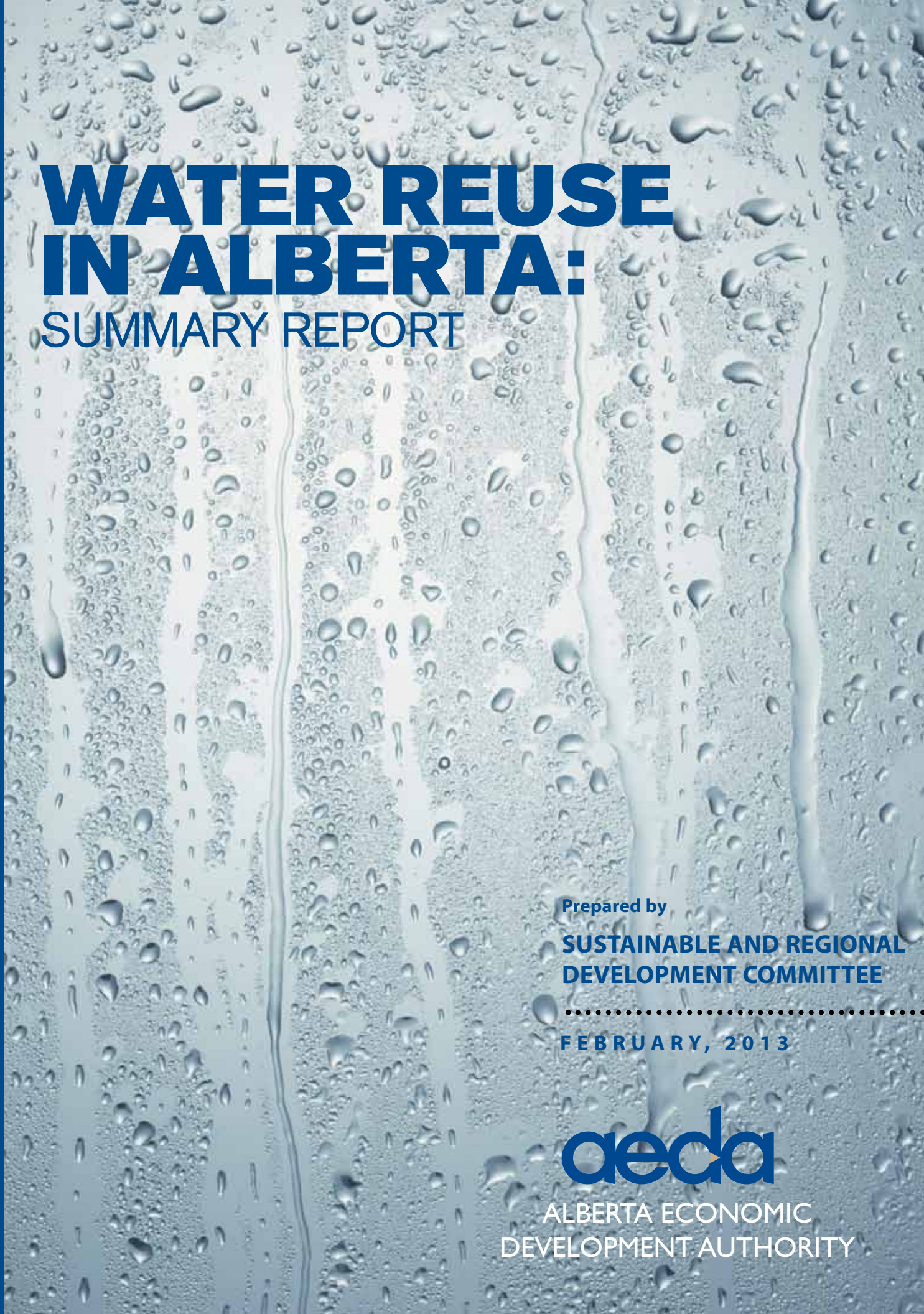
WATER REUSE IN ALBERTA:
SUMMARY REPORT



Prepared by

SUSTAINABLE AND REGIONAL DEVELOPMENT COMMITTEE

FEBRUARY, 2013

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ALBERTA ECONOMIC DEVELOPMENT AUTHORITY

MESSAGE FROM AEDA

Dear Premier Redford:

The Alberta Economic Development Authority's (AEDA) committee on Sustainable and Regional Development is pleased to present you with this report titled 'Water Reuse in Alberta.' The report outlines Alberta's water supply challenges, provides an overview of water reuse policy and legislation, and highlights the impacts of current water reuse restrictions on economic development across the province. The report concludes with a number of recommendations for the Province's consideration.

The Government of Alberta needs to invest resources to address Alberta's water supply challenges and ensure that water issues do not continue to hamper economic growth. In light of growing user demands on water, current water legislation and practices do not promote sustainable growth. Water reuse is an important policy matter whose urgency is only hastened by continued reports of economic stagnation due to the unavailability of water. Action on this file must be a priority if Alberta is to maintain its economic momentum.

This summary report places emphasis on the challenges of present water practices and legislation, outlines existing opportunities to address those challenges, and articulates clear recommendations for the Government of Alberta. In the development of this report, AEDA collaborated with and sought input from the departments of Environment and Sustainable Resource Development and Enterprise and Advanced Education.

We encourage the Province to support and develop water reuse legislation that is environmentally, economically and socially sustainable. Alberta can be a leader on this important economic development issue, joining British Columbia in being the only provinces in Canada to boast water reuse guidelines and regulations.

We encourage the Government to continue their focus on this important issue.

Yours truly,

Barry M. Heck
AEDA Chair

Mike Mahon
Chair, Sustainable and Regional Development Committee

1.0

As outlined by the Alberta government in the Water for Life: Alberta's Strategy for Sustainability almost a decade ago, there is a significant need to address Alberta's water supply challenges and ensure that access to water, or lack thereof, does not constrain or hamper community development and economic growth.

While the political support for water reuse has grown, findings of research undertaken for this report suggest that current legislation in Alberta has not allowed the practical application of water reuse to match this political will. If Alberta is to meet growing demands on water resources and maintain a competitive and sustainable economy, the province must update its water management and reuse policy, legislation, technologies and practices, and integrate the concepts into its current water governance and water license allocation systems.

This summary report provides an overview of the regional water allocation, licenses, use and return flow in Alberta; it provides an update on water reuse policy and legislation in Alberta and Canada; and it describes the water supply and reuse experience in five of the land use regions as defined by Alberta's Land Use Framework (LUF). The perspectives and experiences shared by individuals, and examples of how water reuse is currently impacting economic development are presented. Based on the above work, nine key challenges, opportunities, and recommendations are summarized at the end of the report.

DEFINING WATER REUSE

In order to facilitate discussion on water reuse policy and technology with stakeholders, this report used the following definition of reused water:

"Water that has been altered from its original state through municipal, industrial, or agricultural use and subsequently used for the original purpose or a new purpose with or without treatment"

It is notable that the terms "water reuse" and "water recycling" are interchangeable within the energy industry.

The report also references potential sources of water (see Table 1) and the economic sectors and respective water reuse applications (see Table 2). It is within the context of these definitions that water reuse is discussed throughout this report.

Table 1: **POTENTIAL SOURCES OF WATER FOR REUSE APPLICATIONS.**

Water Source	Definition
Municipal Wastewater	Wastewater collected at a central facility for treatment to quality levels required by Alberta Environment and Sustainable Resources (ESRD) for release back to the environment.
Greywater	Untreated water from kitchen sinks, bathrooms and laundry drains, NOT including sewage.
Industrial Wastewater	Water which comes into contact with any raw material, product produced from the raw material, or by-product, including waste, from processing the raw material. This source also includes other effluents from water use within industrial facilities (e.g. cooling water, boiler blowdown, flow back water).

Table 2: **WATER REUSE DEFINED BY APPLICATION.**

Sector	Application
Agriculture	Irrigation
Municipal & Commercial	Landscape irrigation, domestic use, fire protection, road cleaning
Industrial	Cooling water, process water, dust control, concrete mixing, soil compaction, domestic use
Energy	Injection for extraction, process water, boiler make-up water, domestic use
Recreation	Surface water augmentation, recreational and aesthetic features
Environment	Wetland management, surface water augmentation

3.0 METHODOLOGY

Primary and secondary research was undertaken for this report. As part of the primary research, a review of existing policies and regulations related to water reuse in Alberta, British Columbia, the United States, and Australia was undertaken to understand current barriers and opportunities.

A series of interviews with individuals from the water industry in five land use regions, as defined in Alberta's Land Use Framework (LUF) was undertaken to obtain their perspectives and experiences.

Secondary research included gathering and reviewing existing research on the state of water in the province. Research was conducted on existing water supply and demands and impacts of water on the economy. In some cases, information on specific initiatives or statistics provided by interviewees was verified through research. Specific research was conducted in regions where interview participation was lacking.

4.0 OVERVIEW OF WATER IN ALBERTA

Water availability is emerging as one of Alberta's primary resource issues and each region has unique challenges. Approximately 80 percent of the water supply in this Province is located in the north, while approximately 80 percent of water demand is in the south (Alberta WaterSMART, 2008a).

The existing state of water in each of the land use regions throughout the province was outlined in the 2008 Sustainable Water Management and Economic Development in Alberta report by Alberta WaterSMART, and is summarized below in Table 5. The summary outlines the allocation, licenses, use and return flow in each region.

Table 5: **SUMMARY OF 2005 WATER ALLOCATION, LICENSES, USE AND RETURN FLOW.**

Land Use Region	Major Land / Water Use	Annual River Flows						
		Natural Flow (billion m3)	Protected Flow (billion m3)	Allocated Flow (billion m3)	Licensed Use (% Allocation)	Estimated Use (2005) (% Allocation)	Forecast Increased Use (2020)[2] (% Allocation)	Return Flow (% Allocation)
South Saskatchewan	Irrigation, Municipal, Commercial, Industrial	9.40	3.55	5.235	83	46	52	17
Red Deer	Private Irrigators, Municipal	1.85	N/A	0.372	72	62	66	28
North Saskatchewan	Industrial Cooling, Municipal	7.55	3.78	2.808	18	10	14	82
Upper Peace and Upper Athabasca	Municipal, Forestry, First Nations	66.0	N/A	0.573	59	38	57	41
Lower Athabasca	Oil and Gas, Mining	20.0	N/A	0.551	86	23	65	14
Lower Peace	Municipal, Forestry, First Nations	70.0	N/A	0.023	66	39	43	34

5.0

WATER REUSE POLICY AND LEGISLATION

Alberta Environment and Sustainable Resource Development (ESRD) recognizes the need for the development of

"appropriate regulations and water quality and technical standards or guidelines to facilitate the safe use of reclaimed wastewater".

Although such standards and guidelines have been published at the national level, the Government of Alberta—namely ESRD—states that "reclaimed wastewater from any source cannot be used inside buildings or for other domestic applications in Alberta" (Government of Alberta, 2012). However, Alberta has passed the 2010 Alberta Guidelines for Rainwater Harvesting, which allows the reuse of water collected from roofs.

Alberta Municipal Affairs had also released a fact sheet titled "Alternative Solutions Guide for Reclaimed Water Reuse". The fact sheet provides clarification on how stakeholders should proceed with developing proposals for obtaining approvals of water reuse applications, indicating that individuals must obtain a variance under the Safety Codes Act and a variance by the technical administrator of the equipment used for the application. It also indicates that individuals must obtain approvals to use certain natural source water through the authority having jurisdiction or ESRD, as well as a number of other detailed information requirements. Due to the complexity of issues such as ownership and return flow, it is expected that ESRD will not issue water reuse-related approvals in the near future, especially in the South Saskatchewan River Basin.

Some progress has been made on a national level with the 2010 updates to the *National Plumbing Code*, which supports the use of reclaimed water and governs plumbing in Alberta, the publication of the *CSA B128.1-06/B128.2-06 (R2011)/B128.3-12 Design and Installation of Non-Potable Water Systems/Maintenance and Field Testing of Non-Potable Water Systems/Performance of Non-Potable Water Reuse Systems*, and the publication of the *2010 Canadian Guidelines for Domestic Reclaimed Water for Use in Toilet and Urinal Flushing*, which reference these CSA standards. However, the National Plumbing Code only allows the use of non-potable water for flush toilets, urinals and subsurface irrigation systems. It does not allow for closed loop greywater use applications within buildings.

The Municipal Affairs fact sheet described above references the National Building Code, and the Health Canada Guidelines. However, to our knowledge, these documents have not been used in Alberta to develop provincial water reuse policies and regulations.

Another issue concerning policy is return flow and ownership of treated wastewater. The return flow allowance in diversion licences is important because water that is returned to the river is assumed to be available for other licensees. Return flows will change with the emergence of water reuse initiatives. The amount of water returned to the river after it is reused depends on how the water is reused.

The political challenges are twofold: 1) balancing the desire for increased conservation and reuse with the need to maintain flow levels in the river for downstream users and for a healthy aquatic ecosystem; and 2) the issue of who owns treated wastewater.

6.0 REGIONAL PERSPECTIVES

Interviews were conducted with municipal, industry, and regulatory leaders on water availability and use in each land use region. A brief description of the water use and anticipated growth in each region and a brief summary of interview perspectives is provided below. A detailed summary of interview perspectives and secondary research findings from each region is provided in Appendix A.

South Saskatchewan Region

The SSR accounts for about 73 percent of all estimated water use in the Province (Alberta WaterSMART, 2008a). In this region, the majority of water allocations are for the irrigation-agriculture sector and the municipal sector, representing 79 percent (Government of Alberta, 2009) and 14 percent of allocated water, respectively. This represents virtually all of the Province's water allocations for irrigation and approximately 68 percent of all municipal water allocations in Alberta. Approximately 89 percent of water consumed for municipal purposes within the region is from populations currently residing in cities and towns. Eighty percent of people in this region live in the Calgary metropolitan area. Population growth in urban centers is expected to continue growing at a rapid rate, with an estimated increase of two million people by 2076, of which 1.6 million are expected to reside in the Calgary metropolitan area (Government of Alberta, 2009).

The planning and implementation of water reuse projects in this region has grown in recent years, though experience remains limited. Some experiences are common among municipalities, while perceptions, approaches, and goals related to water reuse vary substantially.

The key challenges in the SSR are a result of the closed basin. Access to water for multi-sector development is currently limited to water transfers. **This has led to considerable tension throughout the region with respect to water licensing and allocation, and regional solutions.** Access to water is vital to allow for anticipated growth; the urgency of addressing these issues resides significantly in this geographic region.

North Saskatchewan Region

Edmonton is projected to grow by about 60 percent to 1.6 million people by 2040. This will correspond with significant growth in residential, commercial and industrial sectors. It is clear from the Edmonton Municipal Development Plan (MDP) that the City is focusing on water reuse in the industrial sector to reduce the total amount of water diverted from the natural water systems in the region. Due in part to the inextricable link between quality and quantity, short and long term planning for reuse is happening in this region at the municipal, industrial, energy, and cross-sector levels.

The perspectives from this region with respect to water reuse implementation represent the opinions of the municipal representative interviewed, the policies of the Edmonton MDP, and statements from the Water Management Framework for the Industrial Heartland and Capital Region.

There is significant policy support and desire to reduce license allocations and limit new withdrawals, to mandate the reuse of wastewater and to limit all or some wastewater release to the river. It appears that the lack of a provincial regulatory framework may not have an impact on the inertia behind efforts to reuse water in this region. This has the potential to lead to political and technical inconsistencies in water reuse implementation practices across the province, in particular with respect to the issues of ownership.

Red Deer Region

In an area made up of numerous small communities, the development of regional systems has become an interest to many. The population of Red Deer in 2011 was approximately 92,000 people (City of Red Deer, 2011), and projections for the 2031 population have been estimated to be 185,000 people (Schollie, 2006). In a 2006 comparison of 16 municipalities, Red Deer had the fourth lowest water price rates in Alberta. Perspectives from this region in Appendix A come from the Red Deer MDP, and the Red Deer River Alliance integrated watershed management plan and draft water quality objectives for the River.

The key challenge in this region is water quality, while water quantity is expected to become a more significant issue in the near future. Documentation indicates that forecasted climate models estimate lower precipitation rates, higher evaporative losses, and lower summer river flows. It appears that local policy support of water reuse projects is not enough to move their implementation forward, and this may be caused by the lack of a regulatory framework.

6.0

Lower Athabasca Region

In the Regional Municipality of Wood Buffalo (RMWB), population is expected to more than double in the next 20 years and Fort McMurray is expected to be the third largest urban area in Alberta. The RMWB is currently the home of approximately 104,000 residents, of which 77,000 live in Fort McMurray, and the remaining live within the nine rural communities spread throughout the RMWB. Continual increases in oil and gas development are expected to contribute one trillion dollars into the Canadian economy. Water use is expected to increase due to the growth of industry. It is estimated that between 2005 and 2020, water use will grow by 188% (Alberta WaterSMART, 2008a).

The main challenges are water quality and the management of winter flows. Due to the nature of existing and potential water reuse in this region, return flows is an issue in this region. While the government supports the implementation of municipal wastewater and industrial water reuse and cumulative effects assessments point to water reuse as the option with the least environmental impact; the challenges related to ownership and return flows have not been formally addressed.

Upper Peace and Upper Athabasca Regions

The Upper Athabasca Region has similar water issues to the Lower Athabasca Region with respect to the upstream petroleum sector and oil sands operations, and variability in seasonal flow. Less long term planning with respect to water use for energy applications has occurred in this region, likely due to the concentration of oil and gas development currently located in the Lower Athabasca.

The diminishing groundwater quality in rural areas, coupled with the requirement of 100 % return flow during low flows on the Wapati River has local authorities exploring long term water supply options that will reduce related infrastructure costs.

7.0 RECOMMENDATIONS

This study has identified a number of key challenges, opportunities and recommendations, as outlined below:

Challenge	Opportunity	Recommendations for Government
Water supply challenges—resulting from increasing water demand, water governance restrictions, and allocation system provisions—are limiting community development and economic growth.	Water reuse practices offer an opportunity to address the water supply challenges in the province.	Support and develop water reuse legislation or regulations that are environmentally, economically and socially sustainable.
Water policy and legislation does not provide a clear definition of water reuse or its sources, thus creating confusion over who has the rights to reused water—the province or the license holder.	Establishing a clear definition for water reuse and identifying water reuse sources would promote more efficient discussions between stakeholders and help them identify who receives the economic benefit of water reuse.	Develop a new regulatory framework that includes clear definitions of water reuse, including but not limited to municipal wastewater, grey water, and industrial water (such as boiler water, cooling water and process affected water).
The current regulatory framework is trailing behind the interest of communities to develop water reuse projects, thus hampering innovative solutions to water challenges.	Although water issues in each region differ, municipal and industry leaders from across Alberta have a great interest in developing water reuse projects if given the ability through legislation.	Develop water reuse policy, regulations and standards as soon as possible.
Alberta appears to be lagging behind other jurisdictions in Canada and around the world in providing a legislative framework to support water reuse.	Legislative frameworks have been developed in British Columbia, the United States and Australia, amongst others, which in turn, can provide guidance for Alberta in updating its regulatory framework.	Undertake a review of existing water reuse regulations in other jurisdictions to inform a new water reuse regulatory framework in Alberta.
Each land use region has unique water challenges and potential reuse opportunities.	Flexibility in regulations to accommodate regional needs will promote more sustainable economic growth across the province.	Develop a new regulatory framework for Alberta that is sufficiently flexible to accommodate regional needs across the Province.
The relationship between water reuse and return flows is not well understood.	Return flow and water reuse are inextricably linked. A better understanding of this relationship can be developed with more modelling and analysis, as well as a review of how other jurisdictions are handling this issue.	Undertake modelling and analysis of return flow in the South Saskatchewan River Basin, and undertake a review of how other jurisdictions manage return flow requirements, to inform the development of water reuse policy, regulations and standards.
Legislation has not kept up with advances in water reuse technology.	Water treatment technologies have advanced significantly over the last several decades, providing more opportunities for safe and cost effective reuse.	Consider existing and future technological advancements when developing Alberta's new regulatory framework.
The economic drivers for implementing water reuse are not clear in all cases.	Further investigation into the cost-benefit and cost allocation of the investment in water reuse is required to convince stakeholders of economic viability. Understanding the true value of water will help support this economic case.	Conduct analyses of cost-benefits and cost allocation to clearly identify the economic benefits of water reuse for various stakeholders.
People are concerned about the safety of water reuse systems, potential impacts on their health, and the security of the system.	Parallel government efforts on development of regulations and public education initiatives early in water reuse implementation phases will improve efficiency of adoption.	Initiate the development of public education initiatives on water reuse to enhance the efficiency of water reuse implementation.

Appendix A:

PERSPECTIVES ON WATER REUSE IMPLEMENTATION LIMITATIONS BY LAND-USE REGION

Theme	Perspectives
	South Saskatchewan
Water Management Needs	• The closed SSRB limits access to water for multi-sector development to water transfers. This has led to considerable tension throughout the region with respect to water licensing and allocation, and regional solutions. • Individuals from the south central area of the region shared that the public perception over the lack of water may be restricting growth in areas that are in fact not experiencing water shortages.
Business case/cost of implementing	• The demand for reuse is just starting now. • Water needs to be treated for purpose. • It is cheaper to treat and reuse water than to source new water. • Reusing water is complicated and expensive. • The technology is available but the business case is not. • There are large costs associated with retrofitting existing infrastructure to accommodate or support reuse.
Limited use of available technology	• There is currently limited use of available technology to better manage water quantity.
Lack of long term planning for reuse	• Current systems were built prior to the system being constrained and were therefore not built for a constrained system.
Policy and governance support	• There is a lack of regional water management perspective, regional dialogue, understanding, cooperation and solutions. • Reuse opportunities need to be viewed in the context of the watershed. • Management decisions need to be at the basin level. • There is no regional group that has legislative standing. • Initial government support for innovation does not translate into government support for implementation. • There is a need for a paradigm shift from: water coming from one place to: using it again once it has been removed from the system. • There is a need for a paradigm shift from: a constrained water supply is a constraint to: a constrained water system is both a constraint and an opportunity. • Discussion should not be solely on a system need, should also discuss system opportunity. • Potential growth in the energy sector in this region, specifically for development of tight oil and shale gas resources, may require a more delicate balance of water resource management and governance.
Inconsistent government and legislative support	• There is a disconnection between different levels of the provincial government on requirements of water reuse systems. • Legislation has not caught up with current technology. • The benefit of return flow requirements to the river is not legislatively supported consistently between the municipal and energy sectors. • Water reused and water returned to the River must be balanced and impacts understood. • Reuse options should be placed-based.
Opportunities	• Industrial cooling applications – example Enmax Shepard Energy Center. • Golf course irrigation and commercial sub-surface irrigation – example City of Calgary. • Stormwater harvesting and use for toilet and urinal flushing – example City of Calgary. • Aquifer storage and recovery – example Rocky View County. • Closed loop water treatment processes – example Rocky View County.

Perspectives			
North Saskatchewan	**Red Deer**	**Lower Athabasca**	**Upper Peace/Upper Athabasca**
• There is a policy desire to reduce license allocations and limit new withdrawals. • There is a policy desire to mandate the reuse of wastewater and to limit all or some wastewater release to the river.	• Water quality is the greater concern. • Although quantity is not an issue now, the forecasted climate models indicate lower precipitation rates, higher evaporative losses, and lower summer river flows may reduce water availability in the future.	• The main challenges are water quality and the management of winter flows. • Limited return flows due to the nature of water use in the region.	• The main challenges are the management of winter flows. • Groundwater quality is diminishing in rural areas. • 100% return flow is required during low flow periods.
• Water reuse will only become economic when the price of potable water or other alternatives increase.	• N/A	• N/A	• Water reuse could reduce the size of anticipated infrastructure, and therefore costs to communities. • Partnerships with oil and gas companies with respect to water use could be mutually beneficial.
• Technology is much further ahead than legislation. • The government wants a precedent in order to make future decisions.	• There is potential to reduce unnecessary use of high quality water.	• Technology exists, however new technology is still required for improved recycling capabilities, especially for tailings pond water use.	• N/A
• Traditional planning of infrastructure is unsustainable.	• N/A	• Research on the relationship between water reuse and energy use is necessary. • Research on salt accumulation is required to understand long term effects of water reuse.	• A costly alternative water supply and associated infrastructure will be required to accommodate future growth in the major urban center.
• Policy direction is there but could be stronger. • There is a need for water reuse and eco-industrial park standards and approaches. • Clarity on ownership of source water for reuse is necessary.	• The Red Deer water conservation plan indicates overcoming the "yuck factor" as a challenge to reducing unnecessary use of high quality water.	• Policy has driven water conservation and reuse in the energy sector. • Government supports the implementation of municipal wastewater and industrial water reuse. • ERCB draft directive strongly discourages the use of fresh water and encourages increased recycling rates in SAGD operations. • Cumulative effects assessment point to water reuse as the option with the least environmental impact	• N/A
• Main issue is legislation and regulatory capacity to approve projects. • Due to the discretionary nature of applications, it is a case-by-case basis, which requires review. • There is a lack of resources and experiences for ESRD to focus on reuse.	• The region's lack of knowledge and understanding about the requirements to undertake water reuse projects prevails. This infers a lack of legislative support and clarity.	• While the above perspectives support reuse, policy limiting water reuse still exists. An example is the use of produced water in coal bed methane development. • Due to a lack of regulations, the region is researching design standards abroad.	• N/A
• Industrial applications – example EPCOR Suncor wastewater reuse joint venture. • Eco-Industrial applications – example Industrial Heartland and Capital Region. • Municipal wastewater reuse for the energy sector – example Drayton Valley. • Municipal wastewater reuse for municipal, domestic purposes – example NAIT wastewater treatment facility.	• Industrial cooling water applications. • Eco-industrial applications • Municipal wastewater for municipal sector purposes. • Golf course irrigation. • Grey water reuse – example: recreation center.	• Industrial cooling water applications. • Eco-industrial applications. • Municipal wastewater and industrial water reuse for industrial and energy sector purposes. • Snow melting facilities for municipal and energy sector purposes. • Municipal wastewater use for municipal sector purposes.	• Municipal effluent for horticulture irrigation – example poplar tree farm. • Municipal effluent for the energy sector.

[3] One interviewee considered the potential use of produced water as a water reuse application; however, produced water is not included in the proposed definition of water reuse provided herein.

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The following were responsible for this report:

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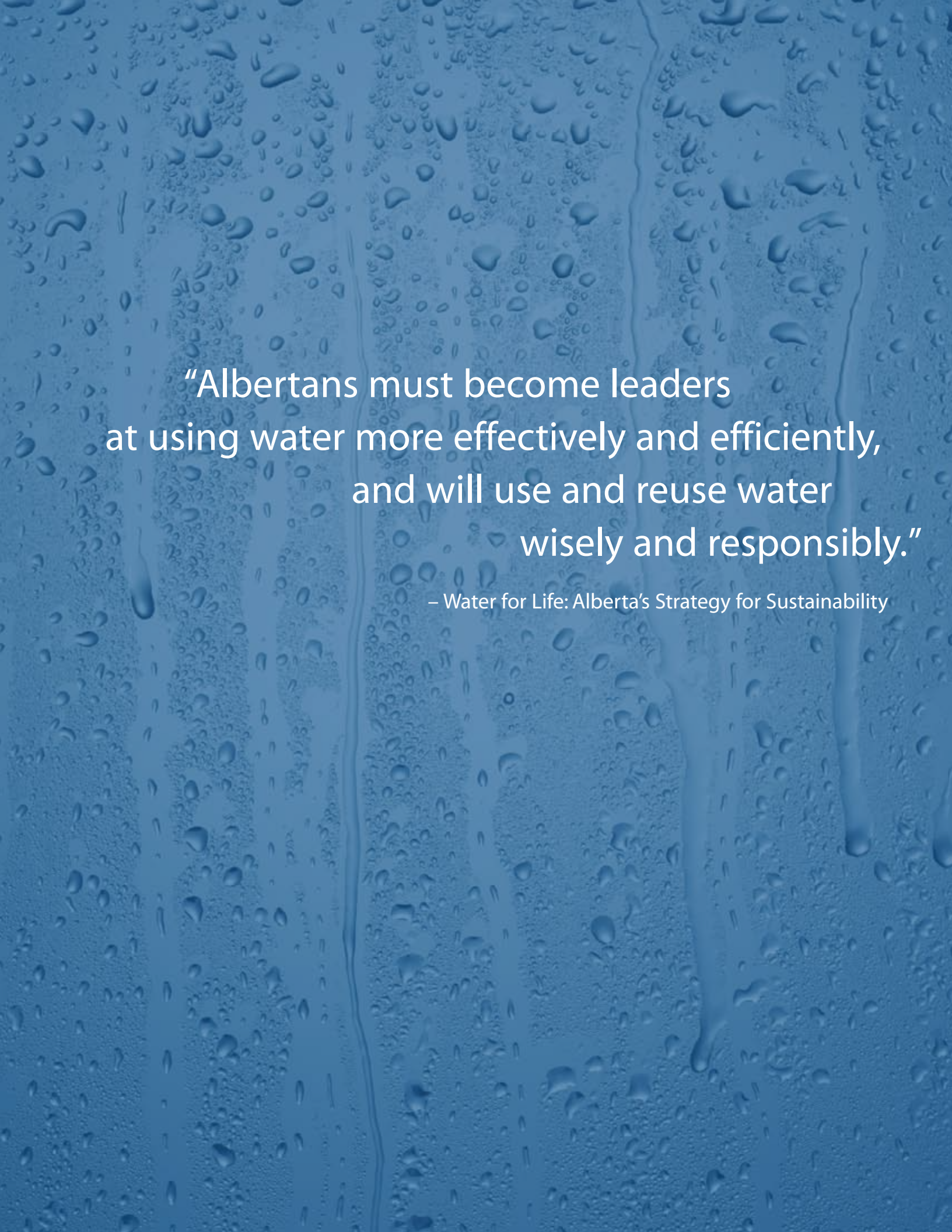
"Albertans must become leaders
at using water more effectively and efficiently,
and will use and reuse water
wisely and responsibly."
– Water for Life: Alberta's Strategy for Sustainability

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