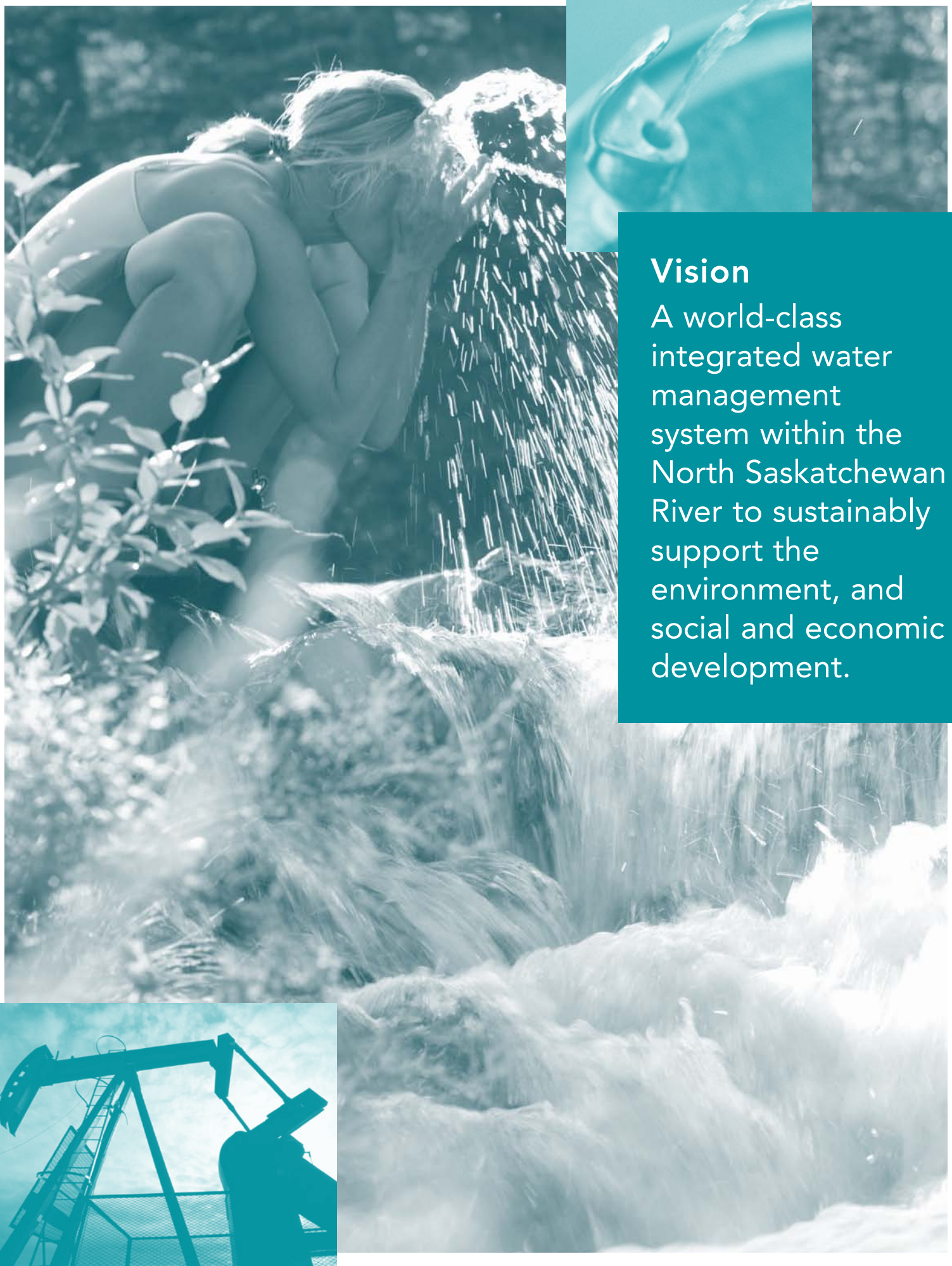
the water management framework

FOR THE INDUSTRIAL HEARTLAND AND CAPITAL REGION

five years of implementation

2007 - 2012

Alberta Government



Vision

A world-class integrated water management system within the North Saskatchewan River to sustainably support the environment, and social and economic development.

introduction

After five years of implementation during changing economic conditions, the time is right to consolidate learning and plan the next steps. This document describes the implementation work completed to date and reaffirms stakeholder commitment to future work, applying the cumulative effects approach to manage water quality and quantity in the Devon to Pakan reach of the North Saskatchewan River.

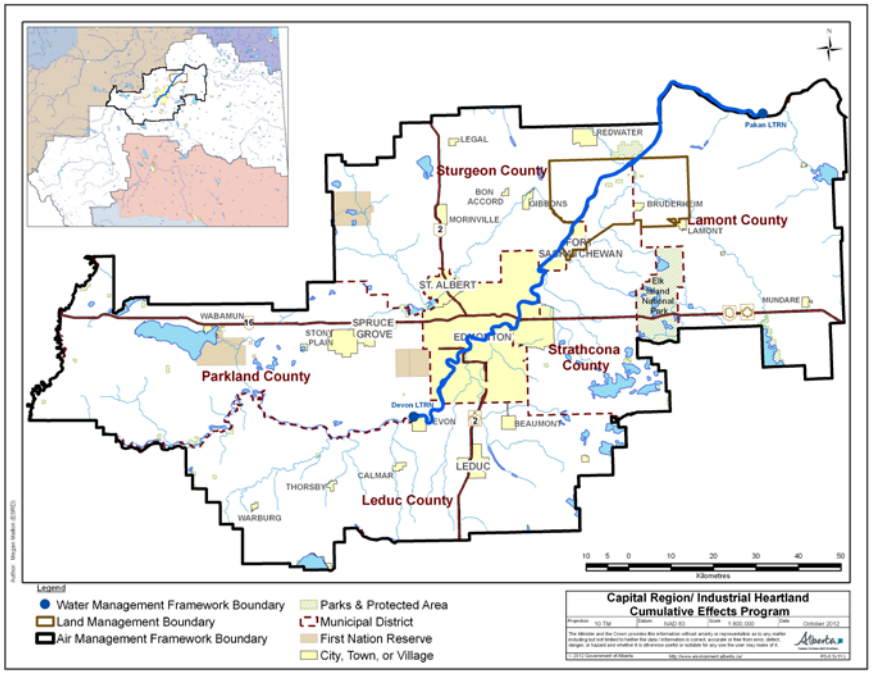
The Government of Alberta is working with citizens, communities and industry to improve our resource management systems, protect the environment, develop Alberta's prosperity and support expanded market access. *The Water Management Framework for the Industrial Heartland and Capital Region* is one of several environmental management frameworks collaboratively developed in recent years. By targeting a specific region of the province, this framework, in 2007, provided a model for other regional environmental management frameworks. This framework aligns with the goals of the Government of Alberta's Integrated Resource Management System that sets and achieves the environmental, economic and social outcomes Albertans expect from resource development and maintains the social licence to develop resources. This system includes the development of regional plans through the *Land-use Framework*, a single regulator for oil and gas, a world-class monitoring system to provide transparent, reliable information on achievement of outcomes and other policies such as *Water for Life*.

The *Water Management Framework for the Industrial Heartland and Capital Region* presents a collaborative, cumulative effects management approach to protect the reach of the North Saskatchewan River, from Devon to Pakan, which is directly impacted by municipal and industrial effluent discharge. The Water Management Framework Implementation Steering Committee (Steering Committee) is implementing the framework's vision, strategic objectives and guiding principles to develop an integrated water management system for the region. The Steering Committee is chaired by Alberta Environment and Sustainable Resource Development. Membership includes representatives from the Government of Alberta, municipal governments, industry and a watershed planning and advisory council. The Steering Committee used additional sub-committees to explore science, engineering, communications, and other topics.

Steering Committee Organizations	Members
Municipal Government	3
Industry	4
Watershed Planning & Advisory Council (WPAC)	1
Government of Alberta	2
TOTAL	**10**

a highly prized river reach

Since the North Saskatchewan River is fundamentally important to the population and economic activity of the Industrial Heartland and Capital Region, prudent use and management of important resource is critical to support both economic activity and population growth.



THE DEVON TO PAKAN REACH OF THE NORTH SASKATCHEWAN RIVER IN THE INDUSTRIAL HEARTLAND AND CAPITAL REGION

The Capital Region is defined by the boundary of the Edmonton Capital Region Board including Elk Island National Park. Within this area there are 25 municipalities including the City of Edmonton, Fort Saskatchewan, Spruce Grove, Leduc and St. Albert. This region is the sixth largest metropolitan area in Canada by population, with 1,176,300 citizens. The Industrial Heartland refers to the total land zoned by the municipalities of Sturgeon, Strathcona, Lamont and Fort Saskatchewan in their Joint Area Structure Plan.

The region is also home to the Alexander First Nation, Paul First Nation and Enoch Cree Nation communities. In addition to the developed area within the region, there are large areas of cropland and a number of large lakes including Wabamun and Cooking lakes.

The North Saskatchewan River traverses the region, and is the primary water source for municipal and industrial use. The region has a strong industrial base including refining, chemical manufacturing and electric power generation, and is a potential area of growth for bitumen upgrading. The Devon to Pakan reach supports the current population and a large segment of Alberta's resource processing industry. Any discharges or withdrawals from the river affect downstream users to the Saskatchewan border and beyond.

where it all started

In 2007, Alberta's economic momentum led to anticipation of significant development along the North Saskatchewan River. Increased population and increased use of resources challenged stakeholders to consider how best to balance economic and social growth with environment.

The framework provided direction on an integrated regional solution to address the water quantity and quality issues associated with the use of the North Saskatchewan River, beginning at the town of Devon and ending at the Pakan bridge water quality station. The Steering Committee looked at options to create that integrated regional solution, including methods of incorporating reclaimed water from the existing municipal water treatment facilities. At that time, there were industrial projects already in the regulatory queue. The framework provided strategies and actions to promote existing and proposed industrial endeavours as well as the sustainability of the Devon to Pakan reach of the river.

WATER QUALITY & WATER QUANTITY

The framework considers two main issues: water quantity and quality. It proposed that water quantity be managed based on flow expectations. The goal was to manage water quantity to ensure that sufficient water remained in the river to maintain aquatic life and support current and proposed industrial development.

The water quality goals, which are more fully explored in the framework, were to:

- improve water quality from fair to good
- minimize load discharge
- "keep water clean" based on that point at which contaminants increase in the river by more than 20 per cent from upstream to downstream in the Devon to Pakan reach of the river
- minimize the impact or "footprint" on the North Saskatchewan River (such as no new intakes in Phase 1 – described below)
- assign values to contaminant concentrations (termed "threshold levels") to reflect problem conditions and the need for associated management responses.

The Steering Committee realized that achieving these outcomes would require flexible and innovative solutions and therefore devised a conceptual model to describe the future vision for water management. The potential solutions described by the conceptual model include minimal loading discharge to the river, conservation measures such as the use of fresh and reclaimed water, and sustainable management of solids and wastes. Multiple infrastructure systems could be built to embody the intent and ideas described in the conceptual model.

A three phased plan was developed (short term, intermediate and long term sustainability) to tackle the development pressures.

- Phase 1 (2007-2009) Enabling Current Development
- Phase 2 (2009-2012) Foundation Building for Long Term Sustainability
- Phase 3 (2009-2041) Sustainability

understanding our river

Maximum Allowable Load (MAL)
MALs are used to manage water quality by measuring concentrations of contaminants of concern. These values tell us whether instream contaminant loads of specific contaminants are seasonally compatible with water quality objectives and water quality management goals.

To further understand the North Saskatchewan River, the Steering Committee formed a sub-committee to establish environmental water quality baseline conditions and to build on regional scientific knowledge. The sub-committee collected effluent and water withdrawal information, increased monitoring in the North Saskatchewan River, conducted river modelling, such as Environmental Fluid Dynamics Code (EFDC) modeling, and developed Maximum Allowable Loads (MALs) for containments of concern. The science and information was summarized into a Synthesis Report.

CONTAMINANTS OF CONCERN

Contaminants of concern encompass a broad range of variables including nutrients, bacteria, suspended solids, ions, some metals and organic constituents.

A pilot suite of variables was selected for development of water quality objectives and resultant allowable loads.

FINDINGS

Decision-making based on science is foundational to the implementation of the framework. Significant advancements have improved the understanding of the current state of the North Saskatchewan River, and helped to build associated decision-making support tools such as modelling and other evaluative methods. This work was a huge undertaking, and was considered an incredibly valuable exercise for all stakeholders involved.

Wastewater treatment has improved over time and resulted in an improvement of water quality. Despite these enhancements, nutrient enrichment remains the most apparent human impact on the North Saskatchewan River within the Devon to Pakan reach. There is a need for ongoing research; tool development and maintenance; and coordinated monitoring of effluents and ambient river conditions, including an integrated monitoring evaluation and reporting system.

investigating design options for managing growth pressures

To investigate options for managing growth, the Steering Committee formed a sub-committee to test five possible long-term development scenarios to achieve framework outcomes by 2041, including the use of reclaimed municipal wastewater for industrial use.

This work included an engineering study to determine if the use of reclaimed municipal wastewater was technically possible, using growth assumptions and various load reduction targets. The engineering study incorporated work on containments of concern and Maximum Allowable Loads as described previously.

FINDINGS

A modified version of the current system is capable of achieving the necessary environmental outcomes without the added cost of a regional water reclamation pipeline or additional water reclamation facilities. The engineering study illustrated the importance of clear measurable and definable end results based on science-based environmental outcomes.

a world-class system

To minimize the footprint on the river, industry is limiting discharges to the river, sharing existing infrastructure locations for current developments and promoting the use of shared intakes. Area municipalities have upgraded wastewater facilities and improved stormwater management. Such collaborative use of infrastructure requires effective governance and administration. To explore shared governance in the region for wastewater treatment, the Steering Committee formed a sub-committee to review collaboration processes used in other regions, policies, laws and institutions, and to consider existing governance models for wastewater treatment used worldwide.

FINDINGS

The Industrial Heartland and Capital Region governance and management of wastewater treatment assets is unique. The existing situation of shared intakes and comingled effluent treatment is a representative model of a world-class system. This current system then, should serve as a model moving forward, as it administers the framework's vision for *a world-class integrated water management system within the North Saskatchewan River to sustainably support the environment, and social and economic development.*

what has evolved since the framework was released?

The Steering Committee provided a forum for meaningful stakeholder engagement, innovative thinking and adaptive management, including strong leadership to sub-committees, confirming study assumptions and taking informed action at decision points as findings became available. Over the past five years, the vision, principles, and strategic objectives of the water management framework were applied. However, some of the context and management strategies have continued to evolve. This evolution is described below.

Alberta's Water Management Framework for the Industrial Heartland and Capital Region will make Alberta a world leader in innovation and technology.

The Framework will minimize the impact or "footprint" on the North Saskatchewan River by improving the quality of the water and ensuring water conservation practices are in effect.

The Framework will be implemented using distinct phasing.

The Framework has a regional perspective and may be used as a model for other regional frameworks in the province.

ECONOMICS

Existing and planned development is significant in this area, but is expected to occur at a reduced rate. The opportunity is now to improve monitoring, consolidate knowledge and build models to better understand conditions in the North Saskatchewan River.

REGIONAL MANAGEMENT SYSTEM

The current management of wastewater treatment works for the region. With its shared intakes and comingled effluent treatment, it is considered a world-class system. There is no immediate need to implement a new governance arrangement. Water reclamation will be evaluated and considered where feasible and remains an important consideration in future development.

WATER QUALITY MANAGEMENT

The objective of managing water quality is to maintain or improve the current water quality in the Devon to Pakan reach of the river, with emphasis on downstream water quality at Pakan. To meet this goal, water quality management will incorporate allowable loading calculations, based on site specific water quality objectives developed for contaminants of concern in the North Saskatchewan River. Water quality objectives and resultant allowable loads were determined for a pilot suite of pollutants. A broader array of pollutants may be assessed going forward, based on continuing monitoring and evaluation studies. The calculation of maximum allowable loads accounts for how temporal flow patterns affect changes in water quality over the course of a year. Once established, the use of maximum allowable loads will be applied through the regulatory process. This process will enable a tiered management system of investigation and potential mitigation management action when exceedances occur.

WATER QUANTITY MANAGEMENT

The water management framework has targets to remain below certain weekly net water use numbers in the Devon to Pakan reach. The numbers vary weekly according to both seasonal and year-to-year variation in flow in the North Saskatchewan River; the available water for net use decreases at lower river flows. The lowest weekly 'available water' number (Appendix D, Table 1) is 4 cubic metres per second, for some of the weeks in December and January. Based on water withdrawal and returns data for *Water Act* licences in the Devon to Pakan reach of the river, this is sufficient for current and future use. Ninety per cent of the time the net use has been below 2.5 cubic metres per second. Some management of the timing of peak withdrawals by the largest licensees may be required into the future. In the meantime, water use relative to the weekly 'available water' numbers will continue to be tracked and considered by decision-makers in new licence applications and amendments.

PHASING

Work to build the long-term foundation and sustainability phases have overlapped. In practice, phasing of framework implementation has occurred concurrently.

The framework enables existing operations and current developments – the policy of no new physical intakes on the North Saskatchewan River continues, unless there are no other options, and proponents are encouraged to use reclaimed wastewater where feasible.

STEWARDSHIP IN ACTION

Industry and municipalities have been employing actions consistent with the framework for many years – the framework has served to make these principles of management more explicit. Examples of actions consistent with the water management framework include:

- Sherritt International Corporation, Agrium Inc., Sulzer Ltd. and Umicore share one intake and send effluent to the Alberta Capital Region Wastewater Commission.
- The Dow Chemical Company shares its intake with other industries and its newer facilities have no discharge to the North Saskatchewan River.
- The Gold Bar Wastewater Treatment Plant supplies the Suncor Energy refinery with reclaimed water.
- New industry like North West Redwater Partnership will use an existing intake and are looking at sending effluent to the Alberta Capital Region Wastewater Commission.
- City of Edmonton is working at improving stormwater quality and reducing Combined Sewer Overflow (CSO) events.
- Improved access to water quality information for the North Saskatchewan River.

priorities and next steps

Going forward, the implementation of the water management framework will continue to define water quality objectives and maximum allowable loads, and their application through the regulatory process.

A key component of managing water quality will be integrated monitoring in support of the framework and maximum allowable load approach.

Communicating management actions and how they are consistent with the principles of the framework continues to be key.

Science gaps will continue to be filled and knowledge of the North Saskatchewan River improved. This includes maintaining the tools developed to understand the river.

Emerging issues will continue to be managed by applying the principles of the water management framework.

For more information, or to order additional copies, contact:

Alberta Environment and
Sustainable Resource Development
Information Centre
Main Floor, 9820 - 106 Street
Edmonton, AB T5K 2J6
Toll-free: Dial 310-0000 and the phone number
Telephone: 780-427-2700
www.environment.alberta.ca

This document is printed on chlorine-free paper made from 100 per cent post-consumer fibre. In choosing this paper, Alberta Environment and Sustainable Resource Development saved 2,309 litres of water, prevented 60 kilograms of greenhouse gas emissions, conserved 1 tree and diverted 31 kilograms of waste from Alberta landfills. The paper was produced using wind power, which prevented 31 kilograms of air emissions and saved the use of 16 cubic metres of natural gas.

March 2013
ISBN No. 978-1-4601-0808-6

the water management framework

FOR THE INDUSTRIAL HEARTLAND AND CAPITAL REGION

Alberta Environment

Vision

A world-class integrated water management system within the North Saskatchewan River to sustainably support the environment, and social and economic development.

contents

4 Executive Summary

7 Mandate

9 Introduction

11 Acknowledgements

12 The Need for Action

13 The Consultation and Review Process

14 Evaluation Criteria

16 The Vision for the Water Management Framework for the Industrial Heartland and Capital Region

17 The Water Management Framework for the Industrial Heartland and Capital Region

19 Conceptual Diagram:
Sustainable Regional Water Management Network to 2041

20 Phases

24 Next Steps

25 Appendix A:
North Saskatchewan River – Devon to Pakan Reach

26 Appendix B:
Glossary

28 Appendix C:
Potential Management Tools for Meeting Water Quality Targets in the Industrial Heartland and Capital Region of the North Saskatchewan River

30 Appendix D:
Water Fact Sheet

executive summary

The Water Management Framework for the Industrial Heartland and Capital Region Report is the result of consultation, collaboration and future-focused planning for growth by Alberta Environment, industry, municipalities, and representatives from municipal water and wastewater treatment facilities and the North Saskatchewan Watershed Alliance.

It builds on the October 2, 2007 announcement about Alberta's new cumulative effects management framework that recognized the current approach to managing and mitigating the impacts of individual projects as being limited in its ability to address the cumulative effects of various individually regulated projects. Recognizing that the 470-square kilometer area just northeast of Edmonton known as Alberta's Industrial Heartland is the site of significant proposed industrial development, the Minister for Alberta Environment, the Honourable Rob Renner, tasked an advisory committee to advise him on a new integrated water management framework for the region. This Framework is part of the government's broad new approach to address cumulative effects on the environment and is provided as input to the Capital Region Integrated Growth Management Plan.

The Water Committee for the Industrial Heartland and Capital Region was asked to address the water quantity and quality issues surrounding the use of the North Saskatchewan River from Devon to Pakan. In addition, the Committee was asked to take into consideration Alberta's economic development, the industrial projects currently undergoing regulatory review and existing industry in the region. Sound management practices over previous decades have protected the flow and quality of the North Saskatchewan River. With appropriate management, ample capacity exists in the North Saskatchewan River to support a healthy industry and growing population.

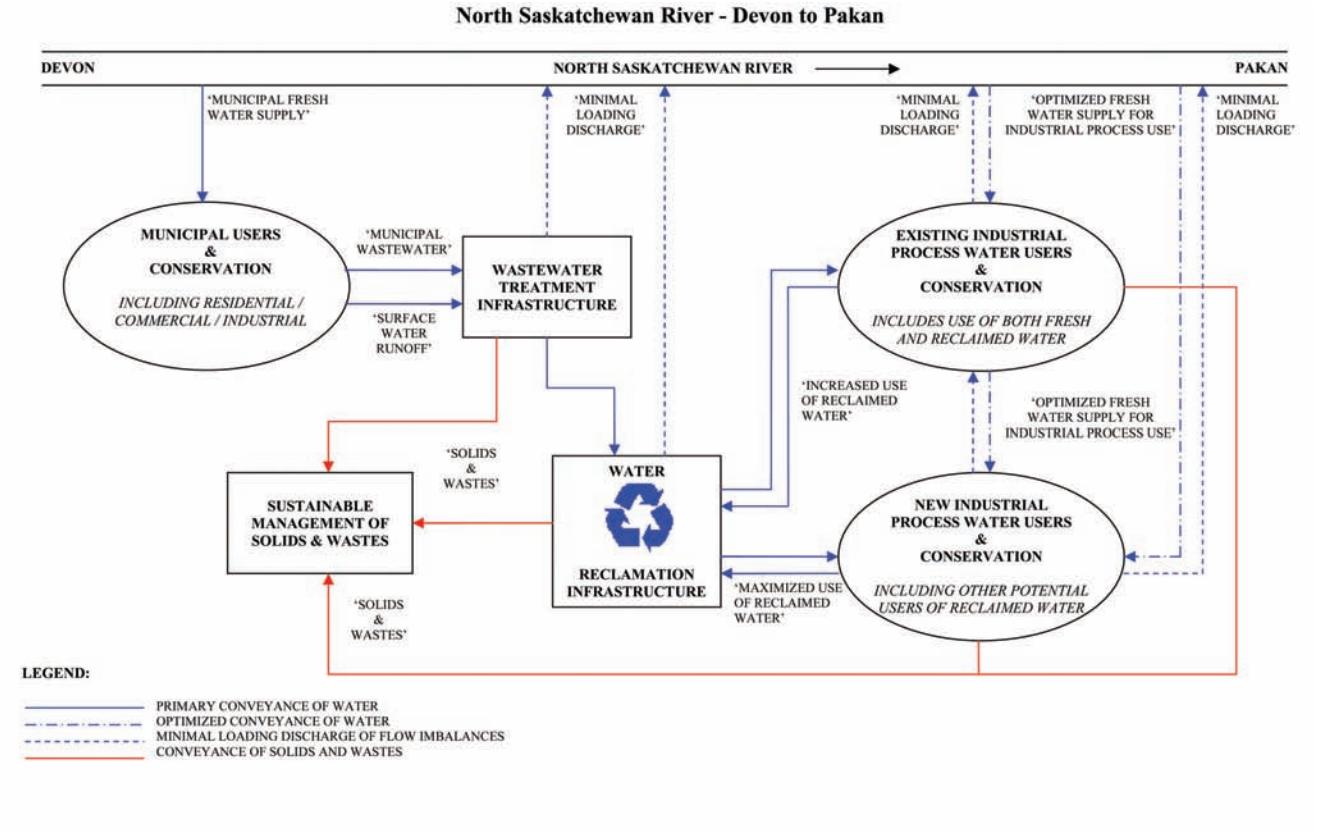
The Committee examined ways to reclaim water from the Capital Region and other municipal water treatment facilities and looked for other ways to ensure the sustainability of the North Saskatchewan River from Devon to Pakan, in the short, medium and long term.

The strategic objectives of the new Water Management Framework for the Industrial Heartland and Capital Region are:

- Make Alberta a world leader in water and water reclamation technology.
- Minimize the impact or "footprint" on the North Saskatchewan River by improving the quality of the water and ensuring water conservation practices are in effect.
- The Framework will be implemented using distinct phasing.
- The Framework has a regional perspective and may be used as a model for other regional frameworks in the province.

The following diagram describes the future vision for water management in the North Saskatchewan River and the water management functions that will enable it to be realized. The *Sustainable Regional Water Management Network to 2041* below represents a concept, not an actual system. It should be noted that there may be multiple infrastructure systems that can be built to meet the philosophy described in this concept diagram.

Conceptual Diagram: Sustainable Regional Water Management Network to 2041



The Committee recommends that the Framework be phased in through three broad phases, which the Oversight and Implementation committees could subdivide into smaller, more discrete stages or tasks.

PHASE 1 (NOW TO 2009)

Phase 1 will allow for short term needs to be met while starting a process to build toward the Industrial Heartland integrated supply network. An Oversight Committee will be created to begin working on governance and funding to implement the Framework and an Implementation Committee will create an operative Framework Implementation Plan. Projects currently in the regulatory queue will go ahead. During this timeframe steps and planning to improve water quality will continue - there will be no further degradation in water quality in the North Saskatchewan River.

PHASE 2 (2009 – 2012)

Phase 2 will create a foundation for long term sustainability. By this phase, new and future planned upgraders will have moved through the regulatory phase. Detailed engineering designs and studies will be completed for the Framework. The governance structure will be functioning.

PHASE 3 (2012 – 2041)

Phase 3 will ensure sustainability. Within this timeframe it is expected that water management for the Industrial Heartland and Capital Region will be world-class. The Framework will result in continuous improvement and water quality in the North Saskatchewan will have improved.

The Water Committee for the Industrial Heartland and Capital Region recommends that next steps for the Framework will involve the creation of the Oversight Committee to provide a governance structure and see the phases through to completion. An Implementation Committee will describe a detailed Framework Implementation Plan.

The Committee advised that the Framework Implementation Plan should provide for evaluating the environmental benefit of all major policy and investment decisions. Further, this evaluation should involve technical and economic assessments of alternatives to achieve scientifically sound, clear and measurable environmental outcomes.

mandate

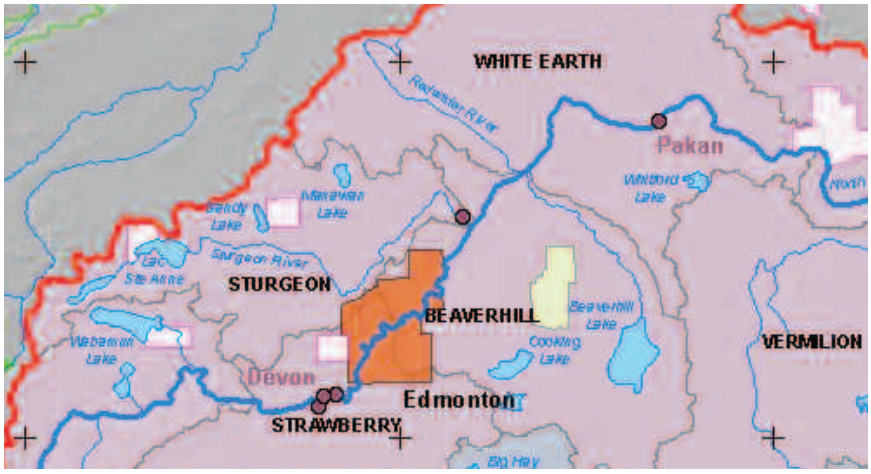
Industrial Heartland *refers to the total land zoned by the municipalities of Sturgeon, Strathcona, Lamont, and Fort Saskatchewan in their Joint Area Structure Plan (ASP), and adjacent areas in the Capital Region.*

Integrated *addresses supply/ withdrawal, treatment/ reuse and discharge. It is defined as the whole or the sum of the parts, provided the end environmental outcome is achieved.*

Regional *refers to the Industrial Heartland's integrated supply network that will enable the region's water management challenges to be addressed.*

On October 2, 2007, Rob Renner, Minister of Environment announced a new cumulative effects management framework approach to protect air, land and water. This framework and others under development are linked components of the Alberta Government's broad new course of actions to manage cumulative effects of human activity on the environment throughout the entire province.

The first application of the broad cumulative effects strategy will be to provide a management framework for water use in the Industrial Heartland and Capital Region. To advise on the Framework, a Water Committee for the Industrial Heartland and Capital Region was formed. The Committee was asked to advise on an integrated regional solution to address the water quantity and quality issues surrounding the use of the North Saskatchewan River beginning at the town of Devon and ending at the Pakan bridge/water quality station. The Committee was instructed to look at ways to incorporate reclaimed water from the existing municipal water treatment facilities as well as other options. The Framework should take into consideration Alberta's economic and social development, and the industrial projects that are already in the regulatory queue, while ensuring the sustainability of the North Saskatchewan watershed, including short, medium and long term strategies.



The Water Committee for the Industrial Heartland and Capital Region focused on an integrated regional solution to address the water quantity and quality issues with the use of the North Saskatchewan River beginning at the town of Devon and ending at the Pakan bridge/water quality station.

The Committee recognized that to achieve the objectives of the broad cumulative effects strategy requires consideration of both non-point and point sources of pollution interaction with the river. To improve water quality in the North Saskatchewan River both types of sources must be addressed. The mandate of this Committee was limited to point sources only. It is understood that non-point sources will be addressed as part of a later phase within this Framework.

This Committee includes representation from Alberta Environment, industry, municipalities and water and wastewater treatment facilities. Committee members are listed below.

Committee Members

Jim Ellis (Chair) – Alberta Environment
Doug Bertsch – North West Upgrading
Ed Brost – Shell
John Corriveau – Northeast Capital Industrial Association (NCIA)
Mike Darbyshire – Alberta Capital Region Wastewater Commission
Denise Exton – Strathcona County
Joe Gysel – EPCOR
John Hodgson – City of Edmonton
Al Hyndman – BA Energy
Larry Kirkpatrick– Sturgeon County
John Kus – North American Oil Sands Corporation / StatoilHydro
Ben Ludwig – Carbon Development Partnership,
Dodds-Roundhill Coal Gasification Project
Christine Malaka – ATCO
Brian Marcotte – Alberta Capital Region Integrated Growth Management Plan
Chris Micek – Agrium
Carol Moen – Dow Chemical
John Percic/Marie Johnson – Petro-Canada
Brian Sharpe – Total E&P Canada
Gord Thompson – North Saskatchewan Watershed Alliance (NSWA)

introduction

***Sustainability** includes the environmental sustainability – the health – of the North Saskatchewan River; the economic use of the river water for municipal and industrial use; and the social impact of future development.*

Albertans expect their government to actively work to ensure that air, land and water will be protected and managed appropriately. Economic growth in our province impacts the environment in ways that not only affect our quality of life, but also our future. The Alberta Government is working to manage the pressure of growth in the province to ensure that together we are building a stronger province; to ensure that our industrial activity, current and future, is enhancing the quality of life we enjoy in this beautiful province; and to ensure that our vision for the province is future-directed.

Government already has in place policy directions such as *Water for Life*, the *Climate Change Action Plan*, the *Biodiversity Strategy*, *Clean Air Strategy for Alberta*, *Alberta's Economic Development Strategy* and is developing the *Land-use Framework*. This Water Management Framework for the Industrial Heartland and Capital Region aligns with these broad government strategies and initiatives, while targeting a specific region of the province and providing a model for other regional environmental management frameworks.

The Devon to Pakan reach of the North Saskatchewan River supports a current population of one million people and a large segment of Alberta's resource processing heavy industry. The Framework described in this report brings water management to the North Saskatchewan River from Devon to Pakan into alignment with changing public expectations. Since the North Saskatchewan River is fundamentally important to the population and economic activity of the Alberta Capital Region, prudent use and management of the important resource that the river represents is critical to support both economic activity and population growth.

The Industrial Heartland will continue to see unprecedented industrial growth in the upcoming years with the operation, construction and planning of new bitumen upgrader facilities and other large-scale industrial activities. The Framework presented in this report describes concepts for managing the total cumulative effects impacting the North Saskatchewan River that comes from all regional users of the North Saskatchewan River from Devon to Pakan.

With the municipal growth and industrial development projected for Alberta's Industrial Heartland, it is natural for there to be concern over the impacts that could result. While prudent management of water allocation and usage must be ensured, historical data shows us that from a volume perspective, there is room for considerable growth to be sustained in the region.

Currently, an issue relative to the growth and its impact on the North Saskatchewan River is the loading of contaminants that cause eutrophication (nutrient loading) of the river. Point source and non-point source emissions contribute to the contaminant load.

There is a variety of land use in the Industrial Heartland and Capital Region, including agricultural activities, heavy and medium industry, country residential areas, and urban and rural residences. The total cumulative effects impacting the North Saskatchewan River coming from sources other than industry will be addressed as a part of a later phase within this Framework.

This report describes the agreed-upon principles behind the development of the Framework, including the need for regional planning of the system, certainty of water supply that is economically viable for industrial growth, and a management system that uses the North Saskatchewan River within its ecosystem capacity.

The current level of proposed development calls out for a comprehensive review, but the focus clearly should not be on 2007-2008. The Committee recognizes that it is essential to focus and plan for the future, which for the purposes of planning has been set at 2041. The Committee's priority was to anticipate impacts on the North Saskatchewan River in terms of water supply and the impact of discharge back into the river. The Committee's objective was to plan so that there will be no further deterioration of water quality, and ultimately, that there will be an improvement of the current conditions.

Planning for and managing the impacts of cumulative effects, particularly for the upgraders, against the backdrop of an increasing urban population demands a thorough approach. In addition, project developers need regulatory certainty, including the certainty of water supply to commit to their projects.

Through resolve to maintain environmental sustainability, balance the realities of economic growth, and operate within a framework that provides for continual improvement, the Water Management Framework for the Industrial Heartland and Capital Region positions Alberta as a world leader in the management of cumulative effects on the environment.

acknowledgements

The Committee acknowledges the individuals, organizations and stakeholders who participated in the work involved with developing this Framework by creating and delivering presentations.

The Committee also acknowledges the assistance of the technical and administrative support team:

Alberta Environment Secretariat

Ernie Hui
Tim Jantzie
Pat Marriott
Preston McEachern
Sarah Pearce
Kate Rich
John Taggart
Edith Vanderpuye

Administrative Support

Renata Coderre – Sierra Systems
Nancy Mackenzie – Writer
Stephen McCauley – ISL Engineering and Land Services
Bill Page – PAGE Management Counsel Ltd.

the need for action

Alberta Environment conducts water quality monitoring of the North Saskatchewan River upstream and downstream of the Capital Region and the Industrial Heartland areas. Based on monitoring of important water quality descriptors (including metals, toxic organic compounds, and non-toxic, ecosystem-altering nutrients), the upstream and downstream concentrations of nutrients and bacteria indicate capacity has been exceeded for some compounds. This challenges all regional water users to find technical solutions (such as enhanced water treatment) and delineate current and future source loadings to the river and/or to find alternate management solutions (such as water reclamation).

From upstream to downstream of the Capital Region and the Industrial Heartland region, water quality in the North Saskatchewan River declines from good to fair and an index developed for non-fish biota components (primarily invertebrates) declines from good to marginal conditions.

Eutrophication of the North Saskatchewan River during periods of low flow has been a long-standing concern among stakeholders. Excessive amounts of phosphorus and nitrogen are found in runoff from agricultural activities, urban lawns and golf courses as well as domestic sewage and industrial releases.

The volume of flow in the river downstream of Edmonton is not currently under stress and provides capacity for net withdrawals to support considerable growth. Most water allocation volume is returned to the river; net withdrawals constitute a very small fraction of river flow.

In addition, the Industrial Heartland and Capital Region will continue to see burgeoning growth in the upcoming years. The increased population and the operation, construction and planning of new bitumen upgrader facilities and other large-scale industrial and non-industrial (e.g., municipal and agricultural) activities will place increased demands for water on the North Saskatchewan River. Despite its physical size, the North Saskatchewan River is not a large river for northern Alberta. It has a third of the flow in the Athabasca River and one-seventh of the flow in the Peace River.

Planning for the current and foreseeable level of proposed development demands a framework that is future-directed - one that manages current and future cumulative demands upon the North Saskatchewan River. It will be essential to anticipate impacts on the North Saskatchewan River considering both water supply and discharge impacts for the upgraders.

This Framework is a key environmental component of the Capital Region Integrated Growth Management Plan (CRIGMP) which Premier Stelmach initiated in June 2007. The CRIGMP also is a response to the massive growth projected for Alberta's Capital Region. It involves the region's 25 municipalities, under the leadership of the province, in collaborating on a long-term, integrated management plan for economic growth in the region.

the consultation and review process

In a series of meetings during fall 2007, the Water Committee for the Industrial Heartland and Capital Region, consisting of government, industry, municipalities, and representatives from municipal water and wastewater treatment facilities and the North Saskatchewan Water Alliance met to define principles by which future development along the North Saskatchewan River, beginning at the town of Devon and ending at the Pakan bridge/ water quality station, would be governed.

Definitions were delineated and the known facts about the situation (givens) as well as principles were agreed-upon. Please see *Appendix B: Glossary* for the key terms. Once the givens and principles were agreed upon, the Committee was asked to consider water quality in terms of waste assimilation - how much water can be removed from the river and how much more effluent can be put in without having a detrimental effect on the river. The Committee recognized the need to plan for the future – to minimize effluent discharge into the river and maximize water conservation. The Alberta Environment chart in *Appendix C: Potential Management Tools for Meeting Water Quality Targets in the Industrial Heartland and Capital Region of the North Saskatchewan River* outlines options for both – four options to increase water in the river (or stabilize it) and four options for reducing or stabilizing the effluent put into the river.

The Committee considered the current situation and presented new models designed to address the water management issues of the North Saskatchewan River and potential industrial development in the Industrial Heartland. The models were then evaluated using the Evaluation Criteria noted in this report.

Elements from each of the models that passed the evaluation criteria were drawn together into a single concept model, which is represented by the Sustainable Regional Water Management Network to 2041 schematic provided in this report.

The Committee agreed that a future-driven, phased-in approach to managing cumulative effects is required to keep current projects in development and to target required changes to infrastructure on a number of levels. The Framework is future-driven and will be phased in over the course of three main phases, as described in the Phases section of this report.

evaluation criteria

***Framework** – an underlying set of ideas, principles, agreements or rules that provide the basis or outline for something intended to be more fully developed at a later date.*

The Committee agreed upon a number of situations and facts, which they described as givens. In addition, a number of *principles* were used to guide the development of models options. These givens and principles became the evaluation criteria used in determining the Framework. These combined *givens* and *principles* are listed below.

REGIONAL APPROACH

The model must provide a regional approach that:

- is integrated – addresses supply/ withdrawal, treatment/ reuse and discharge. It is defined as the whole rather than the parts and how they work together.
- is cumulative effects driven and considers the economic, social, and environmental impacts, particularly the impacts on water, air and land.
- has the ability to serve all municipal and industry users from Devon to Pakan.
- includes reclamation of municipal and industrial return flows.

PHASED APPROACH TO DEVELOPMENT AND IMPLEMENTATION

The model will describe a phased-in approach that:

- uses Best Available Technology Economically Achievable (BATEA) and provides the opportunity to move to more efficient, environmentally sound processes as science-based work indicates the need
- encourages and recognizes solutions that limit the number of impacts and make effective use of, or enhance, existing capital infrastructure.
- allows existing industry to be integrated into the Framework throughout the sustaining phase of the Framework timeline (Phase 3)
- allows for the support and development of clearly measurable and definable end result goals and solutions in the future based on sound, science-based environmental outcomes.

MEETS THE NORTH SASKATCHEWAN RIVER WATER MANAGEMENT TARGETS

The model will meet the criteria for the Framework by describing a way to:

- improve the quality of the North Saskatchewan River and meet targets including those described by existing policy related to pollution prevention and water quality limits
- manage water quantity to ensure that sufficient water remains in the river to maintain aquatic life and support current and proposed industrial development
- attain water quantity and quality targets as announced on October 2, 2007 (please see Appendix D).

ENABLES SUSTAINABLE GROWTH

The model will describe ways to enable sustainable growth by:

- ensuring certainty and an economically viable, secure supply
- managing the impact of collective development in a sustainable manner
- signaling a change for the future and demonstrating ways it is future-oriented.

the vision for the water management framework for the industrial heartland and capital region

The Committee agreed upon a *Vision Statement* for the Framework: **A world-class integrated water management system within the North Saskatchewan River to sustainably support the environment, and social and economic development.**

Strategic objectives in support of the *Vision Statement* guided the development of the model.

- **Alberta's Water Management Framework for the Industrial Heartland and Capital Region will make Alberta a world leader in innovation and technology.**
  - > The Framework will result in significant improvement of North Saskatchewan River water quality.
- **The Framework will minimize the impact or "footprint" on the North Saskatchewan River within the timelines of the Framework**.
  - > The Framework is based upon a water conservation ethic.
  - > There will be minimized load discharge to the river.
  - > The use of existing and new withdrawal infrastructure will be optimized to minimize the diversion of raw water.
  - > Reclaimed water will be used much more prevalently to enable a reduction in the diversion of raw water.
- **The Framework will be implemented using distinct phasing.**
  - > The Framework will result in simplified regulatory administration.
- **The Framework has a regional perspective and may be used as a model for other regional frameworks in the province.**
  - > The Framework will result in increased regional capacity to support growth.

the water management framework for the industrial heartland and capital region

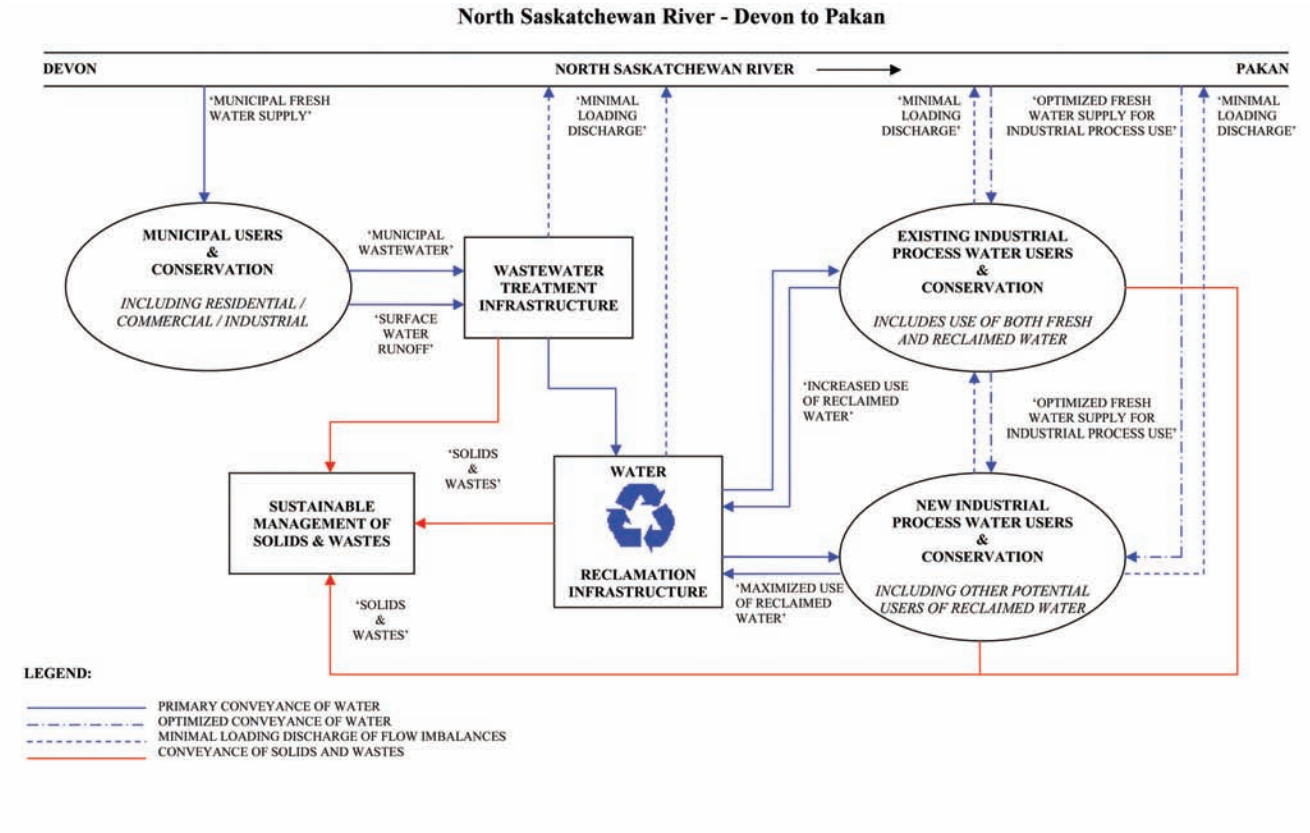
The model represents the future vision of the Framework and the water management functions that will enable it to be realised.

The principal components of the model include the following.

- Promotes a water conservation ethic for all users including residential, municipal, commercial, industrial, agriculture, etc.
- Advocates for a greater use of reclaimed water for non-potable water demands.
- Moves toward a minimal-loading discharge policy for return flows to the North Saskatchewan River
- Uses an integrated approach to the management of solids and wastes that arises from the wastewater treatment and reclamation processes.
- Maximizes value by evaluating options based on environmental, full-cycle economics and social impacts.
  - > This includes the option of advanced treatment of effluent at each water treatment facility to near potable standards and discharge to the river.
- Ensures a secure, reliable supply of water.
- Optimizes the supply of raw river water for industrial process uses by utilizing and upgrading existing intake structures.
- Uses existing infrastructure for the short term growth demands.
  - > Where appropriate, the transition of these assets moves to multi-party use.
  - > As the infrastructure for reclaimed water is developed and becomes a part of the Industrial Heartland integrated supply network, the Framework supports the transition from the use of raw water to the use of reclaimed water.

conceptual diagram

SUSTAINABLE REGIONAL WATER MANAGEMENT NETWORK TO 2041



The diagram describes the future vision for water management in the North Saskatchewan River and the water management functions that will enable it to be realized. The *Sustainable Regional Water Management Network to 2041* represents a concept, not an actual system. It should be noted that there may be multiple infrastructure systems that can be built to meet the philosophy described in this concept diagram.

phases

The Committee agreed upon the delineation of three distinct phases, recognizing that once the Framework has been approved, the Oversight and Implementation committees will devise additional discrete steps within the larger context of three phases. The Committee agreed that no single water supply solution will be optimal for all new projects.

For each of the phases, the Committee identified outcomes that would be achieved by the end of the phase. Being outcome-driven allows for technological advancements, economic decisions, and security of supply. Over time, additional outcomes will need to be described to allow for further studies, which will, in turn, drive new outcomes. Strategies to achieve each outcome were discussed as were a number of implications. The development of innovative technology throughout the coming years will no doubt play a role in the achievement of the ultimate vision.

PHASE 1 (NOW – 2009) "ENABLING CURRENT DEVELOPMENTS"

This phase will build toward the regional system to meet short term needs.

During Phase 1, projects currently in the regulatory queue will go ahead. This phase will strive for optimum use of existing infrastructure to supply current industry needs. During this phase, projects currently in the regulatory queue will go ahead and no new physical intakes on the NSR will be approved.

Outcomes

- Provide certainty for current developments.
- Continue with river water quality improvement measures and avoid water quality degradation.
- Establish a baseline on current North Saskatchewan River conditions.
- Develop a Framework Implementation Plan for the reach of the river from Devon to Pakan, from now to 2041.
  - > The Framework Implementation Plan should provide for evaluating all major policy and investment decisions for their environmental benefit.
  - > This evaluation should involve technical and economic assessments of alternatives to achieve scientifically sound, clear and measurable environmental outcomes.
- Confirm governance.
- Confirm funding strategies.

Strategies

- Form Oversight Committee to establish governance.
- Determine funding.
- Form Implementation Committee to create the Framework Implementation Plan.
- Operate under targets set by Alberta Environment related to Threshold Conditions for North Saskatchewan River water quantity and quality: green, yellow and red threshold conditions.
- Initiate engineering designs and studies on baseline conditions – establish a baseline for comparison.
- Begin the assessment of full life-cycle costs to achieve environmental and social outcomes of alternative approaches.
- Identify overall regional strategies/ actions that will contribute to no degradation of water quality and quantity in the North Saskatchewan River. Include Government of Alberta, industry, municipal, agriculture, etc.
- Use existing infrastructure locations for current developments so as to minimize footprint on the North Saskatchewan River.
- Build on existing commitments to use reclaimed water.

Implications

- Alberta Environment will make decisions about whether to allow additional diversions from the North Saskatchewan River
- Other stakeholders will need to be involved to address overall issues through the North Saskatchewan Watershed Alliance.

PHASE 2 (2009 – 2012)
"FOUNDATION BUILDING FOR LONG TERM SUSTAINABILITY"

Phase 2 will result in foundation building for long term sustainability. By this phase, new and future planned upgraders will have moved through the regulatory phase. This phase will provide for industry development, enabling industry to make the transition to the new regional system(s) as the existing withdrawals are upgraded to current standards to become a part of the supply network for the Industrial Heartland or, alternatively, phased out as they reach the end of their service life.

Outcomes

- Detailed engineering design studies are complete.
- Full life-cycle costs of alternative approaches are assessed.
- Implementation of infrastructure is initiated.
- Governance is functioning effectively.
- Funding is in place.
- Elements of this Framework are in place, including evaluation, monitoring and reporting components.
- Continued use of reclaimed water.
- Regional collaboration is fully established.
- Regulatory administration is simplified.
- The Government of Alberta has established a master plan for managing the total cumulative effects of human activity for non-point source pollution.

Strategies

- Build regional collaboration among players.
- Build monitoring, evaluation and administrative tools.
- Implement technological advancements.
- Identify and resolve existing infrastructure that will become part of the Industrial Heartland supply network and decommission elements of existing infrastructure that are no longer required.
- Allow new industry to use new and upgraded infrastructure while existing industry transitions to the Industrial Heartland supply network through the existing operating license renewal process.
- Incorporate reclaimed water from the City of Edmonton and the Alberta Capital Region Wastewater Commission treatment facilities as required.

Strategies (continued)

- Enhance use of reclaimed water as primary source of supply.
- Continue to explore opportunities that fit within the Framework.
- Continue to make the transition of existing facilities to the Industrial Heartland supply network through the existing operating license renewal process or as infrastructure is available for transitions to occur.
- Establish governance.

Implications

- Funding decisions are resolved.

PHASE 3 (2012 – 2041) "SUSTAINABILITY"

Phase 3 will see the integration of existing facilities into the framework, making an integrated supply network for the Industrial Heartland. It will support a world class integrated water management system within the North Saskatchewan River to sustainably support the environment, and social and economic development

Outcomes

- Alberta has a world class, operational, regional water management system for the North Saskatchewan River that is:
  - > economically competitive with other urban and industrial areas
  - > supportive of the water conservation ethic for all users including industrial, residential, municipal and commercial
  - > a showcase for the integration of reclaimed water as a primary water source for industrial use.
- Water quality in the North Saskatchewan River has improved to good or better at Pakan.
- There is minimal loading discharge for return flows to the North Saskatchewan River.
- Primary water source is reclaimed water for non-potable water demands.
- There is an integrated approach to the management of solids and wastes.
- The Industrial Heartland uses a sustainable, integrated supply network.

Outcomes (continued)

- Value is maximized because options are evaluated based on environmental, full-cycle economics and social impacts.
- A process has been developed to evaluate water quality to ensure continuous improvement.
- There is continuous improvement.
- There is a secure, reliable supply of water.
- There is minimal use of withdrawal infrastructure and raw water by industrial process users.

Strategies

- There is full implementation of an integrated supply network infrastructure.
- There is secondary processing and sustainable management of solids from water treatment and effluent reclamation.
- All types of water users participate in contributing to improving the overall sustainability of the North Saskatchewan River.
- An Adaptive Management System is in place that provides an evaluation, monitoring and reporting, and adjustments as required.
- There is continued transition of existing facilities to the Industrial Heartland integrated supply network through the existing operating license renewal process.

Implications

- Quality of life has improved.

next steps

As noted, the three-phase approach outlined in this report will need to be subdivided to enumerate additional stages, tasks and courses of action. By describing additional phases within each of the three broad phases, the need to conduct further studies will be addressed and these studies will in turn drive the outcomes.

The Committee felt that the reclamation of treated wastewater was an important contribution to solving many of the current issues. The need to be future-focused is to be emphasized.

The Water Committee for the Industrial Heartland and Capital Region recommends that next steps for the Framework will involve the creation of the Oversight and Implementation committees to see the phases through to completion.

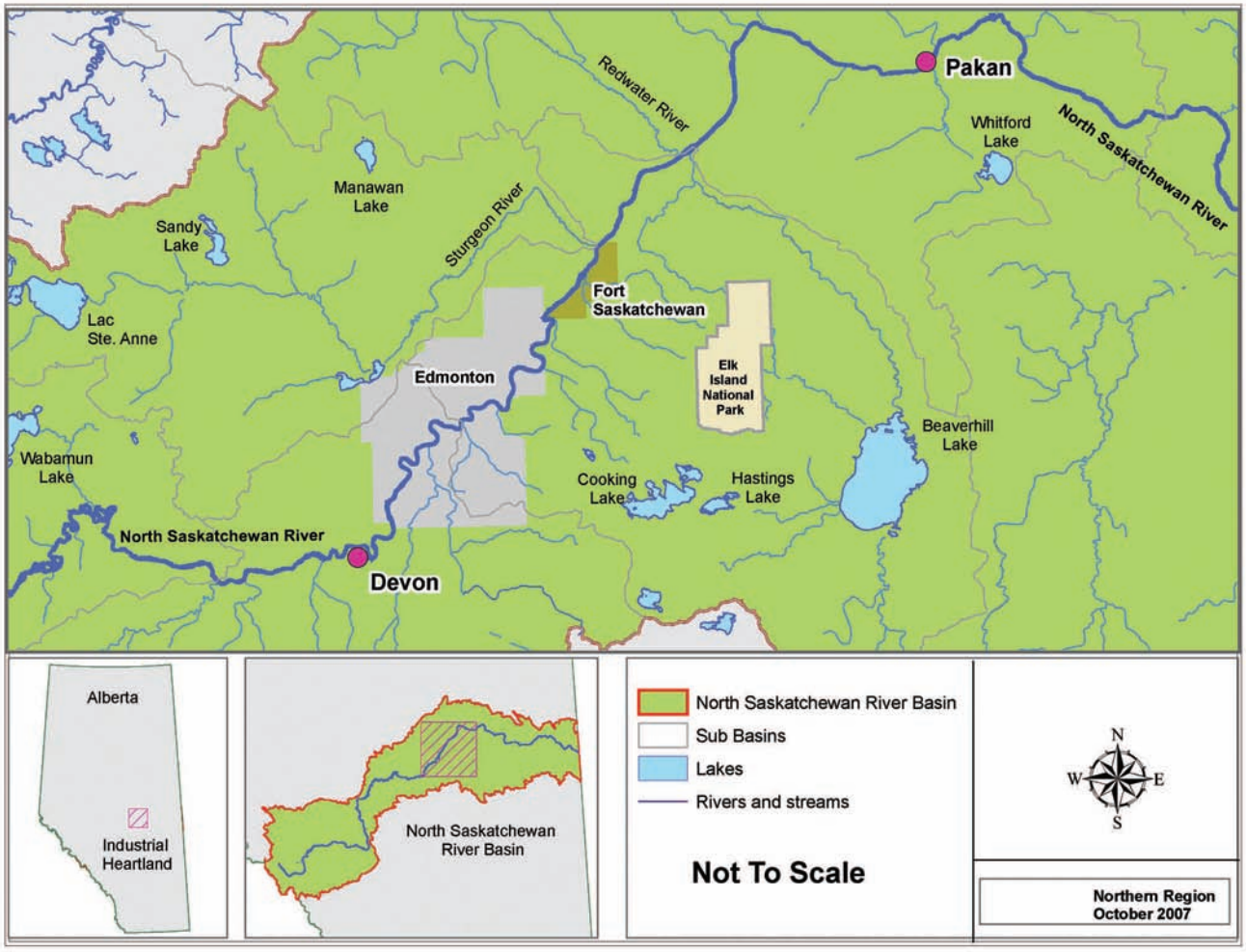
The Oversight Committee will describe a governance structure. Governance over the various elements of water supply and effluent management of the Industrial Heartland will be fit-for-purpose considering the time and assets to be managed and integrated. As the water users migrate to an integrated supply network, effluent treatment and greater re-use of wastewater, the governance will need to adapt accordingly. The Oversight and Implementation committees will have to address transitional issues to blend private assets, existing or yet to be built, into the Framework while respecting commercial interests, values and capital at risk. There are many established vehicles along the risk/ reward continuum to address common use assets.

It is recommended that the Implementation Committee create the Framework Implementation Plan, which should focus on end-result goals in a regional context, such as limiting nutrient and other critical loadings on the river. The Framework Implementation Plan should describe how proponents supplying solutions will be evaluated. It is suggested that evaluation should be administered through a single window review and quasi-judicial decision process that measures the solution against Alberta Environment's overall assessment of the North Saskatchewan River sustainability.

The Framework Implementation Plan must be forward-looking and prepare for dealing with issues that have not yet been identified.

appendix a

North Saskatchewan River – Devon to Pakan Reach



appendix b

GLOSSARY

Cumulative Effects

Cumulative effects refer to the changes to the environment caused by all past, present and reasonably foreseeable future human activities.

Environmental Media

The air, land, water, biodiversity or any other parts of the environment.

Environmental Outcomes

Outcomes are desired environmental end states defining the specific conditions or functions that Albertans expect for the environment.

An outcome is an event, occurrence or condition that results from an activity or program and has an actual effect on resources, the environment or Albertans. For planning purposes, outcomes are the desired/expected endpoint or state and should guide the development and implementation of related programs.

A shared outcome is developed and defined using a collaborative approach. Shared governance, accountability, responsibility and stewardship start with an agreement on what the involved parties want to see as the end result. Development of shared outcomes requires decisions on who needs to be involved and the best process to use.

Integrated

Integrated – addresses supply/ withdrawal, treatment/ reuse and discharge. It is defined as the whole or sum of the parts provided the end environmental outcome is achieved.

Load Discharge

Release of contaminants, usually expressed in kg/day, at levels or concentrations above that which can be removed through application of Best Available Technology Economically Achievable.

Municipality

The geographical area of a city, town, village, summer village, municipal district, improvement district, special area, specialized municipality or settlement area as defined in the Métis Settlements Act (Source: Water (Ministerial) Regulation).

Non-point Source Pollution

Unlike pollution from industrial and sewage treatment plants, non-point source (NPS) pollution comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and underground sources of drinking water.

Point Source Pollution

Point Source Pollution is pollution that arises from a single defined location or facility. Point sources of pollution include municipal and industrial effluent discharges.

Regional

Refers to the Industrial Heartland's regional water Framework that will be developed to enable the region's water management challenges to be addressed.

Return Flow

Water that leaves the control of the licensed facility, after the water has been used for the purpose for which it is licensed under the Water Act.

Reclaimed Water

Water that is utilized after it has fulfilled its primary purpose as identified in a Water Act licence and before it becomes return flow (leaves the wastewater treatment plant back to a watercourse).

Shared Governance

Shared governance is when both government and external parties share responsibility for policy development and delivery of planning, programs or services but government retains accountability. The extent of government involvement varies with the level of control that is desired and/or the capacity of the external parties to carry out the functions. This requires a clear accountability framework with clear roles, responsibilities and relationships.

Target

A target is a value that reflects a desirable outcome.

Threshold

A threshold is the value of an indicator that reflects a problem condition.

Treated Wastewater

Effluent/discharge from wastewater treatment plant that meets the quality outlined in the wastewater treatment plant approval prior to discharge to the receiving environment or the quality specified for reuse.

Wastewater Treatment

Any structure, thing or process used for physical, chemical, biological or radiological treatment of wastewater, and includes a structure, thing or process used for

- wastewater storage,
- treated wastewater use and disposal, and
- sludge treatment, storage and disposal.

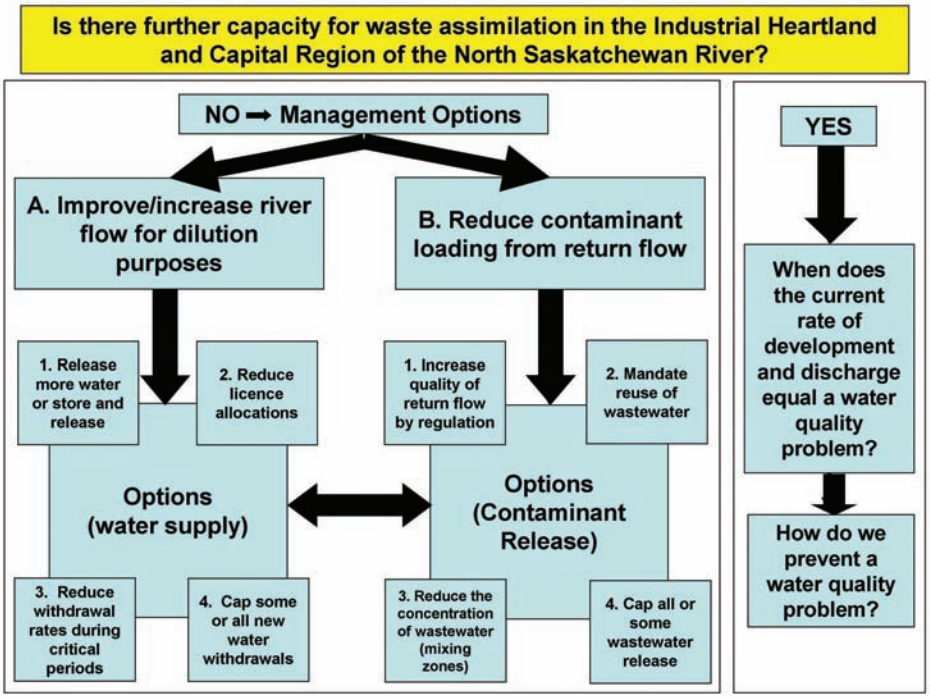
(Source: Wastewater and Storm Drainage regulation.)

Wastewater

Defined as domestic wastewater and may include industrial wastewater.
(Source: Wastewater and Storm Drainage regulation and Environmental Protection and Enhancement Act.)

appendix c

POTENTIAL MANAGEMENT TOOLS FOR MEETING WATER QUALITY TARGETS IN THE INDUSTRIAL HEARTLAND AND CAPITAL REGION OF THE NORTH SASKATCHEWAN RIVER



This chart outlines the management options or tools that may be used to improve water quality in the North Saskatchewan River. These options were explored when developing the Water Management Framework for the Industrial Heartland and Capital Region.

Water quality is based on several factors, including the quantity of water in the river naturally, the amount of water withdrawn for consumption, and the amount and type of loadings to the river. Water quality is managed based on many chemical parameters in the water and limits for the North Saskatchewan River have been set in order to ensure aquatic ecosystem health will be maintained or enhanced, despite the industrial and population growth it will bear. As the concentration of the amount and type of various parameters in a North Saskatchewan River increases, the river's capacity for further waste assimilation is decreased. Capacity is reached when impacts result in a shift away from background conditions, or a decline from good to fair.

To ensure sustainable growth and future capacity for waste assimilation in the Industrial Heartland and Capital Region of the North Saskatchewan River, a combination of the management tools shown in the chart may be used. Water quality in a river is managed according to both quantity and quality, therefore two categories of management actions exist:

- A: Improve/increase river flow for dilution purposes and/or
- B: Reduce contaminant loading from return flow.

Options to improve or increase river flow include the following:

- release more water or store and release water
- reduce license allocations
- reduce water withdrawal rates during critical periods and/or
- limit some or all new water withdrawals.

Options to reduce contaminant release include the following:

- increase quality of return flow by regulation
- mandate the reuse of wastewater
- reduce the concentration of wastewater at area of release (to allow for better mixing), and
- limit all or some of wastewater release.

appendix d

This fact sheet can also be found at www.environment.alberta.ca/2106.html.

Overview

Water-related Issues in the Industrial Heartland

FACTS AT YOUR FINGERTIPS

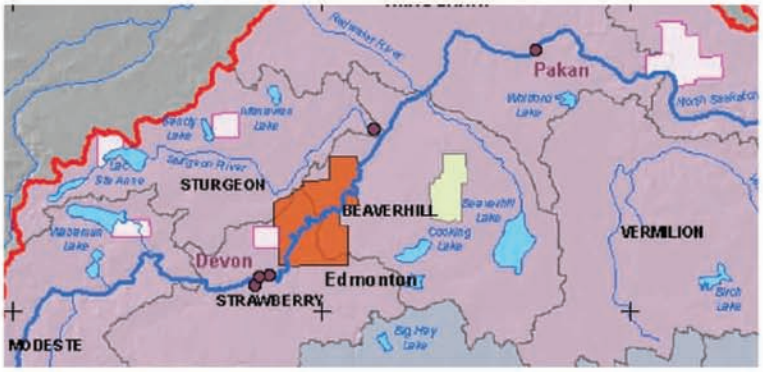
The aquatic environment of the North Saskatchewan River may become stressed and ecosystem capacity exceeded if a regional plan to manage water issues and cumulative impacts is not implemented in the near term.

Issues

- ***Water Quantity:*** Sufficient water remains in the river to maintain aquatic life and support current and proposed industrial development. Water allocation issues are effectively addressed by the Water Management Framework.
- ***Water Quality:*** Water quality in the North Saskatchewan River (NSR) has been negatively impacted at different locations and could continue to decline without cumulative limits in place and actions to mitigate further impacts.
- ***Process Water for Industry:*** The supply of industrial process water for the Industrial Heartland must be viewed as part of the broader issues of water quality and quantity, and a regional solution should consider industry needs, best technology and environmental limits.

Analysis

Despite its physical size, the NSR is not a large river for northern Alberta. It has a third of the flow in the Athabasca River and one-seventh (15%) of the flow in the Peace River.



For more information about Alberta's action on climate change visit www.environment.alberta.ca

Alberta

Water Quantity

Status: Sufficient water currently remains in the NSR to maintain aquatic life and support current and proposed industrial development.

A river environment is shaped by the range of flows it historically experienced. An accepted management approach is to maintain this historic pattern of flows as closely as possible. In Alberta, water quantity targets are established on a weekly basis to match the variability of flows that naturally occur.

Although the Government of Alberta has licensed the use of 29% of the mean annual flow of the NSR, only 5% of the mean annual river flow is permanently lost for consumptive use. Projected development of 8 upgraders will increase total consumptive use to 6% (an increase of 1%).

Under our trans-boundary agreement with Saskatchewan, Alberta is required to pass 50% of the mean annual flow across its border. Alberta is currently meeting its trans-boundary requirements, as approximately 95% of the mean annual flow enters Saskatchewan.

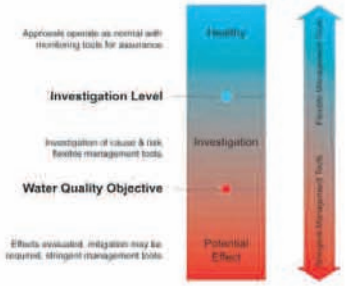
Water Quality

Status: Water quality in the North Saskatchewan River (NSR) has been negatively impacted beyond desired limits at different locations and would continue to decline without cumulative limits in place and actions to mitigate further impacts.

- Alberta Environment conducts water quality monitoring of the NSR upstream and downstream of the capital region and the Heartland areas. Based on monitoring of important water quality descriptors (including metals, toxic organic compounds, and non-toxic, ecosystem-altering nutrients), the upstream and downstream concentrations indicate capacity has been exceeded for some compounds, particularly nutrients and bacteria derived from Edmonton. This challenges industrial developments to find technical solutions (such as enhanced water treatment) or alternate management solutions (such as waste water reuse) to ensure they do not exceed ambient water quality guidelines.
- From upstream to downstream of Edmonton and the Industrial Heartland (IH) region water quality in the NSR declines from good to fair and an index developed for non-fish biota components (primarily invertebrates) declines from good to marginal condition.
- Review of effluent from existing and proposed IH facilities indicates significant loading of some substances to the river.

Water Threshold Model

Water quality is managed based on many chemical parameters in the water while quantity is managed based on flow expectations for each week. Individual investigation and water quality objectives triggers exist for each parameter that enters the river (e.g. nutrients, metals and industrial chemicals) with management actions for these triggers as shown in the figure to the right.



Establishing Cumulative Effects Targets and Management

A Water Management Framework (WMF) supported by aquatic science has been established. Key objectives of the WMF are to:

- Manage cumulative effects in the NSR, ensuring the three goals of Alberta's Water for Life Strategy: *safe, secure drinking water supply; healthy aquatic ecosystems; and reliable, quality water supplies for a sustainable economy.*
- Create a system that protects the aquatic environment, provides incentives to improve environmental quality and is flexible to the unique demands of the industrial heartland region.

Management of river systems generally fall within three interlinked categories:

- **Quantity:** The physical characteristics of water flow including the amount and timing of water flow. Management ensures suitable water quality (dilution) and habitat for biota.
- **Quality:** The mass load and concentration of chemical constituents in the water both suspended and dissolved. Management ensures protection of habitat, use and health.
- **Biotic Health:** The status of organisms living in the river described by density, diversity, recruitment (birth/colonization, immigration rates) and mortality. Biotic health is difficult to manage directly instead it provides a litmus test for how well quantity and quality is managed.

To set quantity and quality objectives for the NSR specifically, this Water Management Framework for the NSR used information on river flow, water quality and biotic requirements to establish minimum water quantity and quality thresholds.

Water quality targets were defined based on regulated river flows from 1973 to now and water chemistry from 1998 to present (following major upgrades in water treatment) from a "keep water clean" perspective and a "use-protection" perspective:

-

- Targets to "keep water clean" were based on that point at which contaminants increase in the river by more than 20% from upstream to downstream in the Devon to Pakan reach of the river.
- Use-protection targets were based on existing Alberta, Canadian Council of Ministers of the Environment and United States Environmental Protection Agency water quality guidelines as specified in existing Alberta policy.

This WMF:

- Sets environmental limits to changes in the physical and chemical ecosystem of the NSR which can be tolerated while still protecting all water uses, including those of the organisms that live in the river.
- Protects the aquatic ecosystem in the region for future use.
- Provides a baseline for acceptable impact.
- Ties current management activities for individual companies and sectors into a larger ecosystem perspective. Impacts from one development are considered in terms of their affect on all uses.
- Ensures that our trans-boundary commitments with regard to water quantity and quality continue to be met.
- Provides incentives to evaluate the most beneficial and efficient uses of water within the capital region.

Threshold Conditions for NSR Water Quantity and Quality

Water quality is based on several factors, including the quantity of water in the river naturally, the amount of water withdrawn for consumption and the amount and type of pollutants in the river. These factors were used to identify individual thresholds for each parameter, thereby allowing each to be managed as required. The WMF identifies three water management conditions related to the threshold for each parameter:

Threshold Conditions:

- Green: Cumulative impacts from Edmonton and IH are minimal. The river system is in near-background state.
- Yellow: Impacts are resulting in a shift away from background conditions. Sources, trend and risks must be evaluated. Management activities will be invoked as appropriate and required.
- Red: Impacts exceed limits for a designated use and a management plan must be developed that clearly addresses risk and mitigates environmental impact.

It is possible to have yellow or red conditions for some parameters but to be in green conditions for others. The intent is to ensure that management actions efficiently target problem substances and that, as the WMF is applied over time, aquatic ecosystem health of

the NSR will be maintained or enhanced, despite the industrial and population growth it will bear.

These thresholds are tied to management actions which would be undertaken to offset the human/ industrial impacts on water use (see Table 3).

WATER QUANTITY GUIDELINES

Current in-stream flow science recommends a minimum of 85% of instantaneous flow (15% allowed for use) to support aquatic life under most flow conditions (designated green conditions) with increasing restrictions during dry periods (yellow and red conditions). In-stream flow science was used to determine water quantity targets, with the most restrictive target allowing 4 m3/s of consumptive use. Current consumptive use is estimated at 3.5 m3/s, indicating that current water use remains within acceptable targets.

Table 1 presents the specific flow targets that define the green-yellow and yellow-red boundaries and the water available for use in the yellow and red flow categories. Water availability during green conditions (all flows above the yellow cutoff) is not included because it is dynamic at 15% of instantaneous flow. The chart shows values (quantity in m^3/s) for defining yellow and red boundaries on a weekly basis and the associated water available for consumptive use in yellow and red flow conditions. In most cases, withdrawals of the available water during the lowest flow of a yellow condition exceeds the initial amount of water available in the corresponding red condition. This is accepted during Phase 1 and will be addressed when ecosystem base flows are considered in Phase 2.

Table 1. TARGETS FOR WATER QUANTITY BY THRESHOLD CATEGORY*

Week	Yellow		Red	
	Cutoff (m3/s)	Available water	Cutoff (m3/s)	Available water
1	88	8	77	4
2	95	9	78	4
3	100	9	88	5
4	99	9	87	5
5	98	9	82	4
6	99	9	84	5
7	97	9	88	5
8	95	9	85	5
9	99	9	88	5
10	101	9	87	5
11	105	10	92	5
12	104	10	92	5
13	121	11	95	5
14	144	12	99	5
15	164	14	122	7
16	178	16	149	8
17	185	18	165	9
18	163	15	139	8
19	163	15	135	7
20	179	16	148	8
21	176	16	135	7
22	197	18	163	9
23	192	17	141	8
24	207	19	172	9
25	227	20	187	10
26	224	20	180	10
27	197	19	178	10
28	206	19	164	9
29	205	18	157	9
30	183	16	145	8
31	164	15	138	8
32	165	14	122	7
33	161	15	146	8
34	151	14	129	7
35	149	14	128	7
36	140	13	115	6
37	132	12	116	6
38	122	11	96	5
39	131	11	97	5
40	119	11	102	6
41	126	11	100	5
42	112	11	99	5
43	113	10	88	5
44	114	10	93	5
45	110	10	92	5
46	104	10	86	5
47	90	8	67	4
48	92	8	71	4
49	97	9	80	4
50	93	9	79	4
51	98	9	89	5
52	93	9	85	5

WATER QUALITY GUIDELINES

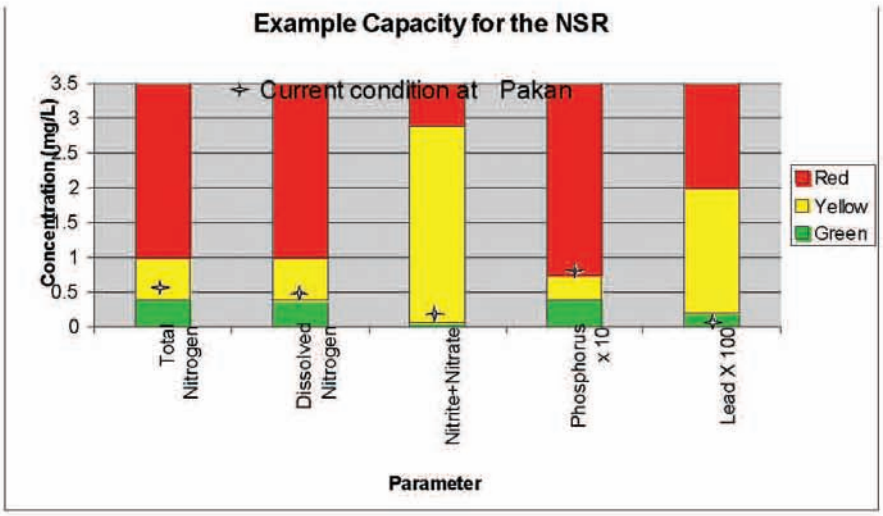
Targets have been established for each of 100 compounds that are currently found in effluents discharged to the North Saskatchewan River.

The below provides examples of water quality targets (yellow) and guidelines (red) for some of the compounds for which these have been set.

Example application of the WMF for water quality

Table 2: Examples of Water Quality Targets for the North Saskatchewan River

* Based on regulated flows



Example Organic (ug/L)						
ANTHRACENE	ND	ND	Detection	Detection	0.012	NA
BENZENE	ND	ND	Detection	Detection	1.2	NA
BENZO(A)PYRENE	ND	ND	Detection	Detection	0.0044	NA
Example Pesticide (ug/L)						
2,4-D	0.12	0.009	0.144	0.01	4	NA
Other Pesticides[4]	Use Alberta Pesticide Index once complete					

Legend:

Pakan: *Location on NSR where AENV has been monitoring water quality downstream of the Capital Region monthly for over 30 years)*

ILT: *Investigation Level Threshold based on the concept of keeping clean water clean, it is calculated as a 20% increase from concentrations monitored at Devon, upstream of Edmonton.*

ELT: *Effects Level Threshold based on existing Alberta, CCME and USEPA guidelines for the protection of designated uses. Designated uses include protection of aquatic life, drinking water, irrigation, etc.* AENV is considering reach specific objectives based on environmental effects for parameters like total and dissolved nitrogen and phosphorus. These will be developed through consultation and scientific evaluation.

Table 3: Water Management Activities and Actions by Threshold Category

These management actions are related to the ***Water Threshold Model***, page 3:

Management Status	Core Activities	Ambient River Conditions			Management Actions	
		Flow	Quality	Biological	Water Quantity	Water Quality
Red Condition	Implement management plan and evaluate	Weekly cut-offs See Table 1	Surface water quality guideline exceedance	Confirmed biological impacts resulting from effluent not acceptable	5% of river flow available for use (m3/s available is 4-5 winter and 5-10 summer)	Effluent –based solutions and/or other measures implemented
Yellow Condition	Increased environmental monitoring & investigation of cause Explore management options & develop a management plan	Weekly cut-offs See Table 1	20% increase from background conditions	Detectable biological impact requires response	10% of river flow available for use (8 to 10 m3/s available in winter, 10 to 20 m3/s available in summer)	Evaluate effluent limits, loading and toxicity to establish risk of **cumulative impact** Evaluate effluent-based and other solutions (e.g. integrated quality-quantity measures)
Green Condition	Baseline environmental monitoring & evaluation Technology performance assessment	Weekly cut-offs See Table 1	Background conditions are maintained	Background conditions are maintained	Sector-based water conservation targets apply 15% of river flow available for use	BATEA applied to new & existing (on renewal) operations Current wastewater policy applies

Ongoing Multi-Stakeholder Engagement in the Region's Water Management Framework

The NSR Water Management Framework provides a baseline for acceptable impact of industrial and other growth and a context for a wider dialogue with industry, community stakeholders and experts about desired environmental outcomes for the region and methods for achieving them. In order to further evolve this framework, Alberta Environment will work together with the North Saskatchewan Water Alliance (NSWA) in its role as the

regional Watershed Planning and Advisory Council under the province's Water for Life Strategy.

Flexible, innovative and achievable solutions for regional watershed management, return flow and waste water re-use will be developed as the WMF is implemented and results are evaluated over time. Additional working groups will be formed to complete this work as required.

Outcomes – Water Management

- ***Improved water quality in the NSR.***
- ***A Water Management Framework (WMF) specific to the North Saskatchewan River that is:***
  - Science-based.
  - Provides baseline data.
  - Sets limits to ensure water quantity and quality are maintained.
  - Identifies management actions in the event flow/discharge limits enter yellow and red conditions.
  - Guides stewardship of the water resource.
  - Provides incentives to identify and pursue the most beneficial and efficient use of water.
- ***River flows and water quality which are protective of the aquatic ecosystem.***
  - Lake Sturgeon habitat is maintained or improved.
- ***Room for economic and regional growth.***
- ***Regional solutions that are publicly accepted.***
  - Over the next few months, stakeholders will be brought together to develop a Regional Water Solution to address water challenges in the Industrial Heartland, including a strategy for wastewater re-use.
- ***Improved cooperative, water management to achieve regional outcomes.***
- ***Trans-boundary water commitments re: water quantity and quality will continue to be met.***

This framework is part of the government's broad new approach to address cumulative effects on the environment.

For more information, or to order additional copies, contact:

Alberta Environment
Information Centre
Main Floor, 9820 - 106 Street
Edmonton, AB T5K 2J6
Toll-free: Dial 310-0000
and the phone number
Telephone: 780-427-2700
www.environment.alberta.ca

ISBN No. 978-0-7785-6807-0