are promoted that add incremental capacity, as-needed, to the sewer collection system.
- **Focusing local**
  SPAs focus on gaining back trunk capacity by focusing on more accessible assets and solutions. These include improvements to the local sewer system, and reducing stormwater inflows by leveraging storm management facilities and working with customers. Many of the solutions are on or near the surface and are easier to upgrade or retrofit in the future if new needs arise.
- **Resiliency with trunk bypass capacity**
  SPAs identify 55 critical trunk crossings across the city that pass under environmentally sensitive ecosystems or critical infrastructure. At these locations the SPAs recommend and prioritize future actions that will provide bypass capacity in order to minimize adverse effects in the event of a trunk failure.
- **Monitoring Drives Planning**
  SPAs are used to identify the locations that are the key indicators of system health and flow capacity to support investment in monitoring at those locations. This will allow for the identification of capacity trigger points that necessitate action. Shifting from modeling to monitoring driven decision making allows for more responsive and adaptive planning decisions.

Capacity Recovery at the Local Level

"Buying Back Capacity"

Future trunk capacity assessments are underway for each SPA based on current population growth estimates and the growth priorities identified in the City Plan. It was determined that most of the sewer trunk infrastructure in place has sufficient capacity to support future population growth of up to two million people. For the areas where future capacity issues were found, trunk construction could often be avoided by more aggressively acting to control and slow down wet weather inflows into the upstream sewer system. The five priority SPA areas focus these wet weather management approaches.

From both a performance and cost effectiveness perspective, focusing on investments that slow or prevent wet weather inflows is more sustainable in the long-term. Because trunks are sized to accommodate large storm surges, any action that prevents or especially slows down storm flows entering these trunks will free up capacity for normal baseline flows from customers.

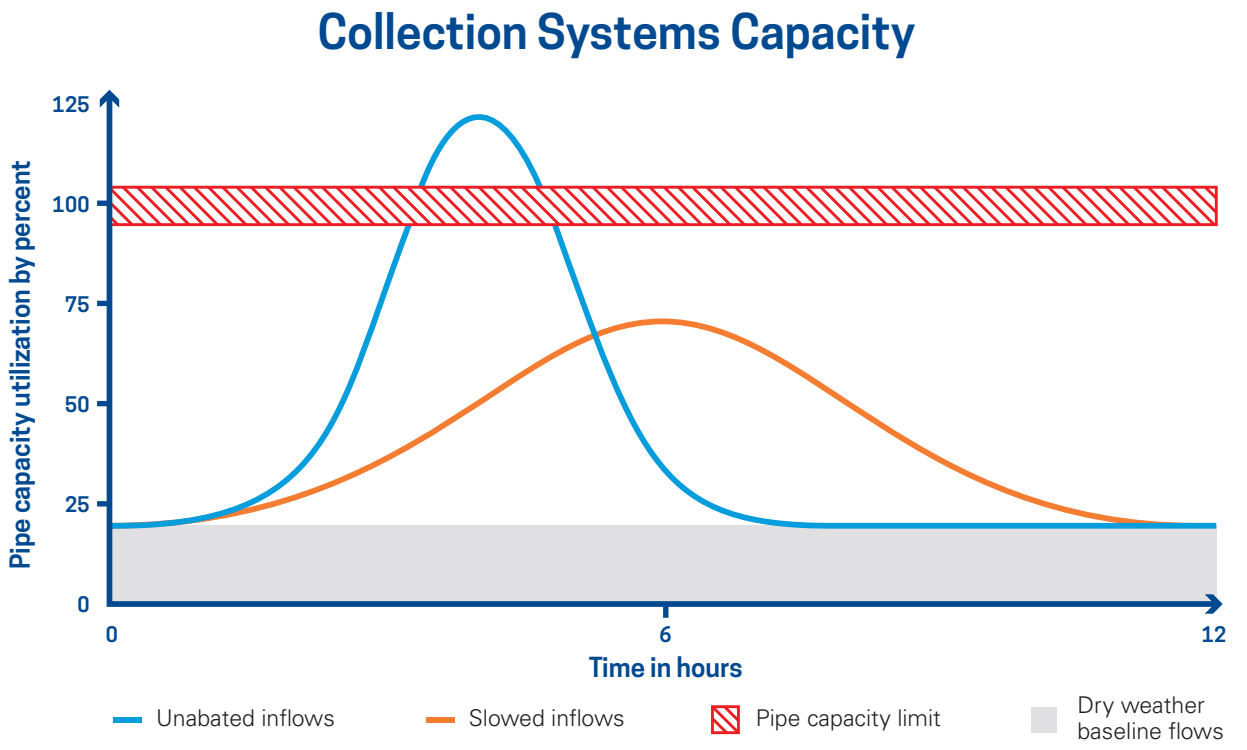
Actions to gain system capacity include:

EPCOR:

- Manhole sealing, especially at road and surface sags to prevent stormwater inflow from the surface.
- More aggressive sewer relining in high infiltration, low capacity areas.
- Leveraging SIRP investments to manage wet weather, reduce and slow storm inflows in the sanitary and combined sewers.

Customers:

- Engaging with our commercial, industrial and institutional customers to further enable increasing the uptake of green hectares and LID storm features.
- Engaging with our residential customers to decrease the number of improperly connected downspouts and initiating a program that enables customers to build on-property improvements, such as rain gardens, to retain runoff.



Lowering Trunk Utilization by Slowing Inflows

Large, intense rainfall events, such as thunderstorms, tend to cause very large, but short duration "pulses" of flow through the storm, sanitary and combined sewer trunks. It is these pulses of wet weather flow which test the limits of a collection system's capacity.

Trunk capacity can be regained by slowing flows down. Stretching a pulse of stormwater so that it takes two hours to get through a trunk instead of one hour will cause it to take up half the volume of the unabated one hour pulse.

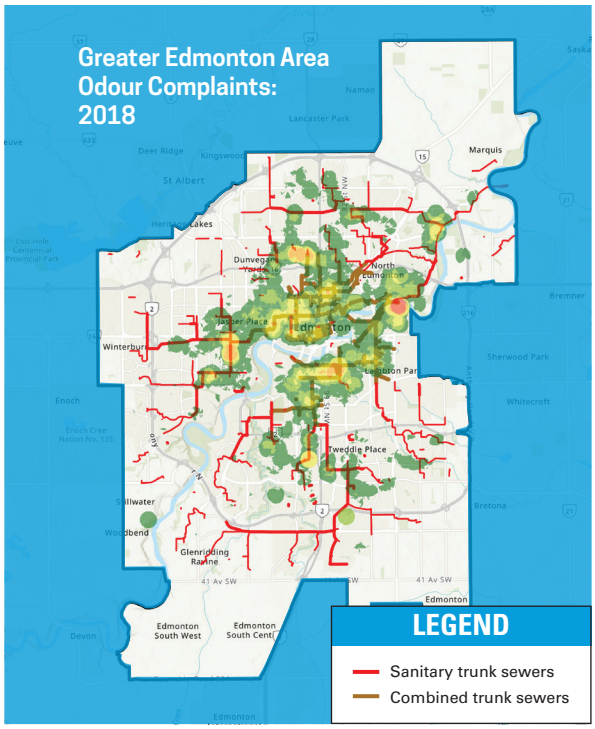
SIRP actions such as LIDs, smart ponds and surface/lot improvements can all be used to retain stormwater locally, and slow down wet weather pulses.

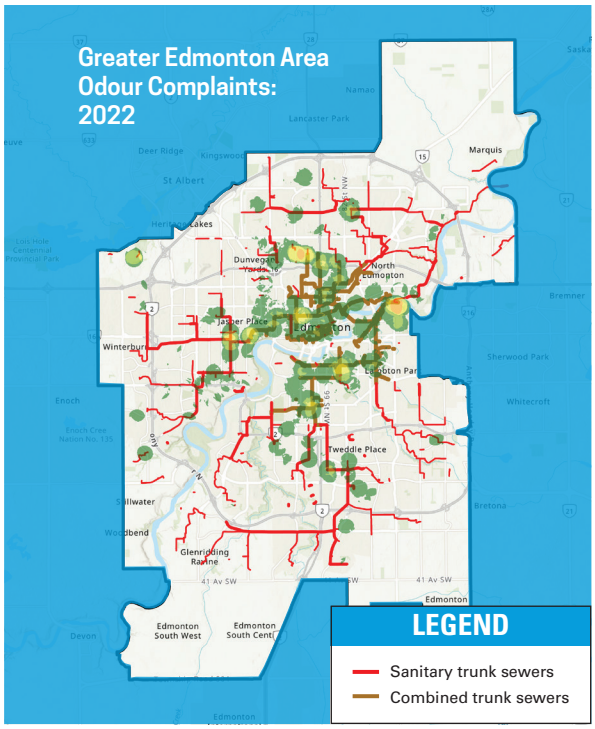
Asset Management Synergies

EPCOR's Asset Management Program employs a risk management framework to prioritize expenditures and allocate resources effectively to minimize adverse impacts to public health and safety, environment, reputation and finances. Taken with other considerations, such as community needs, growth requirements, equity, environmental sustainability and business needs, the risk rankings help to define the maintenance, rehabilitation and replacement priorities for sewer assets across the city.

Corrosion and Odour

To continue to address the impact of sewer corrosion, the Corrosion and Odour Reduction (CORe) strategy objectives are being aligned with the asset management program to ensure it is better captured in the rehabilitation prioritization process. Likewise, for the existing CORe programs that reduce hydrogen sulfide in the sewer system, their identification and prioritization is now being aligned with asset management priorities through the risk management system. This ensures that the benefits incurred by reducing the risk of downstream asset failure factors into CORe priorities. Together, these alignments are maximizing asset risk reduction city-wide while also reducing odour nuisance at the surface.





Since 2018, reports of outdoor odour nuisance have decreased by 52% across the city, corresponding with CORe investments. Aligning CORe with the Asset Management Program will ensure odour nuisance decreases while further reducing impacts to asset condition from corrosion.

Introducing Sewer Bypass Capacity

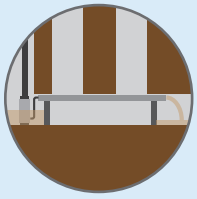
EPCOR has developed a bypass plan for the large trunk system which recommends investments to provide trunk by-pass capabilities for high risk trunks. EPCOR has identified that service disruption caused by trunk failure can be reduced by expanding the capacity to quickly and effectively respond to and perform emergency repairs. In particular, sections of trunk that cross under sensitive areas such as the North Saskatchewan River, creeks, lakes, freeways, railways, pipeline corridors and buildings have been identified as assets where having by-pass capacity is extremely advantageous in the long run.

Bypass Approaches

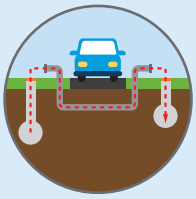
New bypass tunnel

Control structures and divisions

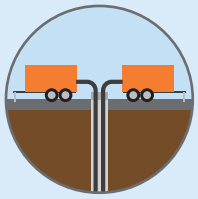
Internal bypass



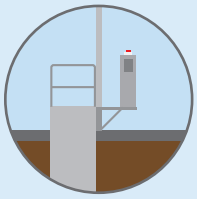
Capped conduit crossings



Bypass skids/ mobile units



Temporary pump stations

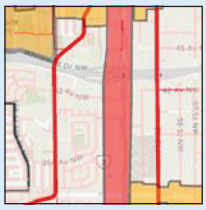


The type of bypass approach used depends on pipe characteristics such as depth, size and flow as well as network factors such as the availability of pre-existing discharge locations.

A successful bypass provides appropriate and safe access points for both the inlet and discharge point.

Sanitary Planning Areas: Planning at the Local Level - An Example

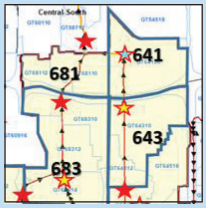
The Calgary Trail SPA is has been identified as one of the top five priority action areas due in large part to its capacity needs and high I&I rates. The SPA is used to detail the primary operational and planning conditions that drive investments in situational awareness, operational improvements and capital enhancements to ensure both local and downstream service requirements are met. A summary of the key focus areas of the SPA are detailed below as an example of form and function provided in all 23 SPA areas.



GROWTH

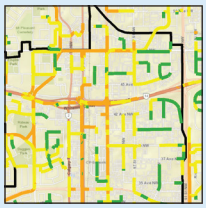
The SPAs use the nodes and corridors prioritization to relate expected growth and intensification with existing sewer infrastructure.

The Calgary Trail SPA has three district nodes, one primary corridor and seven secondary corridors within its boundary which overlap and align with several major trunks whose long term capacity needs will need to be closely monitored.



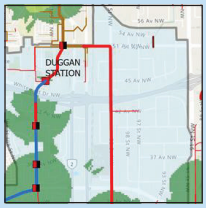
INFLOW AND INFILTRATION

Investment in situational awareness in the Calgary Trail SPA is being driven by high I&I rates for the area. The SPAs recommends installing eight monitoring stations across the areas eight sewer sub-catchments in order to identify and quantify the main source of wet weather flows so that planning actions can be created and prioritized.



ASSET RISK

Many of the large trunks within the Calgary Trail SPA are over 50 years old. The SPAs highlights which specific trunks need to be prioritized for more in-depth inspections and has identified one specific location within the SPA where risk is best mitigated by invest-ing in by-pass improvements.



ODOUR AND CORROSION

The SPAs details both the corrosion and odour risks for the area. The report highlights two areas that are known odour nuisance hotspots as well as identifying two major trunks where accelerated asset loss due to corrosion is more likely.

STORM SYSTEM OVERVIEW

Edmonton's stormwater management system is a complex network of runoff capture, storage and conveyance elements that work to minimize the impacts of both pluvial (rainfall) and fluvial (river) flood risks and protect residents, businesses and the environment. Throughout the city of Edmonton, thousands of kilometres of overland flow routes (roadways, culverts, ditches and swales) and underground infrastructure (storm and combined sewers) and hundreds of distributed storage facilities (stormwater management facilities and LIDs) work together to manage the volume, the flow and the quality of runoff that enters our urban creeks and the North Saskatchewan River.

In 2017 EPCOR introduced the Stormwater Integrated Resources Plan (SIRP), a proactive approach to evaluating flood risk from a health and safety, social, environmental and financial perspectives, complete with capital and operational program to drive down risk over 30 years.

Edmonton's stormwater management system collects, stores and moves runoff off of the landscape through the storm and combined sewer network to the natural environment. The capacity of the system is largely determined by the era in which it was developed and any subsequent infrastructure upgrades. Mature neighbourhoods and those areas developed prior to 1989 generally have a higher flood risk due to the design philosophy that was used at the time of development, which did not include stormwater management facilities and considerations for the roadway to convey stormwater during extreme rainfall events.

Storm system at a glance:

- 3,721 km Storm Sewers
- 850 km of Combined Sewers
- 388 Stormwater Management Facilities
- 418 LIDs
- 276 Stormwater Outfalls

Dual Drainage System:

Modern stormwater management systems are designed with a “dual drainage” focus with both the overland and underground system working hand-in-hand to collect, store, and move runoff for all sizes of storm events. In these systems, stormwater infrastructure are broadly categorized into the “major” system, which includes stormwater management facilities, roadways, ditches, and swales, and the “minor” systems which includes LIDs, catch basins and storm sewers.

Major System

Stormwater Management Facilities EPCOR has three types of stormwater management facilities in the City of Edmonton: Wet and Dry Ponds as well as Constructed Wetlands. Stormwater Management Facilities and the areas around them serve the dual purpose and open spaces which may include walking trails and picnic areas, or event programmable sports fields.

Overland Flow Routes The major system includes conveyance infrastructures that are seen at the surface. This includes things like ditches and culverts, as well as the gutters of the roadway system. The design of newer neighbourhoods takes into account where water will overflow in the event of an extreme event that exceeds the capacity of the sewer system.

Parkallen Dry Pond

Minor System

An example of LID installation along Whyte Avenue

Low Impact Developments (LIDs) are designed to capture runoff across all rainfall events and hold it as close to its point of generation as possible, slowly releasing into the storm and combined sewer systems. These can include a variety of infrastructures including traditional rain gardens, bioretentions, and soil cells as well as small storage infrastructure which hold water during both smaller events and bigger events. By holding water back from the sewer system, LIDs create additional capacity in the sewer network. They also function to reduce I&I into the sanitary network. Additionally, LIDs have many co-benefits including improving water quality, reducing the urban heat island effect and providing critical habitat for pollinators.

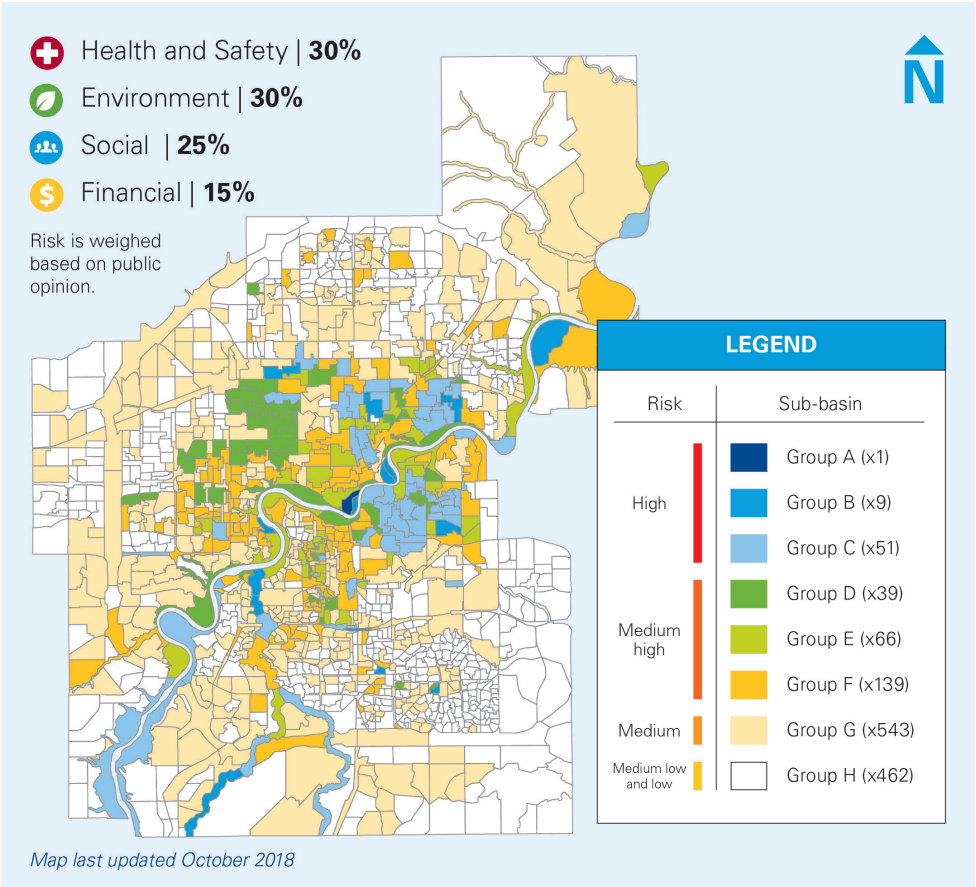
Storm and Combined Sewers are designed to move runoff from the point it lands on the ground out towards a safe discharge location (typically one of Edmonton’s seven urban creeks, or directly to the North Saskatchewan River via one of 276 stormwater outfalls, or towards the Gold Bar WWTP for combined sewers). Storm sewers are typically designed for more regular rainfall events, and are supplemented by the overland system during periods of extreme rainfall. The combined system is designed to accommodate both stormwater and wastewater, and during heavy rainfall events, some diluted combined sewerage may overflow to the natural environment through a combined sewer overflow.

STORMWATER IRP

EPCOR's Stormwater Integrated Resource Plan (SIRP), which was approved by the City of Edmonton Utility Committee and City Council in 2019, is a $1.6 billion system-wide integrated approach. It will be completed over the next 20 to 30 years and will mitigate flood risk by reducing the health, safety, financial and social risks of flooding. The existing capacity constraints in the sanitary system is driven by the design of the systems accommodating a substantial amount of extraneous flows into the systems during wet weather. The investments in the stormwater system through SIRP have the dual benefit of reducing the impacts of wet weather on the sanitary and combined systems. This creates capacity for growth and improves operation and maintenance of the collections systems and associated infrastructure across the water cycle.

The SIRP program is classified into the following five themes of investment:

- **Slow**: The entry of stormwater into the drainage network is slowed by absorbing it in green infrastructure
- **Move**: Excess water is moved away from areas at risk, quickly and efficiently
- **Secure**: Individual properties in higher risk areas are secured against sewer backups, and flooding
- **Predict**: Predict and manage the movement of stormwater through smart intelligent monitoring.
- **Respond**: Respond through fast rollout of flood barriers, traffic diversions, and public communications to protect life, safety and property



Map last updated October 2018

STRATEGIC FOCUS

Supporting Growth

The implementation of SIRP continuously re-evaluates flood risk, priorities and adapts to the needs of the growing city. The SIRPs flexible programming makes it nimble and ready to adapt to changing city-building policies and practices in addition to a changing climate. In particular, the roll out of the slow theme of SIRP investment, developing distributed stormwater storage throughout the city, has multiple benefits across the water cycle:

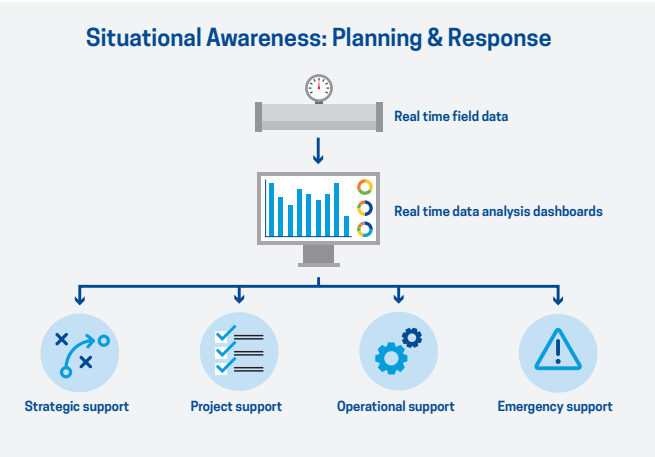
- Reducing localized flooding
- Creating additional capacity in the sewer system for areas impacted with more intense rainfall
- Freeing up capacity in the combined system to accommodate growth
- Creates a land cover that is hydrologically more reflective of a natural watershed
- Full alignment with the City aspirations to enhance the green network and urban tree canopy, and
- Many other environmental co-benefits, including opportunities for native plant species and enhanced habitat for pollinators and other fauna.

Working closely with the City of Edmonton and the development industry, EPCOR endeavours to redefine how the city's stormwater management system is built across both the public and private spaces. We have been developing policy, designing guidance, monitoring and funding mechanisms to enable widespread I&I reduction and development of green stormwater infrastructure throughout the city.

Enhanced Operations

At its core, the **predict** theme of SIRP investment focuses on enhancing the monitoring, and in turn our understanding of how runoff moves across the landscape and through the drainage system. Through building this enhanced monitoring network, EPCOR is better able to predict and develop programming so actively respond to major flooding events. Examples of this programming includes:

- Working with the City of Edmonton and communities to develop an enact Emergency Response Plans
- Customer focused flood resilience planning including lot-level inspections and subsidized flood protection
- Developing a smart system controls operational philosophy. Enabling the automatic operation of outfall gates to protect communities from riverine flood threats. Converting existing stormwater management facilities to "smart ponds", allowing them to actively store water during regular rainfall events.



TREATMENT PLANT OVERVIEW

The Gold Bar WWTP is located in east Edmonton on the south shore of the North Saskatchewan River. The facility is operated to treat sanitary flows by removing solids, organic contaminants, nutrients and pathogens from wastewater generated within the city as a means to protect public health and the regional ecosystem.

Gold Bar's treatment process consistently surpasses regulatory standards for environmental protection and remains in the forefront of technology innovation and process intensification for wastewater treatment.

WWTP at a glance:

- Gold Bar WWTP has been protecting public health and the North Saskatchewan River since 1956 and ARROW Utilities WWTP since 1985.
- Each day an average of 300 million litres of wastewater is treated and 80 million litres at the ARROW Utilities WWTP.

Treatment Stages

The wastewater treatment system in Edmonton has the following process stages:

Pre-treatment removes large materials that can wear or clog plant equipment, while also improving quality of organic solids.

Grit and screenings removed in pre-treatment are dumped into portable bins for disposal at a landfill.

Primary treatment removes solids and scum from the wastewater with mechanical rakes.

Secondary treatment uses microorganisms to remove nitrogen and phosphorus and 95-97% of organic impurities from the wastewater.

Solids collected in this process are sent to the fermenters and anaerobic digesters to be further processed.

A small portion of the secondary treated water enters a membrane filtration process for the purpose of water re-use by industrial partners.

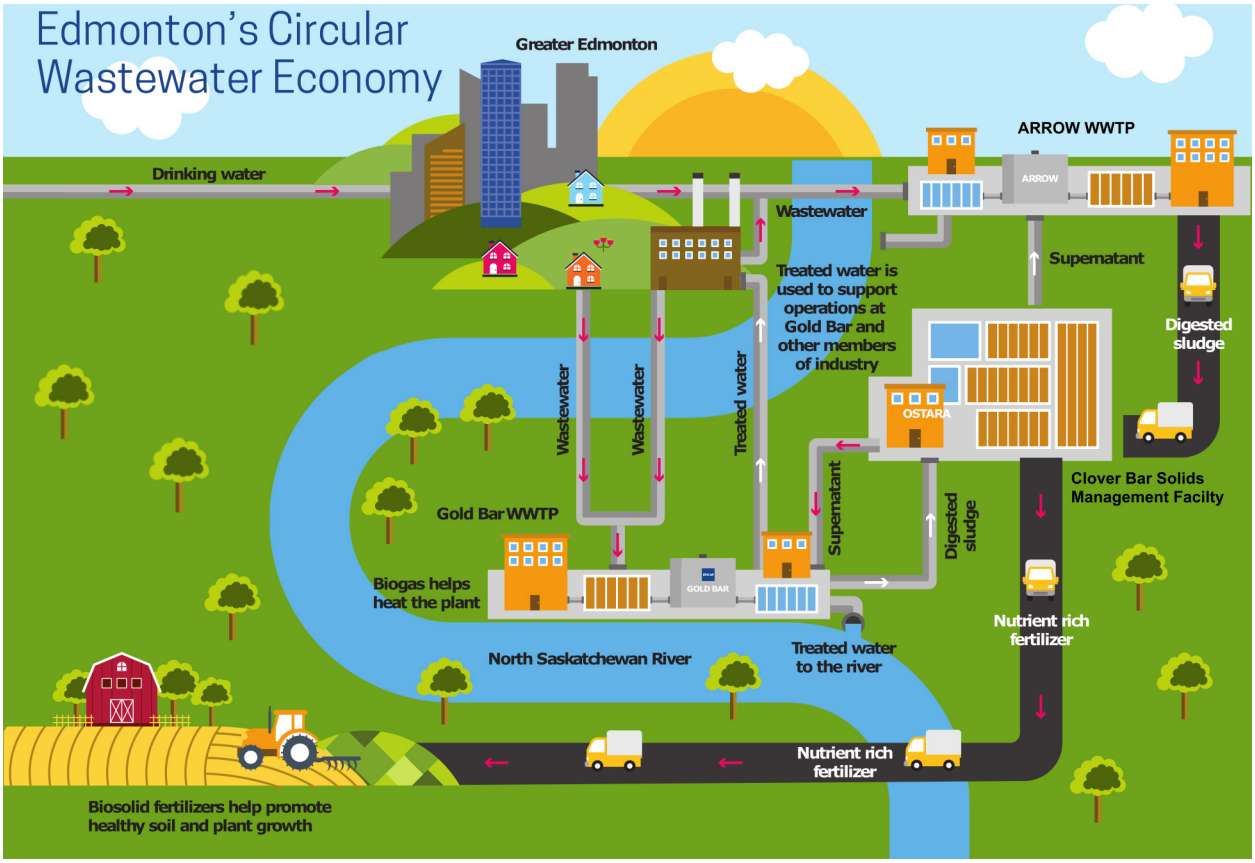
Tertiary treatment further polishes and disinfects the water before it re-enters the environment. The water passes through a UV system and is disinfected by high intensity ultra-violet (UV) light before discharging to the North Saskatchewan River.

Solids handling is where solids are broken-down into stabilized sludge and biogas. The biogas is reused to support plant operations by providing heating and as a process input.

Stabilized solids from the Gold Bar WWTP are conveyed to the Clover Bar Solids Management Facility via pipeline for nutrient recovery.

Nutrients in sanitary wastewater consists of primarily ammonia and phosphorus. Ammonia comes mostly from urine and phosphorus is present in feces and household cleaning products. These nutrients can be very harmful to the aquatic habitat if discharged to surface waters, but can be very helpful for farming and agriculture when applied to the land.

In wastewater treatment solids, liquids and nutrients can be looked at separately to assess the systems' capacity to handle and process these components.



EDMONTON WASTEWATER TREATMENT IRP SUMMARY

The Edmonton Wastewater Treatment IRP (EWWT IRP) was approved by the City's Utility Committee and Edmonton City Council in 2019.

The EWWT IRP is the long-range plan for the Gold Bar WWTP and Clover Bar Solids Management Facility.

Recovering and reusing useful resources like treated water, biogas, and biosolids is also a fundamental goal of the treatment process.

The EWWT IRP outlines the long-term planning assumptions and summarizes pertinent information on the following key areas:

- Analysis of each of the key drivers impacting the IRP including future growth, reliability of process and assets, regulatory impacts, sustainability goals, health, safety & environmental impacts, social impacts, new and emerging technologies.
- Most likely future development scenarios.
- Forecasted long-term capital spending.

The primary treatment basins at Gold Bar.

STRATEGIC FOCUS

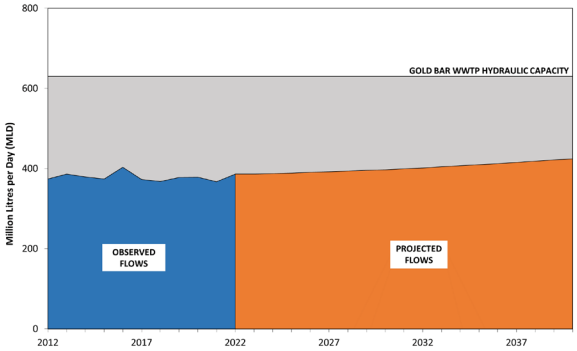
Innovate to Achieve Growth

Providing essential wastewater treatment service to meet Edmonton's growth plans is an important objective for the future. The strategy for achieving growth is to enhance the operation of existing assets with input from stakeholders and employ innovative technologies to intensify existing treatment processes, thereby limiting physical expansions.

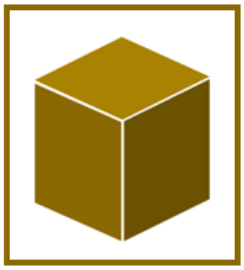
Liquid

There is sufficient capacity within existing plant infrastructure to continue to provide conveyance for the sanitary flows from the city of Edmonton in the future. Original designs that under predicted the impact water efficiency has left a buffer for future flows.

Liquid Capacity Trends: Gold Bar WWTP

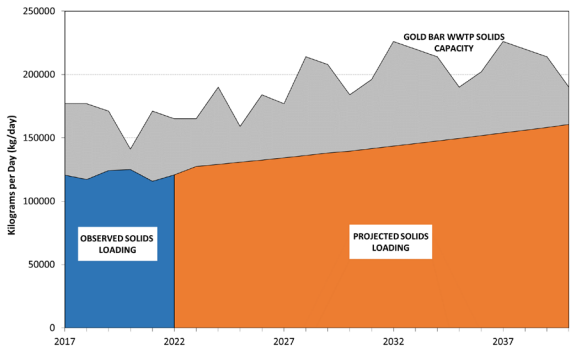


Solids



The capacity of the solids handling processes, specifically in the existing digesters as shown, will be maintained through regular cleaning, maintenance and periodic upgrades to accommodate future treatment demands.

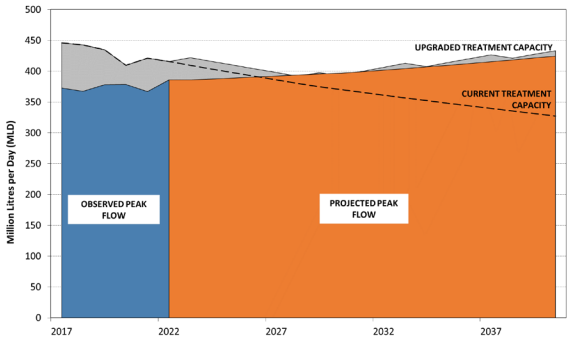
Solids Capacity Trends: Gold Bar WWTP



Nutrients

Nutrient concentration in wastewater increases with population and this reduces capacity for removal. Intensification of the existing process with new technologies, within the plant's existing footprint, will allow continued cost-effective treatment of the city's wastewater in the future.

Nutrients Capacity Trends: Gold Bar WWTP



Gaining Capacity Upstream

Climate change models for the Edmonton region are predicting that high-intensity storms will become more frequent in the future. The high flows that are associated with high intensity storms can impact the treatment process at the Gold Bar WWTP and negatively impact the quality of the water entering the North Saskatchewan River.

Gold Bar and ARROW WWTPs will benefit from EPCOR's One Water approach that reduces and slows wet weather inflows upstream of the treatment plants.

Maximizing Use of Existing Infrastructure

The influx of solids and nutrients to the wastewater treatment process is expected to keep pace with growth in the Edmonton region.

The Gold Bar WWTP is undertaking secondary treatment technology upgrades that increases the concentration of microorganisms in the treatment train. This densification process enhances the biological treatment stage with higher biomass concentrations and improves the nutrient removal rate without increasing the plant's footprint. The implementation of this technology is still in its early stages, but the deliberate effort to concentrate the process in the existing tankage results in a smaller overall footprint with gained efficiencies in nutrient removal.

Asset Management to Build Reliability

EPCOR implements proven asset management strategies to prevent damage to equipment and reduce operational and capital costs. Asset management includes rehabilitation programs that focus on life-cycle and replacement in-kind projects for ensuring assets continue to function as intended.

Gold Bar's electrical infrastructure is aging and poses challenges as outdated components can compromise the plant's efficiency and reliability. Upgrading the electrical system is essential to maintain the plant's overall operational integrity and will allow the plant to adopt more efficient process technologies.

In addition to the electrical system, several concrete channels at the plant have been identified for capital improvement. These channels exhibit signs of deterioration due to corrosion and wear. Implementing a proactive plan to rehabilitate and potentially replace where necessary, ensures the structural integrity of the channels and ultimately extends the lifespan of the infrastructure.

A comprehensive asset management approach that follows plant equipment and structures through their life-cycle is vital for the continued effectiveness and resilience of the Gold Bar WWTP.

PVC Sewer Pipes

CLOVER BAR SOLIDS MANAGEMENT FACILITY

The Clover Bar Solids Management Facility receives digested sludge from the Gold Bar WWTP and ARROW Utilities for further processing. Nutrients from the wastewater that are captured in the sludge are recovered for beneficial reuse at this facility.

Clover Bar was first constructed in the 1970s and consists of a solids basin, three settling basins, a supernatant aeration cell, and the OSTARA Nutrient Recovery Facility.

Clover Bar Solids Management Facility at a glance:

- Nutrients from the wastewater is captured in biosolids and recovered for beneficial reuse at Clover Bar
- Over 20,000 dry tonnes of biosolids is processed each year
- 33 km pipeline transports sludge from Gold Bar to Clover Bar. Sludge from ARROW is trucked to the site.

Digested sludge from Gold Bar WWTP is sent to the Clover Bar facility via 33 km of pipeline; whereas sludge from the ARROW WWTP is trucked to the site.

Basin cells receive the sludge where it then settles and separates into solid and liquid fractions.

The liquid fraction, called “supernatant” is decanted returned to the Gold Bar WWTP and ARROW WWTP through the collection system for further treatment.

The solid fraction called “biosolids” is used on farmlands as a fertilizer in agricultural applications as part of the Nutri-Gold program. Currently this program helps grow over 4,500 acres of regional crops.

OSTARA nutrient recovery process at the Clover Bar site recovers phosphorus from the basin supernatant and converts a portion of the phosphorus and ammonia also into commercially viable fertilizer. This also carries the benefit of reducing the nutrient loading to the wastewater treatment plants.

Other sidestreams collected at Clover Bar include wastewater from Edmonton Waste Management Centre and Enerkem, and treated effluent from the Ostara Nutrient Recovery Facility. Currently these sidestreams are returned to the collection system with the basin supernatant and directed to the wastewater treatment plants.

STRATEGIC FOCUS

Municipal and Regional Partnerships

The Clover Bar Solids Management Facility handles the biosolids from all sanitary waste generated in the greater Edmonton region. Both Gold Bar WWTP and ARROW Utilities transfer the biosolids to Clover Bar.

Supernatant from the basins is returned to both plants for continued treatment. Enhancing the regional partnership is key in managing the nutrients loading for the population of the entire region.

Operational Excellence

There are challenges in operating Clover Bar including but not limited to the lack of permanent dewatering facilities, effective solids recovery and dredging of basins, seasonal limitations to land application and transfer of biosolids, integrity and reliability of lagoon assets, continued accumulation of nutrient inventory, and struvite deposition in piping.

Improving reliability and efficacy of existing treatment is a primary focus for Clover Bar. Necessary capital and operating initiatives are being taken to address these challenges.

Innovations in Technology

The supernatant from the basins carry a significant concentration of nutrients which is returned to the two WWTPs for treatment. The ammonia concentrations in this return contribute about 20-25% of the plants' incoming nitrogen loads. Localized treatment of this side stream at Clover Bar can immensely benefit the wastewater treatment process by reducing the overall nutrient loading. In addition, finding better and more efficient ways to convert biosolids to fertilizer or other useful product will help maximize resource recovery. Thus, new and innovative technology alternatives are being considered and evaluated to define future strategic direction of biosolids management in Edmonton.

City growth will also facilitate an increase in the production of biosolids. With this in mind, the operations at Clover Bar will remain central to the future prosperity of the region – necessitating investments in achieving efficiencies in existing infrastructure and processes.

Asset Management

The aging infrastructure at Clover Bar poses challenges to the basins' long-term integrity and functionality. Equipment used to harvest biosolids from the basins as well as mechanical equipment used to convey material between cells requires maintenance and capital investments.

To maintain the facility's effectiveness, strategic asset management and rehabilitation or replacement efforts are a key aspect of planning. Proactive measures to enhance the resiliency of the components of the lagoon site and prevent potential leaks or breaches in the infrastructure is a crucial area of ongoing focus.

In addition to maintaining structural integrity, the rehabilitation or replacement of assets at Clover Bar presents an opportunity to reduce the facility's environmental footprint. Overall, this approach will enhance the sustainability and effectiveness of the wastewater basins and biosolids production for the region.

Reducing our Environmental Footprint

Future goals for Edmonton Wastewater Treatment and the Clover Bar Facility include improving sustainability and resource recovery by increasing the amount of biogas, nutrients, and reclaimed water that can be re-used, while reducing greenhouse gas emissions.

Three major investment paths are targeted:

- Upgrading and the biogas utilization process to allow the maximum use of biogas as fuel for on site heating and/or power generation and minimize waste through flaring.
- Installation of drying and dewatering infrastructure to improve solids handling will be essential to promote the beneficial use of this resource in agricultural application.
- Investigate the increase of on-site and external industrial reuse applications for reclaimed water.

In order to reduce greenhouse gas emissions, a number of capital projects will focus on minimizing power consumption of existing treatment processes. Planning efforts will also continue to obtain better understanding of process emissions and to devise future strategies for emission reductions from wastewater treatment.

Bob Starko, owner of Starko Century Farms and Deidre Bartlett, EPCOR Biosolids Technologist, go over Starko's Nutri-Gold delivery details. Bob has been using this circular economy product to help fertilize his 1,600-acre farming operation since 2014.

COMMUNITY ALIGNMENT

Stakeholders play an important role by providing meaningful input on EPCOR's operations and plans. Input from stakeholders helps ensure optimization of proposed project design initiatives and helps build sustainable relationships.

Development projects have the potential to create impacts, and require regulatory approval from varying levels of government. Stakeholder understanding and support is critical. EPCOR engages in collaborative, transparent and respectful planning that results in permitting, building and operating critical infrastructure in a way that is aligned with the interests and priorities of the communities EPCOR operates in. Stakeholder input is gathered through informal customer feedback associated with day-to-day operations as well as through formalized consultation programs on development projects.

Engagement for EPCOR involves:

- Designing engagement processes that considers: community preferences for how they wish to be engaged, the extent of potential impact on the community, and the extent of adaptation possible within the known technical and regulatory requirements.
- Meeting or exceeding all regulatory requirements for stakeholder engagement.
- Understanding the values and interests of the affected stakeholders.
- Incorporating public input into the design of the project and consideration of alternatives.
- Clearly communicating how final design decisions and public input were incorporated.
- Being aware of potential cumulative impacts from multiple developments and engagement processes.
- Working to be good partner to the community throughout construction and the life of the facility or infrastructure.

Stakeholder engagement work is focused on five shared outcomes with community:

- **Quality of life**: The plants are operated, maintained and updated in a way that reduces impacts to stakeholders and improves quality of life including noise and enjoyment of parks and recreation.
- **Safety**: Community, public and worker safety and health are protected.
- **Relationship**: An honest, transparent, trusting, responsive, supportive and respectful long-term relationship is developed between EPCOR and stakeholders.
- **Environment**: Pollution is prevented and community beautification is considered.
- **Reliable, Responsible & Sustainable**: Plants are designed, maintained and operated in a prudent and responsible manner.

PROJECT SPECIFIC ENGAGEMENT

Stakeholder participation is considered at various phases of a project. Project teams work with stakeholder engagement specialists on each project to consider how stakeholders might play a role in the:

- **Planning stage**: Assist in identifying impacts, mitigation and help with strategy.
- **Development stage**: Check in with stakeholders on progress and the level of impact of the initiative.
- **Evaluation stage**: At project completion, EPCOR checks in with stakeholders to evaluate performance and suggest improvements in the future.

Public engagement varies based on the initiative. Levels of community engagement are modeled after the City of Edmonton's Public Engagement Spectrum (C593) by specifying the level of public influence and commitment from EPCOR for various scenarios. Communication is an important factor and is integrated into all levels of EPCOR's Community Engagement Framework.

Decorative Art Hoarding installed at 142 Street and Summit Drive as part of the 99 Avenue Trunk Rehabilitation Project

GOLD BAR COMMUNITY COMMITMENTS

Gold Bar WWTP is situated in close proximity of a residential area, adjacent to Gold Bar Park and nature trails that are regularly used for recreational activities by Edmontonians.

To connect with community stakeholders, EPCOR facilitates consultation through a Gold Bar Community Liaison Group to discuss operational and planning updates. EPCOR seeks to implement high quality public engagement that results in critical infrastructure being built and operated in a way that aligns with the interests and priorities of the community and ensures our decisions and actions are guided by the values we share.

Odour management at Gold Bar has improved significantly over the life of the plant thanks to our investments in odour control systems, process improvements and an odour monitoring program. In order to further lessen nuisance impacts in our neighbouring communities, future actions will now also consider and act on reducing odour nuisance sources from incoming wastewater sewer trunks. The first set of investments to support future odour management within the sewer trunk lines is underway in both the Capilano and Beverly communities. These include the deployment of in-sewer hydrogen sulfide monitoring systems, construction of access manholes and sewer trunk inspections. This work is enabling EPCOR to plan future in-sewer odour mitigation actions. By committing to addressing issues outside the fence line of the Gold Bar WWTP, EPCOR will provide more comprehensive reduction in odour nuisance in our neighbouring communities.

Wastewater treatment enhancements and upgrades to maintain acceptable treatment levels will require strategic approaches to retrofitting existing structures, accepting new and innovative treatment technologies that will fit into the current plant footprint, and maintaining relationships with our regional partners for balancing and directing sanitary flows as the city and the region grows.

EPCOR recognizes the importance of building strong and mutually beneficial relationships with Indigenous Peoples in the areas where we operate, including around EPCOR's facilities in the North Saskatchewan River Valley such as the Gold Bar WWTP. Guided by EPCOR's Indigenous Peoples Policy, we are committed to fostering and sustaining strong relationships with Indigenous Peoples based on mutual respect, trust, a willingness to listen and learn, and achieving common interests. We recognize that EPCOR must demonstrate integrity in its conduct and actions in order to earn the respect and trust of Indigenous Peoples.

EPCOR seeks to engage early, meaningfully and in good-faith on projects that may impact cultural practices or lands traditionally used by Indigenous Peoples. We strive to be responsive to the input received from Indigenous Nations and communities regarding our projects, especially as opportunities for Indigenous inclusion, cultural protection and cultural revitalization are concerned.

In alignment with our Health, Safety and Environment Policy, we are committed to preventing pollution and reducing environmental impacts, including those contributing to climate change and affecting the ecosystems in which EPCOR operates. This includes learning from Indigenous Peoples about their experiences with and knowledge of the lands, air and water and responding to opportunities and concerns of Indigenous Peoples related to the environment.

EPCOR will continue to collaborate with industry peers, closely monitoring economic and public initiatives. Our commitment is to maintain agility in our operations and project selection, introducing innovation that aligns with the regulatory landscape while continuously meeting public needs.

EPCOR is committed to minimizing impact to the community surrounding Gold Bar WWTP from reliability upgrades or growth in service. In 2019 EPCOR made a public commitment that **the Gold Bar site and associated facilities will not expand outside of the current fenceline** through at least 2060. This commitment remains in place.

CONCLUSION

EPCOR is committed to providing safe, reliable and sustainable water services to the city of Edmonton and its surrounding communities.

The transition to a One Water Utility has allowed EPCOR to identify solutions for wastewater services that capture the system wide co-benefits of an integrated system. Guided by IRP principals EPCOR is shifting from strict capital driven solution development towards approaches that maximize the use of our existing in-place infrastructure and which engages with our customers and regional partners to continue to grow as a utility that is affordable, climate resilient and sustainable.

Specific capital and operational programs and projects will be submitted with the PBR filling and further articulated in their respective business cases. The consultation process for each program will be followed as they move forward to completion.