



Western Economic  
Diversification Canada

Diversification de l'économie  
de l'Ouest Canada



# **Prairie Prosperity:**

## **A Vision for the Management of Water Resources across Saskatchewan and the Prairies**

Canada



*This report contains the best possible information and advice, based on information collected by Western Economic Diversification Canada (WD) between March 2019 and June 2020. While the authors draw on many credible sources, readers should exercise caution when drawing conclusions, particularly about future climate projections and water scarcity scenarios.*

*WD wishes to thank everyone who has contributed to this report, including those who participated in meetings, workshops and other related events. WD also appreciates the contributions of many water experts, from all levels of government and the public sphere, who provided advice and input.*

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Represented by the Minister of Industry, 2020

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## Message from the Minister



Canada is a water superpower. Across our great land – but especially in Saskatchewan and Manitoba – our water is the key to our prosperity. It sustains economies, turns aspirations to reality and helps communities reach their full potential. Ensuring a sustainable supply of water is crucial to the future growth and prosperity of the Prairies – be it in agriculture, manufacturing, energy or an array of other industries. As a government, we are a partner in helping every resident of the Prairies seize these many opportunities, while also ensuring this precious resource is protected and managed responsibly. The effects of climate change, and its effect on water is undeniable, and we take seriously the responsibility to ensure this precious resource is accessible for generations to come.

As we work to safeguard the quantity and quality of water on the Prairies, *Prairie Prosperity: A Vision for the Management of Water Resources across Saskatchewan and the Prairies* is our roadmap. Providing a blueprint for future discussions and activities, it explores the potential of transformative infrastructure projects such as expanded irrigation.

This report is the result of incredible work by so many people and organizations across the Prairies. It is the product of extensive engagement with provincial governments, Indigenous peoples, communities, agricultural producers, industry and others. This important work began last June at the Prairie Water Summit in Regina, which brought together more than 130 participants passionate about the future of water on the Prairies. The summit began a dialogue between Western Economic Diversification Canada and a broad array of organizations, a fruitful partnership with results going far beyond this report. I want to thank each of them for their indispensable work, the impact of which will be felt for years to come.

Finally, this report would not be possible without the tireless work of one man: our friend and former colleague, the Honourable Ralph Goodale. Whether as a Minister or just a proud Saskatchewanian, we owe much to Ralph – his leadership, vision and dedication have advanced this cause immeasurably.

The Government of Canada endorses the recommendations of this report. We invite all interested partners, stakeholders, and individuals to join this conversation as we work to ensure a sustainable water supply – one that will nourish life across the Prairies for generations to come.

### **The Honourable Mélanie Joly, PC, MP**

Minister of Economic Development and Official Languages  
Minister responsible for Western Economic Diversification Canada



## Message from Terry Duguid



In Budget 2019, Western Economic Diversification Canada was given the mandate to develop a new water and land management strategy for the Prairies that would help protect against the negative impacts of climate change for communities and agricultural producers, particularly those associated with more severe droughts and floods.

Over the past sixteen months, Western Economic Diversification Canada has begun initial engagement with a broad range of partners and stakeholders including provinces, Indigenous leaders, agricultural associations, industry, water management experts, and non-governmental organizations in the development of a strategy. This work has culminated in the development of a recommendation that could lead to transformative change, enhance resilience, and support prosperity for generations to come. The first steps set out in this report would advance major infrastructure projects to expand

irrigation capacity in central Saskatchewan.

Having been engaged in water management issues for much of my career, I recognize that these recommended infrastructure investments will take a great deal of effort, collaboration, and ongoing government commitment. They must also be part of a broader strategy for water management, including the establishment of a Canada Water Agency. Indigenous communities need to be engaged as partners and rights-holders, and we need to continue to improve agricultural and industrial practices to reduce their impact on our precious water resources.

There is much work ahead of us, but Saskatchewan and the Prairies have a once-in-a-generation opportunity to secure their place as global leaders in agri-food production and water management, while also leaving future generations with a more sustainable economy and good jobs.

### **Terry Duguid, MP**

Parliamentary Secretary to the Minister of Economic Development and Official Languages (Western Economic Diversification Canada)

Parliamentary Secretary to the Minister of Environment and Climate Change Canada (Canada Water Agency)



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## Executive Summary

As the global COVID-19 pandemic continues, many western Canadians want to know what kinds of opportunities will chart their future. They recognize that this moment will allow the public and institutions to consider new visions and to suggest new opportunities for growth and collaboration. The Government of Canada has already committed over \$260 billion to support Canadians through this period,<sup>1</sup> but many are wondering what kinds of opportunities will support high quality jobs in the future. Our answer: water. The time has come to embrace a new vision for water management in the Prairies. **We believe that Saskatchewan has an opportunity to harness its agricultural and growth potential for the benefit of all Canadians, and water resources across the Prairies can be safeguarded through enhanced coordination and collaboration.** This is the kind of forward thinking that western Canadians expect from their governments.

WD has spent the last sixteen months considering the feasibility and impacts of two potential pilot infrastructure projects, and opportunities to enhance water security and support irrigation expansion by almost 500,000 acres in south central Saskatchewan, using the water resources of Lake Diefenbaker: the Upper Qu'Appelle Canal (UQC) and the Westside Irrigation Project (WIP). The analysis and advancement of these projects would also inform future water infrastructure investment across the Prairies. At the same time, WD has reached out to partners and stakeholders to identify issues, challenges, opportunities, and priorities related to water management across the Prairies.

WD has arrived at the conclusion that these infrastructure projects are valuable and necessary, and should be pursued with ambition. Advancing the water and irrigation infrastructure projects would enable **lasting economic benefits**. **It is also clear that enhancing collaboration and coordination would support climate change preparedness for communities, and sustainable water management for future generations.**

The **economic benefits of irrigation and water infrastructure** largely result from the forward and backward linkages that are created to support both irrigation farming, and any industrial development that occurs through an increase in water availability. Over the 50-year lifetime of the projects, the combined impact of increased irrigation, industrial development, and water infrastructure projects will enable considerable **net tax and GDP benefits** for provincial and federal governments. According to one study and WD analysis, benefits include:

- **\$85 billion contribution to Canadian GDP.**
- **Approximately \$20 billion in net tax returns for governments**

The combined impact of these irrigation and water infrastructure projects will also create **long lasting employment opportunities**, and **enduring improvements to the personal incomes** of Saskatchewan residents, while improving economic opportunities for future generations. According to one study, these projects will generate:

- **22,700 person years of employment per year**, at project maturity, and a total of 27,800 person years of employment during the 8-10 year build phase.<sup>2</sup>
- **\$23.5 billion increase in personal incomes**, over the life of the projects.

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<sup>1</sup> International Monetary Fund, [Policy Responses to COVID-19: Canada](#) (as of June 25, 2020)

<sup>2</sup> Once all of the forward linkages have been created by both projects (estimated at 20-30 years after the establishment of the irrigation projects), the UQC is estimated to generate 14,500 annual person years of employment, while the WIP is estimated to generate 8,200 annual person years of employment.



The impact of Alberta's irrigation industry, which has been in development for many decades, bears out these impacts. Studies have shown that it generates around \$1.3 billion in annual tax revenue for the federal and provincial government, representing a revenue to expenditure ratio of 3:1. Saskatchewan will not get there overnight, but Alberta should serve as an example of what the impact could be in Saskatchewan.

At the same time as these water and irrigation infrastructure projects are advanced in Saskatchewan, increasing groundwater scarcity will challenge some of the largest and most productive agricultural regions in the world to continue to grow high-value crops. Changes to some important food producing regions around the world provides Saskatchewan an opportunity to lead by ensuring the sustainable use of its water resources to feed a growing global population, provide diversification to its agriculture industry, and expand its processing capacity.

Addressing **climate change preparedness** and **sustainable water management** for the Prairies will provide the foundation for advancing the irrigation and water infrastructure projects while building resilience for Prairie communities.

The interconnected nature of water resources in the Prairies means that the decisions and actions taken in one province, such as agricultural drainage, water allocation, and industrial investment decisions, are all compounded as water moves downstream. Adding to this urgency, **climate change will have profound and lasting impacts on the availability and usage of water resources in the Prairies.**

According to various climate models, future stream flows on the Prairies could shift, with summer flows expected to decrease due to more winter melt events, more precipitation falling as rain, and earlier spring melt events and runoffs. While parts of Prairies could benefit from warming summer temperatures and a longer agricultural growing season, it could become more challenging for farmers to access the water they need for their crops, as more soil moisture deficits and droughts are anticipated, especially late in the growing season. All of these anticipated changes increase the need for proactive collaboration and action centered around a shared vision.

Moving forward on irrigation and water infrastructure projects will require, among other considerations, an acceptable funding model for the potential funding partners. WD has identified various hybrid models which could be acceptable to all parties. The Canada Infrastructure Bank (CIB), which facilitates large capital projects through privately backed loans or investments, is a possible source of funding for these projects. The capital cost, estimated at \$3.27 billion for both projects, could be covered through a number of potential funding ratio scenarios (see section 4.0 for additional funding scenarios).

Overlaying the possibility of advancing irrigation and water infrastructure projects in Saskatchewan are the **very real and important environmental impacts**, including the increased use of agricultural inputs, and water availability in Lake Diefenbaker. Through consultation with Indigenous partners and stakeholders on the impact assessment process, research and engagement with other jurisdictions, and ongoing monitoring and course corrections, the environmental risks of these projects need to be fully addressed and minimized. Current water modelling also shows that in a median flow year, there will be enough water for both irrigation projects, but in anticipation of future drought events, and to address the trade-offs of increased irrigation diversions, the operating objectives of Lake Diefenbaker should be reviewed.

The vision for Saskatchewan and the Prairies outlined in this report is achievable and timely. This is a vision where **Saskatchewan harnesses its agricultural and growth potential for the benefit of all**, and





one where the **water resources across the Prairies are safeguarded** through enhanced coordination and collaboration. Achieving this vision will benefit all residents across the Prairies for generations to come.

Accordingly, WD recommends that:

**The Governments of Canada and Saskatchewan should advance the Upper Qu'Appelle Canal and the Westside Irrigation Project** through a multi-pronged approach.<sup>3</sup>

- a) The Governments of Canada and Saskatchewan should identify appropriate funding vehicles to build the infrastructure projects.
- b) Partners should jointly commit to innovative approaches to build and operate infrastructure to ensure agricultural expansion and enhanced community resilience in the face of climate change events such as droughts and floods.
- c) Indigenous partners and rights-holders must be meaningfully engaged and consulted in all aspects of project planning and implementation, and their concerns satisfactorily addressed as the projects advance, thus ensuring a broad distribution of benefits.
- d) The Governments of Canada and Saskatchewan should collaborate to support project design and conceptualization, including funding the necessary engineering and design elements, studies, and completion of impact assessment by the Impact Assessment Agency of Canada, which is designed to protect the environment, ensure sustainable projects can move forward safely and build public confidence.<sup>4</sup>
- e) The water and irrigation projects in Saskatchewan should be advanced in accordance with the requirements and conditions imposed as part of the impact assessment process.
- f) Consideration should be given to specific actions that will allow farmers to adopt irrigation at higher rates, that permit industrial users to access the water infrastructure, and that encourage investment attraction.

As the experience in other Canadian jurisdictions has shown, water resources are too important and often too interconnected to be managed independently of one another. A stakeholder-driven, collaborative approach could bring together diverse groups to share data and ideas, simulate practical water management scenarios, and set the direction for water management on the Prairies. Meaningful engagement with Indigenous rights-holders is essential. To further enhance resilience to projected climatic changes on the Prairies, and to ensure the sustainability of its water resources, officials and stakeholders from all three Prairie provinces and the federal government should explore opportunities to enhance collaboration to better safeguard the Prairie's water resources (see Annex 3 for considerations).

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<sup>3</sup> At the time of writing this report, the Government of Saskatchewan announced it was committed to advancing both the UQC and the WIP over the next ten years, using a three-phase approach.

<sup>4</sup> Prior to completing the impact assessment, a project proponent will need to be identified, and water use and demand targets for agricultural, industrial, and municipal users will need to be estimated.





## 1.0 Introduction

To complement the vision developed through Canada's Economic Strategy Tables,<sup>5</sup> and to address some of the challenges associated with increasing climate volatility, the Government of Canada set aside up to \$1 million in fiscal year 2019-20 for WD to begin developing a water and land management strategy for the Prairies.<sup>6</sup> This mandate allowed WD to conduct preliminary engagement with the provinces of Alberta, Saskatchewan and Manitoba, several federal departments, municipal stakeholders, Indigenous rights-holders, academics, industry associations, and the private sector to identify challenges, opportunities and priorities to help inform the development of a Prairie-wide water management strategy. Enhanced collaboration and coordination around both water security and water infrastructure projects will be important for Canada and for the Prairies, to promote long-term economic prosperity, and climate change resilience.

WD undertook a number of activities and partnerships between March 2019 and June 2020. Overall, WD's work focused on two interrelated areas. First, WD studied the feasibility and impacts of two potential pilot infrastructure projects, to enhance water security and support irrigation expansion by almost 500,000 acres in south central Saskatchewan, using the water resources of Lake Diefenbaker: the Upper Qu'Appelle Canal (UQC) and the Westside Irrigation Project (WIP). Secondly, WD worked with partners and stakeholders to identify issues, challenges, opportunities, and priorities related to water management across the Prairies.

Our conclusion after this extensive work is that the irrigation projects should proceed. To support the long-term vision for Saskatchewan's economy and agriculture industry, and to safeguard the water resources in the Prairies, Western Economic Diversification Canada's (WD) recommends that:

**The Governments of Canada and Saskatchewan should advance the Upper Qu'Appelle Canal and the Westside Irrigation Project through a multi-pronged approach.<sup>7</sup>**

- a) The Governments of Canada and Saskatchewan should identify appropriate funding vehicles to build the infrastructure projects.
- b) Partners should jointly commit to innovative approaches to build and operate infrastructure to ensure agricultural expansion and enhanced community resilience in the face of climate change events such as droughts and floods.
- c) Indigenous partners and rights-holders must be meaningfully engaged and consulted in all aspects of project planning and implementation, and their concerns satisfactorily addressed as the projects advance, thus ensuring a broad distribution of benefits.
- d) The Governments of Canada and Saskatchewan should collaborate to support project design and conceptualization, including funding the necessary engineering and design elements, studies, and completion of impact assessment by the Impact Assessment Agency of Canada,

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<sup>5</sup> Introduced in 2018, [The Economic Strategy Tables](#) provide a forum for industry and government to turn economic strengths into global advantages, and to foster long-term growth for the Canadian economy.

<sup>6</sup> While WD focused primarily on how collaboration could enhance water security and advance water infrastructure on the Prairies, WD recognizes that water and land management are inextricably linked. The quantity and quality of water influences the range of activities and development on the land, which in turn, affects the quality and quantity of nearby water resources due to usage, conservation, wastewater management, and drainage. Additionally, WD chose to focus on water management, as it is an area of shared federal and provincial jurisdiction, whereas land management is primarily the responsibility of provinces. Therefore, this report does not refer explicitly to land management, as it is implied in the management of water resources.

<sup>7</sup> At the time of writing this report, the Government of Saskatchewan announced it was committed to advancing both the UQC and the WIP over the next ten years, using a three-phase approach.



which is designed to protect the environment, ensure sustainable projects can move forward safely and build public confidence.<sup>8</sup>

- e) The water and irrigation projects in Saskatchewan should be advanced in accordance with the requirements and conditions imposed as part of the impact assessment process.
- f) Consideration should be given to specific actions that will allow farmers to adopt irrigation at higher rates, that permit industrial users to access the water infrastructure, and that encourage investment attraction.

This report explains why WD made the above recommendation, and why this recommendation would enable long-term benefits including climate change preparedness and sustainable water management, and broadly realized economic prosperity for future generations.

## 2.0 Background

### 2.1 The Upper Qu'Appelle Canal

The first water infrastructure project that WD studied in partnership with Clifton Associates was the UQC. The UQC would divert water from the Qu'Appelle Dam at Lake Diefenbaker, and move it 87km southeast through an open, upland canal beside the Qu'Appelle Valley to Buffalo Pound Lake. Buffalo Pound Lake is the municipal water source for the Regina – Moose Jaw region, and supplies water for the potash mining industry in the region. The UQC would allow for between 110,000-175,000 irrigable acres to be developed along the canal route, outside of the Qu'Appelle Valley.<sup>9</sup> The UQC would likely take 10 years to complete, from design to finished construction. Two major studies of the UQC have been completed prior to 2020 (2006 and 2012). The present-day capital cost would include approximately \$1.37 billion to build the canal and pump stations, and \$756 million for agricultural producers to adopt and connect irrigation technology and meet provincial drainage requirements.

### 2.2 Westside Irrigation Project

The second water infrastructure project that WD studied was the WIP. The WIP is a proposed irrigation project that, if fully completed, could stretch from the Gardiner Dam at Lake Diefenbaker along the west side of the South Saskatchewan River, to Asquith, a town west of Saskatoon and more than 100km north of the Gardiner Dam. The WIP would be built in stages over more than 10 years, and would consist of a refurbished and expanded canal system with multiple reservoirs along the northward route. The WIP could result in the development of more than 330,000 acres of irrigated farmland (see Figure 1 for a map of both project locations). The cost estimate for the full development of the WIP is approximately \$1.9 billion for the canal, reservoirs, and pump stations, with another \$1.5 billion estimated for agricultural producers to adopt and connect irrigation technology and meet provincial drainage requirements.

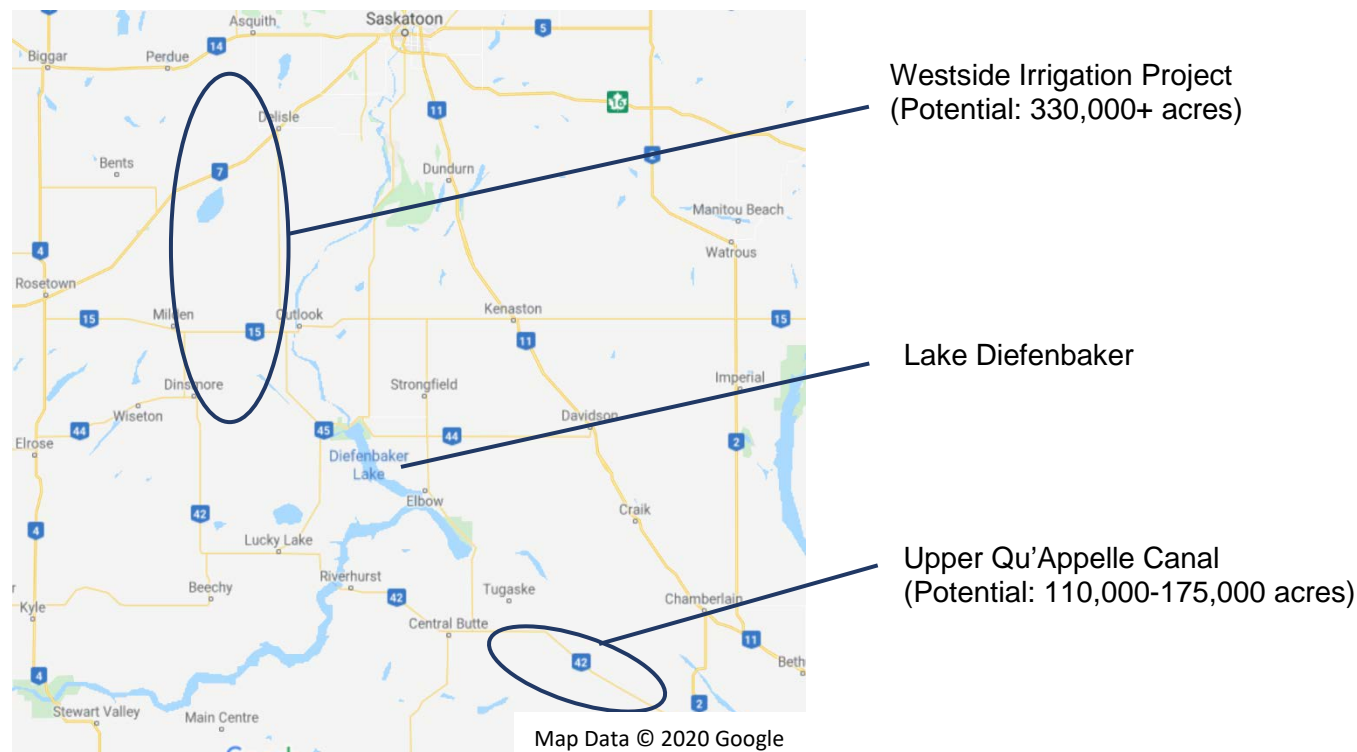
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<sup>8</sup> Prior to completing the impact assessment, a project proponent will need to be identified, and water use and demand targets for agricultural, industrial, and municipal users will need to be estimated.

<sup>9</sup> The range of irrigable acres for the UQC is dependent on water availability from Lake Diefenbaker, canal design capacity, soil conditions in the region, and other factors.

The Prairie Farm Rehabilitation Administration (PFRA) and the Government of Saskatchewan originally conceived of the WIP during the planning and construction of Lake Diefenbaker.<sup>10</sup> The WIP was meant to be one of a number of irrigation projects that would be supplied by Lake Diefenbaker. Construction on the first stretch of the canal, the Westside Main Canal, originally began in 1969, but was halted in 1973 before the canal could reach the town of Conquest.<sup>11</sup> The Macrorie Water Users Association advocated to use the existing canal in the 1980s, and has since used the Westside Main Canal to supply water for a small 3000-acre irrigation district.

**Figure 1 – Approximate Location of the Irrigation and Water Infrastructure Projects**



<sup>10</sup> The federal government established the PFRA in 1935 as a response to widespread drought, farm abandonment, and land degradation at the time. The PFRA worked on several large-scale water infrastructure projects, including the establishment of Lake Diefenbaker. The PFRA was disbanded in 2012.

<sup>11</sup> In 1973, the Government of Saskatchewan (GOS) announced that the Westside canal construction would be delayed. The reasons for the delay [were debated in the Legislative Assembly](#). They included: (1) the producers in the area preferred to continue dryland farming; (2) more experimentation in the east side irrigation project would demonstrate to the dryland farmers that the change to irrigated farming will provide a better farming future; and (3) that funding recreational development on Lake Diefenbaker would realize a greater financial return than irrigation development.

As Table 1 shows, Clifton Associates estimates the combined cost of both projects for the canal infrastructure to be \$3.27 billion, to enable the development of approximately 500,000 irrigated acres. The combined cost of the on-farm irrigation infrastructure is estimated to be \$2.26 billion, most of which would be paid for by individual farmers and producers.

WD considered and studied irrigation projects in Saskatchewan because of the abundant water resources provided by Lake Diefenbaker, the large amounts of suitable farmland near to Lake Diefenbaker, and the projects' economic potential for Saskatchewan's agri-food industry and larger economy. According to some estimates, evaporation can represent 10% of water losses in Lake Diefenbaker in dry years, and in some years, leads to greater losses than human uses.<sup>12</sup>

### Irrigation Expansion in Saskatchewan

The Saskatchewan government recently committed to advancing both the UQC and WIP over the next 10 years, using a three-phase approach, at an estimated cost of \$4 billion. Phase 1 and 2 would see the WIP built to accommodate around 340,000 irrigated acres, while Phase 3 would see the UQC built to accommodate an estimated 120,000 acres.

([Government of Saskatchewan, July 2020](#))

This announcement ties into *Saskatchewan's Growth Plan, 2020-2030*, which looks to increase agri-food exports, and includes a goal to expand the number of irrigable acres in Saskatchewan. This includes irrigation district infill development to add 85,000 new acres by 2030, as well as pursuing efforts to attract private investment to further expand the province's irrigation potential.

**Table 1 – Capital and Operational Costs of the UQC and WIP**

	UQC	WIP	Both Projects
Capital Cost of Canal Infrastructure	\$1.37B	\$1.9B	\$3.27B
Capital Cost of On-farm Irrigation Infrastructure	\$756M	\$1.5B	\$2.26B
Total Cost of Canal and Irrigation Infrastructure	\$2.13B	\$3.4B	\$5.53B
Operations/Maintenance Costs of Canal	\$10M / Year	\$8.4M / Year	\$18.4M / Year
Estimated Irrigable Acres	110,000 - 175,000	330,000	440,000-505,000

## 2.3 Prairie Water Workshops

WaterSMART Solutions, in partnership with WD, led Prairie water workshops in Alberta, Saskatchewan and Manitoba, and had participants identify and discuss water management challenges, opportunities and priorities. Based on these workshops, common challenges and opportunities were identified at all three workshops, and the work that WaterSMART conducted at these workshops helped to identify important considerations for enhanced coordination and collaboration related to water management (see Annex 3).

<sup>12</sup> North, R.L. et al, [Lake Diefenbaker: the prairie jewel](#) (Journal of Great Lakes Research, 2015).

## 3.0 Benefits & Rationale of the Recommendations

Government and the public can realize two sets of benefits through the advancement of WD's recommendation. The first set are economic benefits – increased and enduring economic activity from irrigation and the industries that irrigation and water conveyance enables. The second set of benefits relate to climate change preparedness and long-term water resource management conducted in an inclusive and sustainable manner. This section describes how Prairie residents can realize the long-term benefits that will arise from the advancement of the recommendation.

### 3.1 Large Net Tax and GDP Benefit for Government

Irrigation provides important benefits and returns to the individual producer through higher crop production and more diversified crops, but the long-term economic benefits of irrigation are largely due to the substantial forward and backward linkages created when farmers adopt irrigation. Some of these backward linkages include specialized machinery, irrigation systems, fertilizers, and agronomic supports that are required when farmers adopt irrigation. As the irrigation projects mature, they can also create forward linkages, as irrigation allows for specialized crop production and subsequent crop and animal processing. Additional forage and cereal production in the region allows for agricultural 'building blocks' to develop, such as beef and pork feedlots, and animal processing plants. Specialized crop production can also encourage agricultural building blocks to develop, such as potato processing plants. In Alberta, these forward and backward linkages allow the region and province to accrue 90% of the total benefits from irrigation, while farmers accrue 10% of the total benefits.<sup>13</sup> Although Alberta's irrigation industry is more established than Saskatchewan's, it is an important reminder that irrigation provides benefits that are widely distributed throughout the province.

In the case of the UQC, the canal would provide water for more than agriculture-related industries. Clifton Associates estimated that the UQC would enable potash expansion through the development of two additional potash mines in the region.<sup>14</sup> These industrial building blocks, with their backward supply linkages, capital construction costs, and associated fertilizer plant, would provide additional tax returns to all levels of government. Over the life of the projects, through the many agricultural and industrial building blocks that these irrigation and canal projects would enable, governments would realize a significant net tax return, as their public expenditures on the canal and irrigation infrastructure are returned through goods and services taxes, corporate taxes, property taxes, and income taxes.

As Table 2 shows, the fiscal returns and GDP contributions of each project is substantial.<sup>15</sup> The total fiscal returns of the UQC are \$17.7 billion, while the WIP returns \$6.8 billion. The lifetime contribution to Canadian GDP of the UQC is \$60 billion, and the WIP contributes \$23 billion. Considering the total capital investment of both projects for government and individual producers of the canal and irrigation

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<sup>13</sup> Paterson Earth & Water Consulting Ltd, [Economic Value of Irrigation in Alberta](#) (2015).

<sup>14</sup> Although the UQC would support fewer irrigable acres than the WIP, Clifton Associates assumes that the UQC would lead to additional industrial development in the region. This is based on a belief that the current Qu'Appelle River between Lake Diefenbaker and Buffalo Pound Lake will be an insufficient conveyance in the coming decades, and without the addition of a new canal, the establishment of additional potash mines in the region will not be possible. Given the potash mines and the additional building blocks that the UQC is assumed to enable, the UQC is considered a water supply project, rather than solely an irrigation project.

<sup>15</sup> Given the outsized impact of potash mine development on the economic benefits, and the difficulty of predicting potash expansion in the region, Table 2 and Table 3 have been presented with and without the economic impacts of potash expansion enabled through the UQC.

infrastructure is just over \$5.5 billion, governments will see substantial long-term returns from their initial investments. Assuming producers pay for a majority of the on-farm irrigation infrastructure, the net tax return for both projects would be over \$20 billion.<sup>16</sup>

**Table 2 – Summary of GDP and Fiscal Return Benefits of the UQC and WIP, using a 2.5% discount rate<sup>17</sup>**

	UQC	UQC without Potash	WIP	Both Projects (without potash included)
Contribution to Canadian GDP	\$60B	\$12.5B	\$23B	\$83B (\$35.5B)
Fiscal Returns to the Government of Saskatchewan*	\$14B	\$2.9B	\$4.6B	18.6 (\$7.5B)
Fiscal Returns to the Federal Government*	\$3.7B	\$800M	\$2.2B	\$5.9B (\$3B)
Fiscal Returns to Federal and Provincial Governments*	\$17.7B	\$3.7B	\$6.8B	\$24.5B (\$10.5B)
Net Tax Return to Federal and Provincial Governments	Approx. \$16B	Approx. \$2B	Approx. \$4.2B	Approx. \$20.2B (\$6.9B)
Benefit-Cost Ratio	2.86:1	1.61:1	1.91:1	2.53:1 (1.81:1)

\*Assuming a 30% fiscal return on GDP creation

### 3.2 Enduring Employment and Personal Income Benefits

As with the GDP and fiscal return benefits accrued by government, the construction of the canal and the forward and backward linkages enabled by irrigation and water conveyance infrastructure, would create significant employment opportunities and enduring gains in personal incomes for Canadian and Saskatchewan residents (see Table 3). Over the course of a 50-year time period, the UQC is estimated to generate 460,000 person years of employment, while the WIP is estimated to generate 270,000.<sup>18</sup> At project maturity, once there is full irrigation adoption and all of the forward linkages have been created, the UQC is estimated to contribute 14,500 jobs per year, while the WIP is estimated to generate 8,200 jobs per year, the majority of which will occur in Saskatchewan. These projects will also have lasting impacts on personal incomes, with the UQC contributing to a \$1 billion increase in annual personal income, and the WIP enabling an annual increase of \$350 million in personal income.

<sup>16</sup> The net tax was calculated by taking the total fiscal returns for governments, and subtracting the full cost of the canal infrastructure, and approximately half of the irrigation infrastructure costs. This calculation is approximate, because it is not known how much government support will be provided to irrigators.

<sup>17</sup> Figures provided in Tables 2 and 3 are based on preliminary analysis from Clifton Associates. During production of this report, Clifton Associates updated its economic models. As a result, there may be some deviation between the figures published in this report, and those contained in the final report produced by Clifton Associates for WD.

<sup>18</sup> Clifton Associates estimates that the employment figures are directly tied to the expansion of irrigation and water conveyance infrastructure in the project regions, and would not have occurred without that infrastructure.



**Table 3 – Summary of Employment and Personal Income Benefits of the UQC and WIP**

	UQC	UQC without Potash	WIP	Both Projects (without potash included)
Total Person Years of Employment for Canal and Associated Building Blocks	460,000	142,000	270,000	730,000 (412,000)
Total Person Years of Employment during the Canal and Irrigation Build Phase	10,000	N/A	15,000	25,000
Person Years of Employment at Project Maturity	14,500	4,500	8,200	22,700 (12,700)
Increase in Annual Personal Incomes at Project Maturity	\$1B	\$200M	\$350M	\$1.35B (\$550M)
Increase in Personal Incomes over 50-year Period*	\$17B	\$3.5B	\$6.5B	\$23.5B (\$10B)

\*Using a 2.5% discount rate

### 3.3 Improved Agri-Food Processing Capacity and Global Market Share for Saskatchewan

As mentioned earlier, an important and lasting benefit of irrigation projects is the ability to grow a diverse and higher-value mix of agricultural goods. Using Alberta as a comparator, Clifton Associates estimated how irrigation would change the crop mix in the UQC over time (see Table 4). The proportion of traditional dryland crops are likely to decrease, relative to high-value vegetable and pulse crops. Clifton Associates also expects more forage crops, to support an increase in animal feedlots, and thereby animal processing plants. A 2015 study from Alberta on the benefits of irrigation found that the average irrigated crops from 2000 to 2011 generated more than four times the return of dryland farming.<sup>19</sup>

The production of higher-value, and specialized crop mixes have other important benefits as well. Once the regional production of some crops reaches a threshold, that production helps to encourage processing plants to establish facilities in the region. The decision to locate a processing plant is dependent on several factors, but the starting point is a

reliable and high-quality supply of the chosen crop, which irrigation helps to ensure. Processing plants help to keep more of the value of the crop in the province or region, such as when companies process raw potatoes into table-ready products rather than shipping them out as commodities, or when cereals and forage contribute to animal feedlots in the region, which can then be used in meat processing plants. In 2011 in Alberta, crop and animal processing plants directly contributed over \$500 million to Alberta's annual GDP, and contributed to nearly 16,000 jobs in the province's Southern irrigation region, despite irrigated farmland using less than 5% of the cultivated land base across Alberta.<sup>20</sup> Enabling an

**Table 4 – Anticipated change in the crop mix for the UQC**

	2021	2031	2041	2051
<b>Cereals</b>	45%	40%	35%	30%
<b>Oil Seeds</b>	35%	30%	25%	15%
<b>Pulses</b>	16%	21%	25%	30%
<b>Vegetables</b>	1%	5%	5%	10%
<b>Forage</b>	3%	5%	10%	15%

<sup>19</sup> Paterson Earth & Water Consulting Ltd, [Economic Value of Irrigation in Alberta](#) (2015).

<sup>20</sup> Ibid



increase of almost 500,000 acres of irrigable land, the two projects in Saskatchewan would support the production of a wide variety of high value crops to supply multiple new agri-food processing facilities in the province.<sup>21</sup> Ultimately, the establishment of crop and animal processing facilities depends on several factors, including the product that is being processed, and how much production is occurring regionally. The direct and indirect benefits of crop and animal processing help to maximize the economic impact of the irrigation projects in Saskatchewan.

The opportunity to harness irrigation comes at a moment when the Regina-Moose Jaw corridor and Saskatoon are emerging as increasingly important regions for agri-food production and processing. Increasing the agricultural production of higher-value and diversified crops in these regions through irrigation would help solidify their position as global agri-food production, processing, and export leaders. Saskatchewan also boasts fertile farmland, and world-renowned experts and innovators in the agricultural, livestock, and technology sectors.

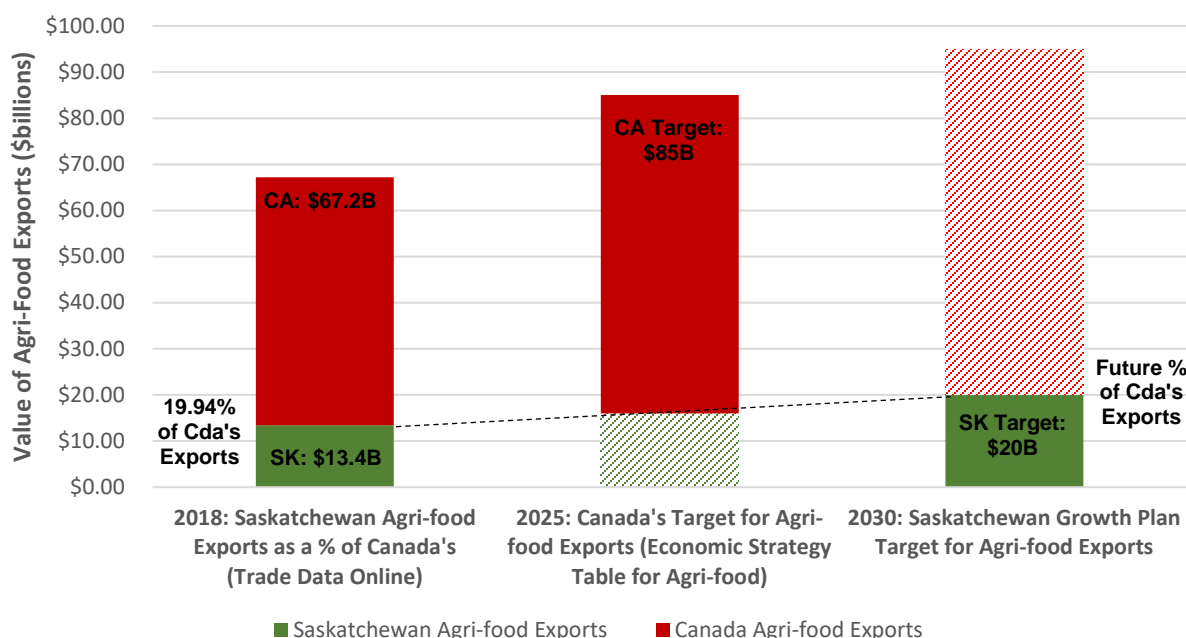
These irrigation projects would also help Saskatchewan to boost agri-food exports in accordance with the provincial Growth Plan, 2020-2030. Figure 2 illustrates 2018 export values, as well as targets for 2025 and 2030 as set out in the 2018 Report of Canada's Economic Strategy Table for Agri-food, and the Saskatchewan Growth Plan, 2020-2030, respectively.

### Prairie-based Supercluster

Protein Industries Canada (PIC) is a Regina-based, industry-led, not-for-profit organization created to position Canada as a global leader in plant protein production. As one of Canada's Superclusters, the Government of Canada is investing nearly \$153 million through an agreement with PIC, to be matched dollar-for-dollar by private sector investment.

([Protein Industries Canada](https://www.proteinindustries.ca/))

**Figure 2 – Saskatchewan's and Canada's Agri-food Exports for 2018 and Future Targets**



<sup>21</sup> Based on discussions with subject matter experts and the experience in Alberta, between 50,000 and 100,000 acres of irrigable land could supply one large processing facility.

At the same time as these water and irrigation infrastructure projects are advanced in Saskatchewan, increasing groundwater scarcity and land degradation will challenge some of the largest and most productive agricultural regions in the world to continue to grow high-value crops. For example, two interconnected aquifer systems in the American Midwest– the Ogallala and High Plains – have sustained one of the largest agricultural economies in the world (see Figure 3). Some regions dependant on these groundwater aquifer systems are beginning to experience water scarcity, and much of the southern part of the aquifer could be depleted as early as 2050.<sup>22,23</sup> Similarly, other major food producing regions around the world are also heavily reliant on groundwater, which is not easily renewed. Climate change impacts are likely to exacerbate the impact of groundwater availability, and this will have major implications for global food production.<sup>24,25</sup>

### Groundwater vs. Surface Water Irrigation

Nearly half of global food production relies on irrigation through groundwater, which is often used at unsustainable rates.<sup>24</sup>

Expansion of irrigated agriculture in the Prairies will likewise require the use of groundwater, in particular, during extended dry periods, which are expected to increase in length under climate change. The challenge, which underscores the need for enhanced collaboration and coordination, will be to jointly manage renewable surface water with the more slowly replenished groundwater, so that groundwater can provide an important and sustainable water supply reserve in times of drought.

**Figure 3 – Map of the High Plains Aquifer**

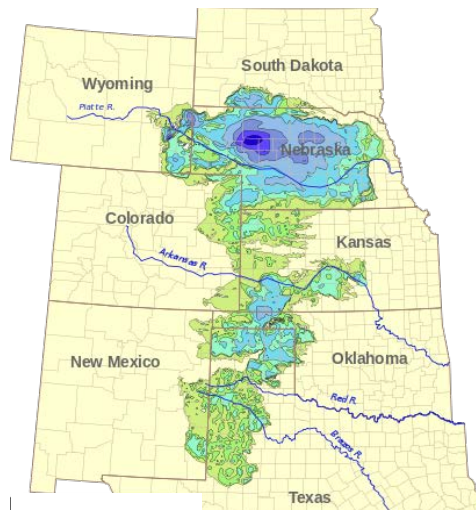


Image source:  
[Wikimedia Commons](#) by  
Kbh3rd, 2009

### The Ogallala - High Plains Aquifer

The Ogallala - High Plains Aquifer alone contributes to the production of \$35 billion in U.S. crops annually.  
([Bruno Basso, 2013](#))

Changes to some important food producing regions around the world present an opportunity for Saskatchewan to utilize its available surface and groundwater resources to feed a growing global population, to provide diversification to Saskatchewan's agriculture industry, and to expand Saskatchewan's processing capacity. While Saskatchewan's climate limits the range of crops that can offset the loss of agricultural production elsewhere, the UQC and WIP will enable Saskatchewan producers to grow more local vegetables and crops. Taken together, these agricultural trends and economic benefits help to make the case for the advancement of the proposed irrigation and water infrastructure projects.

<sup>22</sup> Angie Haflich, [Model predicts aquifers around the globe will be depleted of water in the next 50 to 100 years](#) (High Plains Public Radio, 2016).

<sup>23</sup> Nicole Riva, [Some groundwater could be depleted by 2050, according to a new study](#) (CBC News, 2016).

<sup>24</sup> Famiglietti, J. S., 2014, The global groundwater crisis, *Nature Climate Change*, 4, 945-948.

<sup>25</sup> Richey, A. S., B. F. Thomas, M.-H. Lo, J. T. Reager, K. A. Voss, M. Rodell and J. S. Famiglietti, 2015, Quantifying renewable groundwater stress with GRACE, *Water Resources Research*, 51(7), 5217-5238, doi: 10.1002/2015WR017349.

## 4.0 Funding Models for an Irrigation Project in Saskatchewan

As with any large infrastructure project, due consideration must be given to finding an acceptable funding model that is appropriate to the project, and to local economic and financial circumstances. The financial model should allow the infrastructure to be developed, operated, and maintained with an acceptable mix of public and private funds, and it should insulate taxpayers from unexpected or undue financial burden. The financial model should also be adequately flexible (including contingencies or other options) to address future modifications for increasing operating efficiencies, as well as to address any unexpected negative environmental impacts.

Private and public entities around the world have used various financial models to fund large water infrastructure projects. Some models are better suited than others for funding irrigation infrastructure projects. This is because, relative to other water infrastructure projects such as water and wastewater treatment facilities, irrigation infrastructure tends to have smaller numbers of direct beneficiaries (e.g. crop and animal farmers, processing plants, and industry) from which to recover costs. However, it tends to benefit populations indirectly through contributions to GDP and government revenue, and by supporting high quality jobs.

A longer timeframe is also required to realize the full benefits of irrigation agriculture, due to the complexity and cost of adopting irrigation farming, as well as the time needed to attract increased investment in agri-food processing facilities. Given the challenge of pivoting from dryland farming to irrigation farming, producers may need both training supports and additional capital liquidity to encourage irrigation adoption. It will also be important to find other users for the water resources, such as processing plants and other industrial users, to lessen the financial burden on irrigators to cover ongoing operating and maintenance costs. Despite these challenges, irrigation infrastructure can produce significant and long-term tax revenues for governments, and it often supports significant economic output. The experience in Alberta found that irrigation generated about \$1.3 billion in annual revenue for the provincial and federal government, representing a revenue to expenditure ratio of 3:1.<sup>26</sup> Annex 1 provides a basic overview of some of the models that WD considered, including:

- Public sector grants,
- Government loans or guarantees,
- Rate based support / debt financing,
- Industry contributions,
- Public-private partnerships,
- Tax increment financing,
- Hybrid / blended models.

All of these models can include methods of cost recovery (e.g. fee for service, royalty system, municipal taxation), and in all cases, a move to higher-value crop production can be considered (i.e. as returns and land value increases for producers, so do opportunities for cost recovery). In addition, various models can be blended to adapt to particular local circumstances, and the preferences of decision makers.

Given the proposed schedule to design and build the projects, capital costs could be distributed across a ten-year build period. The Canada Infrastructure Bank (CIB), which facilitates large capital projects through privately backed loans or investments, is a possible source of funding.<sup>27</sup> The capital cost,

<sup>26</sup> Paterson Earth & Water Consulting Ltd, [Economic Value of Irrigation in Alberta](#) (2015).

<sup>27</sup> Senior officials from the CIB have been briefed on both the UQC and WIP.



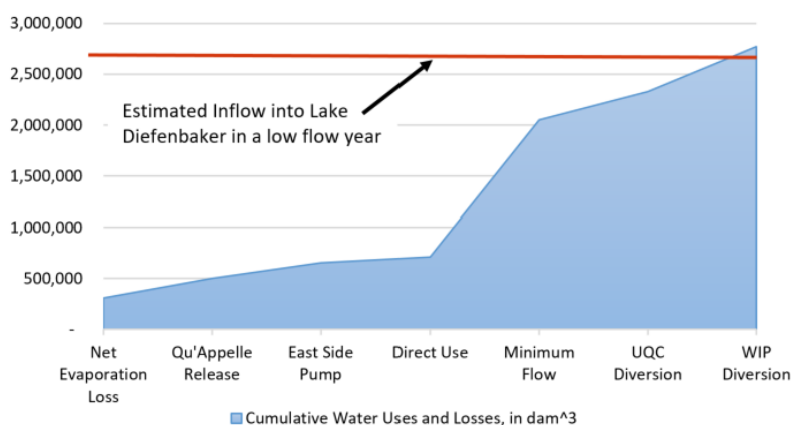
estimated at \$3.27 billion for both projects, could be covered through a number of potential funding ratio scenarios. Any scenario is subject to further negotiation by the parties.

## 5.0 Environmental Considerations

Overlaying the possibility of advancing irrigation and water infrastructure projects in Saskatchewan are the very real and important environmental impacts and considerations. Over the past year, WD's work and engagement has raised several important questions and concerns that will need to be adequately addressed and answered, to advance these projects with widespread public support, and with minimal negative environmental impacts. This section describes some of the most pressing environmental concerns, and suggests initial steps for how the project proponent should address and continually reduce these environmental risks.

### 5.1 Water Availability in Lake Diefenbaker: Trade-offs and Forecasting

**Figure 4 – Cumulative water uses and losses in a low flow year, compared to available inflow at Lake Diefenbaker**



The possibility of expanded irrigation raises important questions about the availability of water resources in Lake Diefenbaker, in years with an average flow from Alberta, and in years with a low flow. Recent water modelling for Lake Diefenbaker shows that from 1981 to 2010, the lowest recorded inflow into Lake Diefenbaker was 2.67 million dam<sup>3</sup>.<sup>28</sup> Using the highest estimations for the other water uses and losses from 1981 to 2010, situated in this low flow

year, the total outflow requirements (including evaporation losses), accounted for 76.6% of the available inflow.<sup>29</sup> In the most extreme drought scenario, the combined diversions from the UQC and WIP could require 720,000 dam<sup>3</sup>, representing about 27% of all inflow in a low flow year, and pushing the water requirements past 100% (see Figure 4 for a graphical representation).<sup>30</sup> Although irrigators in the Lake Diefenbaker region typically use less than 1% of the inflow in a given year,<sup>31</sup> and irrigation technology has become more efficient in its water use over time, irrigators need to be aware that in years of exceptional drought, they may not receive their anticipated water allocations. In a median flow year, the required water diversions for the UQC and WIP are reduced, totalling 129,000 dam<sup>3</sup> and 196,000 dam<sup>3</sup> respectively. In a median flow year, when the inflow into Lake Diefenbaker is estimated at around 6.9 million dam<sup>3</sup>, the combined water diversions for both projects account for less than 5% of the inflow.<sup>32</sup> When both projects are included, the total outflow requirements, including evaporative losses, account for approximately 31% of all available inflow into Lake Diefenbaker (see Figure 5 for a graphical

<sup>28</sup> 1 dam<sup>3</sup> represents a volume of 1 cubic decameter, which is equivalent to 1,000 cubic meters.

<sup>29</sup> Water Security Agency, [State of Lake Diefenbaker](#) (October 2012).

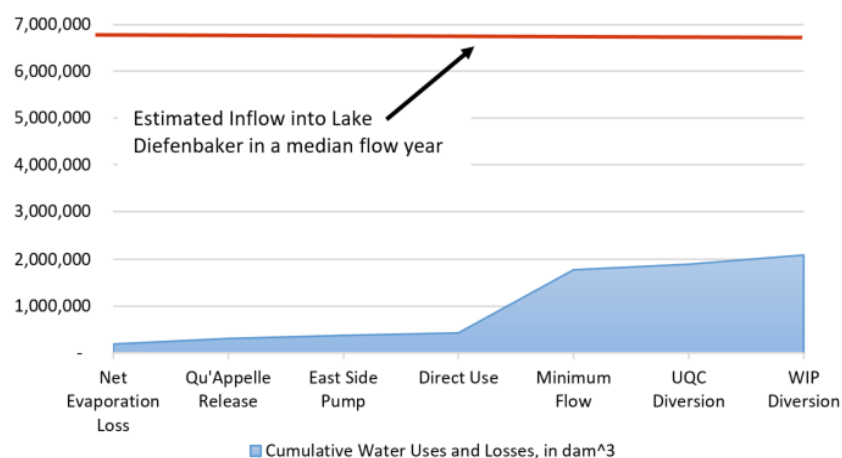
<sup>30</sup> Data gathered from Clifton Associates, *Upper Qu'Appelle and Westside Irrigation Projects Summary Document* (2020), and Water Security Agency, [State of Lake Diefenbaker](#) (October 2012).

<sup>31</sup> Water Security Agency, [State of Lake Diefenbaker](#) (October 2012) – assuming less than 52,600 dam<sup>3</sup> for all direct uses in a median flow year.

<sup>32</sup> The median flow year was calculated by taking the median flow for the years 1981-2010, as calculated in Water Security Agency, [State of Lake Diefenbaker](#) (October 2012).

representation). At present, water modelling<sup>33</sup>, which did not account for climate change, shows that only in the most extreme conditions will the water resources of Lake Diefenbaker be insufficient to meet all of the annual uses and losses. The possibility, however, should require a review of the operating objectives of Lake Diefenbaker, in anticipation of a possible drought event.

**Figure 5 – Cumulative water uses and losses in a median flow year, compared to available inflow at Lake Diefenbaker**



There are also trade-offs that will occur as irrigation is expanded, as there are multiple users and uses for the water resources in Lake Diefenbaker, all with their preferred lake level. Irrigation infrastructure benefits from a stable lake level, as pumping costs and intake infrastructure costs are reduced if the lake level remains consistent. Recreational users, who currently enjoy three provincial parks, over 800km of shoreline, and multiple water-based activities on Lake

Diefenbaker, also prefer stable lake levels. However, prioritizing a stable lake level for irrigation and recreational users involves trade-offs with hydropower production and flood prevention, as there is less flexibility in the operation of Lake Diefenbaker when lake levels are kept constant.<sup>34</sup> Further, as irrigation diverts more water out of Lake Diefenbaker, the reduction of hydropower production from three hydropower plants that use the water from Lake Diefenbaker will incur a quantifiable economic cost.<sup>35</sup> As these examples showcase, further analysis will be needed to arrive at an understanding of the required trade-offs of expanded irrigation and water conveyance from the UQC and WIP.

## 5.2 Increased Contaminants from Agricultural Inputs

An important consideration is the impact of increased contaminants on downstream rivers and water bodies from agricultural inputs.<sup>36</sup> If not properly managed, nutrients and pesticides from agricultural systems can be lost to surface water bodies, resulting in reduced water quality. As an agricultural system, irrigation development could impact the water quality in the Saskatchewan and Qu'Appelle River Systems if the associated use of agricultural inputs results in the increased introduction of nutrients, sediments, and pesticides into downstream streams and rivers via drainage water.

<sup>33</sup> Lindenschmidt, K. E., P. Lloyd-Smith, S. Razavi, S. Mustakim A. Shah, H. Carlson and J. Terry, Hydrological and Economic Assessment of the Upper Qu'Appelle Water Supply Project, Global Institute for Water Security, University of Saskatchewan, January 31, 2020.

<sup>34</sup> Water Security Agency, [State of Lake Diefenbaker](#) (October 2012)

<sup>35</sup> Ibid – The exact cost of lost hydropower production is not known at this time.

<sup>36</sup> Lindenschmidt, K. E., P. Lloyd-Smith, S. Razavi, S. Mustakim A. Shah, H. Carlson and J. Terry, Hydrological and Economic Assessment of the Upper Qu'Appelle Water Supply Project, Global Institute for Water Security, University of Saskatchewan, January 31, 2020.



Drainage water that moves excess water off fields or the farm either naturally or by constructed channels will eventually reach irrigation canals, wetlands, creeks, rivers, or lakes. These water bodies are used for drinking water, irrigation, industrial use, and/or recreation activities, and most sustain aquatic and wetland ecosystems. The negative impacts most commonly associated with increased agricultural drainage result from increases in the amount of nitrogen (N) and phosphorous (P) in downstream surface and groundwater. Increases in the amount of N and P, coupled with warmer weather, can lead to algae blooms in water bodies. Algae blooms ultimately cause low levels of dissolved oxygen in the water, in turn, killing fish and other aquatic animals.

Groups such as the Partners FOR the Saskatchewan River Basin (PSFRB) have raised concerns about the impact that increased agricultural and irrigation development could have on downstream water quality. The Saskatchewan River Delta is downstream from the irrigation development that may occur in the WIP, and as one of the largest inland deltas in North America and one of the most biologically rich landscapes in Canada, potential impacts on the water quality in the delta is cause for concern. With this in mind, the design, construction, and operation of the irrigation infrastructure needs to ensure that the environmental outcomes from agricultural drainage are continually improved over time, and that the health of the Saskatchewan River Delta is monitored continually.

### 5.3 Impact Assessment Agency of Canada

An important opportunity for Indigenous rights-holders and water stakeholders to raise both their concerns and the expected benefits of the projects is during the federal impact assessment process, which is expected to be a requirement for both of the projects under consideration. The Impact Assessment Agency of Canada (IAAC) is responsible for developing impact assessment reports for the Minister and/or Cabinet.<sup>37</sup> The process involves five phases: planning; impact statement; impact assessment; decision-making; and, post-decision. During the planning phase, the public and Indigenous groups are able to identify any key concerns, including any potential impacts on their rights. To the extent possible, the project proponent (which could include a provincial ministry, agency, or Crown corporation), and expert federal departments, find and conduct any relevant studies to address the raised concerns and issues. Throughout the process, interested Indigenous rights-holders and stakeholders are able to participate in public hearings and engagement sessions as the project moves along the five phases. This process is an important opportunity for concerned Indigenous rights-holders and stakeholders to raise environmental, health, social, and economic impacts of the proposed projects.

The entire impact assessment process can take between 1.5 and 6 years, depending on the complexity of a project, the amount of consultation required, the magnitude of anticipated adverse impacts, and the amount of detail required to inform decision-making. The Minister and/or Cabinet then makes a ruling as to whether a project's adverse impacts are in the public interest, and establishes any conditions for the proponent. In the case of the irrigation and water infrastructure projects, the proponent may then be required to amend the design of the projects, to help mitigate any anticipated adverse impacts. After a positive decision, the IAAC is active in verifying a proponent's compliance with any imposed conditions. The work of WD and other concerned Indigenous rights-holders and stakeholders will help enable the IAAC to study the full range of impacts from these projects.

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<sup>37</sup> Government of Canada, [Impact Assessment Process Overview](#) (2020).



## 5.4 Considerations to Address and Reduce the Environmental Risks

Recent reports suggest that certain irrigation system designs can improve water quality and reduce contaminant loads as water moves downstream from irrigation districts.<sup>38</sup> Importantly, this includes the availability of wetlands in reducing the impact of N and P loading in the Qu'Appelle Watershed.<sup>39</sup> However, the degree to which agricultural runoff will impact groundwater and surface water quality in the region cannot be fully anticipated. In part, this is because the effects of agricultural inputs on surface and groundwater quality are dependant on multiple local factors. This includes the drainage characteristics of the soil, the regional geological and hydrological characteristics of the region, and the timing and intensity of local precipitation. Individual producer choices will also impact irrigation drainage quality, such as crop and livestock choices, the type and amount of fertilizers and pesticides used, and the type of irrigation that is employed. Even if all of these factors were known in advance, little work has been done in other regions to evaluate the relationships between land-use and irrigation water quality, further limiting the known impacts of irrigation on downstream water quality in the region.<sup>40</sup>

Another unknown and important factor is the design of the water conveyance and drainage infrastructure. Since September 2015, the Water Security Agency (WSA) has been implementing the Agricultural Water Management Strategy. New regulations, legislation and policies have been implemented to support better irrigation and drainage practices.<sup>41</sup> Collaboration between the WSA and other water partners could ensure the irrigation projects utilize the most effective drainage plans. Mitigation efforts should also incorporate guidance from groups with a vested interest in downstream water quality, including the PFSRB. As has been shown in Alberta and other jurisdictions with advanced irrigation systems, the design of irrigation projects can mitigate the degree to which agricultural nutrients will negatively affect downstream water quality. Yet the difficulty of knowing the impacts beforehand increases the importance of the impact assessment process, to study the range of potential impacts, to help guide the initial efforts to reduce the environmental risks of these projects, and to establish a monitoring program to make course corrections over time.

With these factors in mind, the project proponents should consider the following steps throughout the design, construction, and operation of the irrigation projects, to help reduce the environmental impacts over time. These listed considerations are a starting point, and should not be thought of as an exhaustive list.

Study the project impacts using the Impact Assessment Process and other sources of information:

- Study the known environmental impacts of contaminants from agricultural inputs, and their impact on surface and groundwater quality.
- Study the impact of agricultural inputs on the health of the Saskatchewan River Delta.
- Study best practices in other jurisdictions to manage agricultural drainage from irrigation infrastructure.

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<sup>38</sup> Alberta Agriculture and Forestry, [Water quality in Alberta's irrigation districts 2011 to 2015 : 2014 progress report](#) (2014).

<sup>39</sup> Jennifer Roste and Helen Baulch, [Qu'Appelle Watershed, SK Land-Use and Water Quality](#) (Global Institute for Water Security, 2018).

<sup>40</sup> Alberta Agriculture and Forestry, [Water quality in Alberta's irrigation districts 2011 to 2015 : 2014 progress report](#) (2014).

<sup>41</sup> Water Security Agency, Government of Saskatchewan, [What is the new Agricultural Water Management Strategy?](#) (2017).

- Study the water balances of Lake Diefenbaker, including projections of climate change and changing extreme.
- Study the benefits of joint, sustainable surface and groundwater management, including the role of groundwater in meeting irrigation water demand.
- Consider the concerns of a wide range of Indigenous rights-holders and stakeholders and develop plans to address them.

#### Design and Implementation:

- Design the irrigation infrastructure and operational plans to employ the known best practices, and to surpass legislative and regulatory standards.
- Design the infrastructure to utilize existing or constructed wetlands to help retain and naturally process as much agricultural drainage as possible.
- Do not allow the use of flood irrigation, as it is more likely to transport agricultural inputs off the land and into water bodies.

#### Continual Monitoring:

- Establish a continual monitoring system in the irrigation districts and nearby water bodies to collect data on water quality and other information as required.

#### Course Correct as Information is Made Available:

- Based on the monitoring of water quality, adjust the operations and design of the irrigation infrastructure to seek continual improvements to water quality as it enters nearby water bodies.
- Limit certain fertilizers or pesticides if these are shown to disproportionately impact water quality in the region.

## 6.0 Conclusion

The vision for Saskatchewan and the Prairies provided in this report is achievable and timely. This is a long-term vision for the Prairies, where Saskatchewan harnesses its agricultural and growth potential for the benefit of all, and one where the water resources across the Prairies are managed sustainably and equitably through a coordinated and collaborative manner. The benefits of this vision include enduring and broadly available economic benefits, alongside climate change preparedness for communities. These benefits are available to all residents across the Prairies and Canada for generations to come. This is the right moment to take a bold stance, and to advance WD's recommendation.

## Annexes

### Annex 1: Overview of Financial Models for Water Projects<sup>42</sup>

**Public Sector Grants:** A traditional model, public sector grants involve some combination of federal, provincial, or municipal contribution to capital and/or operational projects costs. Typically, grants are distributed to eligible recipients through an application process, are non-repayable, and are subject to a number of conditions, including specified use. Other common conditions include a proportional contribution by the recipient, maintenance of certain standards, and regular project progress reports. Grants finance capital costs outright, absorbing large costs early, but incur no debt nor interest payment obligations. Typically, public sector grants limit the financial impact on users, although users may be required to pay utility fees at rates sufficient to cover ongoing operations and maintenance. One challenge with public sector grants is that a change in government can change infrastructure priorities or funding availability.

**Government Loans or Guarantees:** Government-backed financing is another traditional model, whereby there is an expectation of repayment that supports capital (most common) and/or operating investments, with terms defined in legally-binding agreement(s). Loans are obtained by a level of government, often with discounted interest rates, and may be provided to another level of government or a third-party entity under agreed upon terms. The terms typically include factors related to repayment term, financing costs, covenants relating to oversight and control, ownership and decision-making considerations, and reporting requirements. Loan financing may be provided as part of a formal program established by government, or on a project specific basis. While government loans or guarantees can support a project's long-term financial stability and reduce risk for beneficiaries, they may limit government borrowing capacity for other/future projects.

**Rate Based Support / Debt Financing:** In this well-established model, financing is obtained by the project owner from the private sector (typically banks or investors), for capital costs, with terms defined in legally binding agreement(s). The financing is typically repaid over time through an assumed revenue or cost-recovery stream. In addition to providing needed upfront capital, this model is flexible (i.e. various financing vehicles – bonds/debentures, mortgage-style debt – may be used to best align with the needs of the project). This model can increase overall project costs, and typically requires demonstration of some pre-existing equity.

**Industry Contributions:** This model is typically part of a broader project funding arrangement and involves one time or ongoing contributions from private sector organizations that receive economic benefit from the project. Funding is typically provided on a standard, agreed-upon rate or unit cost. Generally, the organization operates the infrastructure, charging a user fee for the service it provides. This model can insulate governments from financial risk; however, it is often difficult to obtain sufficient upfront funds for initial infrastructure development. In addition, this model can concentrate the majority of benefits in the hands of private sector investors.

**Public-Private Partnerships (“PPP”):** Public-private partnerships are gaining popularity in Canada and around the world for establishing new infrastructure, including recent projects in Saskatchewan. A long-term service contract between the public and private sectors is established, where the public sector pays the private sector (typically a consortium) to deliver infrastructure and related services. The contract, drafted and signed by all involved parties, outlines their roles and responsibilities concerning

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<sup>42</sup> KPMG, Jurisdictional Scan and Financing Models of Water Irrigation Projects, 2020

design, construction, financing, maintenance, operation, ownership and governance. The PPP model, when executed well, can result in faster project completion, while distributing risk among public and private partners. In some cases, public sector costs are higher than anticipated due to the requirement for private participants to be compensated for their level of investment and the risk they assume.

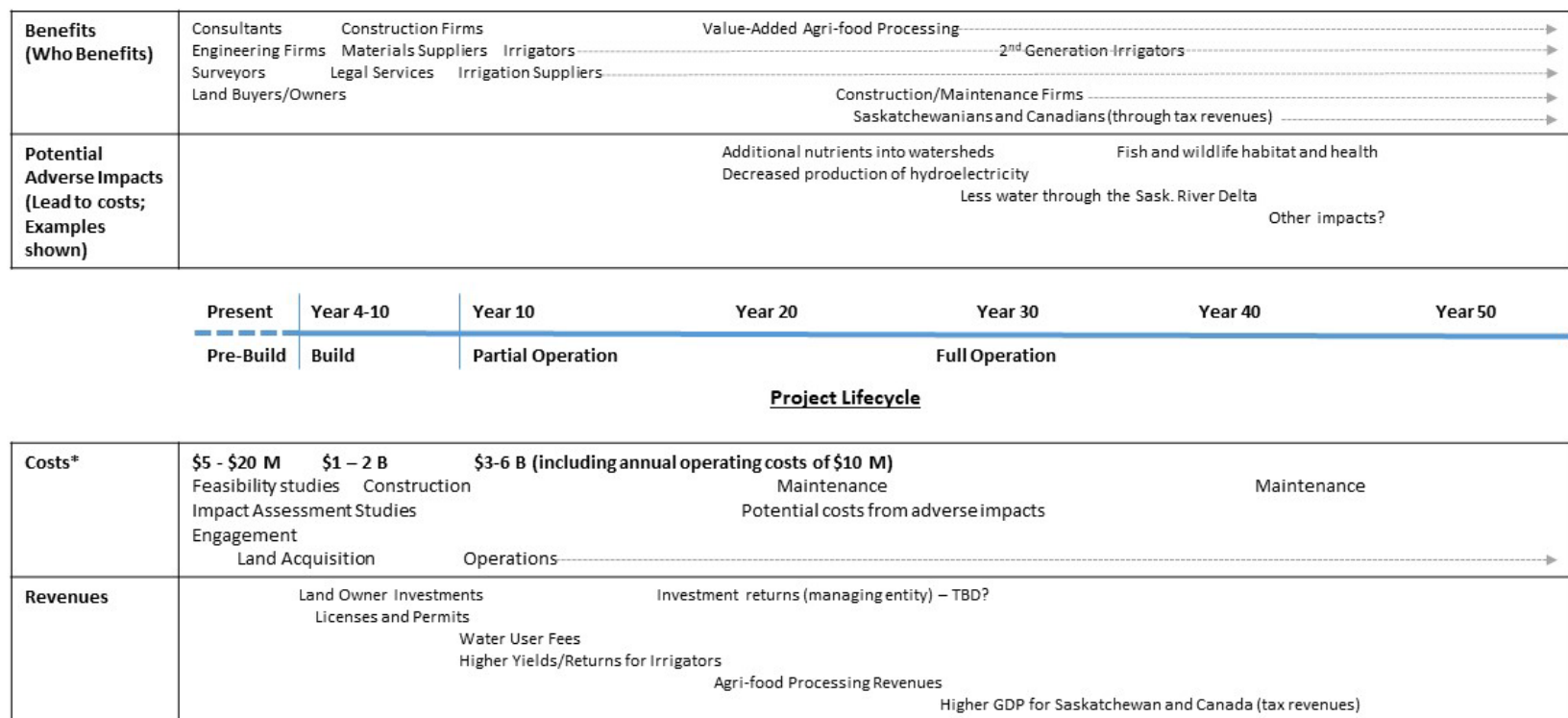
**Tax Increment Financing (“TIF”):** This model involves the generation of additional tax revenues based on an increase in the tax base that new infrastructure brings (i.e. irrigation/water infrastructure increases property values, which leads to increased tax revenue without having to increase the tax rate or add a new tax). TIF is collected within the area that directly benefits from the new infrastructure. Advantages of incorporating TIF elements into the financial model include increasing the value of under-utilized land without burdening existing taxpayers. The timeline of repayment can be a challenge (some projects take decades to pay off using this model), and relying solely on this model carries the risk that benefits/returns never materialize.

In practice, large projects generally rely on a hybrid model or combination of various funding/financing models at each project stage.

- **Feasibility Studies and Capital / Construction** typically involve a combination of sources, including a material public sector investment.
- **Operating / Operations & Maintenance** are often user funded through various rate-based approaches.
- **Lifecycle / Rehabilitation** may be user funded or publicly funded, depending on the nature of the infrastructure, its beneficiaries, and its contribution to government revenues.
- **Governance and Oversight** typically involves various levels of government with jurisdictional oversight, as well as other parties with a vested interest. Governance and oversight depends on local conditions and the nature of the infrastructure.

Given the long timeframe to develop major irrigation projects and the time it takes for the infrastructure to generate returns, there may be an opportunity to attract private investment to the project through a “base” level of investment by federal and provincial governments. Legal entities could be established to manage project funding, pay for the initial steps of infrastructure development, while investing a portion to realize returns and cover longer-term capital and operating expenses. Additional cost recovery through a user fee or royalty structure could be implemented as the project becomes fully operational.

## Annex 2: Irrigation Lifecycle Mapping: Benefits, Impacts, Costs, and Revenues<sup>43</sup>



\* Costs for Pre-Build/Build are based on current estimates. Projected costs for ongoing operations, maintenance and reparations are based on research from around the world suggesting that the costs over the life of irrigation infrastructure are often higher than projected. This is due to inflation, higher than anticipated maintenance costs and costs to increase efficiencies, as well as costs to account for unforeseen environmental and social impacts.

<sup>43</sup> This lifecycle map is intended for illustrative purposes only, and is informed by the experience of other jurisdictions. Long-term costs and revenues are subject to change. Construction and maintenance costs are per project.

## Annex 3: Considerations for Increased Coordination to Manage Water Resources and Prepare for Climate Change on the Prairies

In addition to pursuing the infrastructure in Saskatchewan, WD believes that the pursuit of enhanced coordination and collaboration is important to help safeguard Prairie water resources for the future in light of projected climate change impacts. Degraded water quality, agricultural and municipal drought prevention, and flood mitigation, are all challenges that the Prairies will face in the coming decades, and whose impacts will be exacerbated by climate change. All of these challenges can be proactively managed to some extent by establishing a more coordinated approach to water management. This section describes basic Prairie hydrology, water governance, and some of the benefits of enhancing coordination and collaboration to manage water resources.

### Overview of Prairie Hydrology

Water resources in the Prairie provinces of Alberta, Saskatchewan, and Manitoba, are highly interconnected. In the more populous southern region of the provinces, the highest runoff is primarily generated in the headwaters of the Rocky Mountains. These headwaters flow eastward through Saskatchewan, and into Manitoba. As Figure 6 displays, the decisions and actions taken in one province for water allocation, irrigation drainage, wetland preservation, agricultural inputs, and industrial investment decisions are all compounded as water moves eastward.

This chain of consequences has had detrimental impacts on water quality across the Prairies, and will continue to do so, until these water resources are managed more proactively. Saskatchewan's most important reservoir, Lake Diefenbaker, has seen declining water quality since it was constructed in the 1960's. The factors that influence water quality in Lake Diefenbaker are difficult to isolate, but the greatest impacts seem to result from the agricultural activities and fertilizer inputs from Alberta's southern agricultural regions, which feed into Lake Diefenbaker.<sup>44</sup> Similar processes have led to the degradation of Lake Winnipeg, whose annual algae blooms have impaired the ecological balance of aquatic life, damaged the water quality in the lake, and negatively affected the fishing and tourism industries that Lake Winnipeg supports.<sup>45</sup> As the expansion of agriculture and agri-food output is a key component of each province's economic strategy, and as Saskatchewan aims to significantly expand irrigation in the province, the issue of agricultural inputs and industrial activity impacting downstream water quality will increase over time. To safeguard the health of Lake Diefenbaker, and other transboundary lakes, streams, and rivers, and to protect our groundwater, the management

**Figure 6 – Major River Systems across the Prairies**

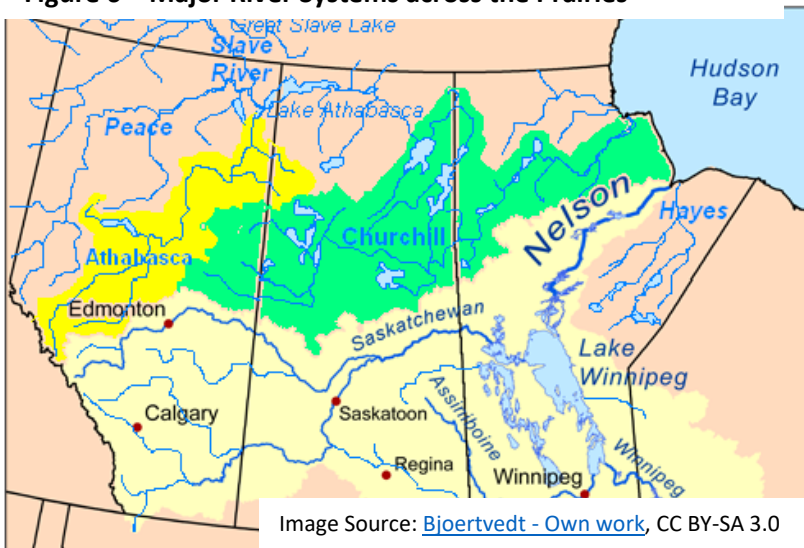


Image Source: [Bjoertvedt - Own work](#), CC BY-SA 3.0

<sup>44</sup> Meagan Hinthner, [Water quality of Lake Diefenbaker may go with the flow](#) (University of Saskatchewan, 2015).

<sup>45</sup> Environment Canada, [Progress Report on the Lake Winnipeg Basin Initiative 2012-13 and 2013-14](#) (Environment Canada, 2014).



of these resources needs to be coordinated more actively among Indigenous rights-holders and water stakeholders across the Prairie provinces.

Further, climate change impacts will have pronounced and varied impacts on water resources across the Prairies. According to various climate models, future stream flows on the Prairies could shift, with summer flows expected to decrease due to more winter melt events, more precipitation falling as rain, and earlier spring melt events and runoffs.<sup>46</sup> Climate change will also cause the Prairies to have warmer and drier summers, with less soil moisture available for agriculture, and more severe, localized flood events.<sup>47</sup> All of these climate change impacts will strain the capacity of communities and water stakeholders to launch effective mitigation and adaptation strategies on their own, and will place additional stresses on groundwater resources.

The following are general statements on surface-water hydrology in the Prairies, based on the work by WaterSMART, and information provided by provincial governments in Alberta, Saskatchewan, and Manitoba.

- Watersheds across the southern region of the Prairies generally originate in the headwaters of the Rocky Mountains, where the highest runoff is primarily generated (see Figure 7). Sub-regions that do not receive inputs from the Rocky Mountains typically have little water available and unreliable water supplies.
- The timing of surface water availability is seasonally dependent. Headwater sub-regions produce most water during the summer, while prairie sub-regions melt in early spring and can have low flows or be dry by summer.
- An increase in the likelihood of extreme weather events including flooding, drought, wildfire, and heat waves is expected due to climate change.
- According to various climate models, future stream flows on the Prairies could shift, with summer flows expected to decrease due to more winter melt events, more precipitation falling as rain, and earlier spring melt events and runoffs. While parts of Prairies could benefit from warming summer temperatures and a longer agricultural growing season, it could become more challenging for farmers to access the water they need for their crops, as more soil moisture deficits and droughts are anticipated.<sup>48,49</sup>

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<sup>46</sup> Environment and Climate Change Canada, [Canada's Changing Climate Report](#) (Environment and Climate Change Canada, 2019), Chapter 8.

<sup>47</sup> Henderson, N. and Sauchyn, D. editors, [Climate Change Impacts on Canada's Prairie Provinces: A Summary of our State of Knowledge](#) (Prairie Adaptation Research Collaborative, 2008).

<sup>48</sup> Environment and Climate Change Canada, [Canada's Changing Climate Report](#) (Environment and Climate Change Canada, 2019), Chapter 8.

<sup>49</sup> Climate models make use of the best possible information and data to identify potential future environmental conditions and scenarios. While they are never 100% accurate, they are useful for planning purposes and the accuracy of projections is improved when the results of various models are combined as in the Environment and Climate Change Canada report referenced above.



**Figure 7 – The Prairie region sub-basins across the Saskatchewan, Missouri, Assiniboine River, and Lake Winnipeg watersheds<sup>50</sup>**



Source: WaterSMART Solutions, 2020

## Water Governance on the Prairies

Jurisdiction over water and land management in Canada is complex. While provinces are primarily responsible for the management of natural resources, the federal government shares responsibility for the management of transboundary waters, and the review of certain land development and infrastructure projects. The federal government works closely with Indigenous partners to support land and water management on reserves. The federal government is also responsible for certain aspects of managing fisheries and aquatic ecosystems, as well as shared lakes and waterways with the United States.

Currently, the federal government works with the Prairie provinces on transboundary-related water activities through the PPWB. The central role of the PPWB is to administer the MAA, which outlines how the three provincial jurisdictions are to share the transboundary waters, and includes general provisions regarding water storage and water quality. To date, the MAA is viewed as a success in ensuring that Saskatchewan and Manitoba receive the water that they are due. Currently, actual water consumption tends to be significantly less than each province's allocation. However, given the expected changes to the climate in the Prairies, and growing demand for water in Alberta and Saskatchewan, there is a chance that the interprovincial agreement will be challenged in new ways in the coming decades. The PPWB has successfully administered the MAA, but has not historically been a public-facing organization, nor do they currently have the mandate to engage broadly with Indigenous rights-holders and water stakeholders from across the provinces. Enhancing collaboration to consider the joint management of surface and groundwater, and the advancement of any water infrastructure projects, would help safeguard the Prairie's precious water resources.

<sup>50</sup> In describing Prairie hydrology, WD chose to focus on the southern Prairie regions for several reasons; the north is not as densely populated, most of the agricultural activity takes place in the southern region, and the north is also wetter in all three provinces.

Inherent water rights for Indigenous peoples are an important part of the governance picture in Canada and on the Prairies. These rights can stem from treaties, as well as a continuation of rights and responsibilities retained by Indigenous groups, rather than ceded to federal or provincial levels of government. An approach for managing water in the Prairies will require significant input, ongoing engagement, and partnerships with Indigenous rights-holders. This also applies to the consideration and development of any infrastructure to enhance water security and expand irrigation, if the infrastructure will impact, or has the potential to impact, the water rights of a First Nations community. Although some level of engagement and collaboration is required by legislation such as the *Impact Assessment Act*, the impact assessment process on its own, is a necessary, but insufficient condition of Indigenous engagement and partnership as the irrigation projects are advanced. Indigenous rights-holders need to be engaged in a meaningful way to have their perspectives and concerns addressed throughout the development of irrigation infrastructure and water management strategies.

In addition to federal, provincial and Indigenous governance of water, several formal and informal partnerships, and non-governmental organizations, have been formed to improve integration and collaboration in water management. For example, across Alberta, Saskatchewan and Manitoba, the Partners FOR the Saskatchewan River Basin was established in 1993 to promote stewardship and sustainability and deliver corresponding programs to contribute to the environmental health of the entire basin. Another example is the Lake Winnipeg Foundation, which advocates for change and supports programs and initiatives to improve the health of Lake Winnipeg. These organizations and partnerships play an important role, often viewing the lakes and rivers as their primary client, while other governance bodies can be more concerned with water quantity and quality from a human-use perspective.

### **Benefits of Enhancing Coordination and Collaboration**

Through enhanced coordination and collaboration, there would be a greater understanding of the downstream and upstream impacts of water infrastructure, more consistent and transparent data to draw on, better water modelling, more public engagement on water management and infrastructure development, and established relationships between inter-provincial water stakeholders. Similarly, the consideration of irrigation projects in Saskatchewan would provide an important learning opportunity as other provinces seek to advance their own water management projects to enhance climate change preparedness and support economic growth.

WaterSMART, in partnership with WD, held Prairie water workshops in Alberta, Saskatchewan and Manitoba, where participants identified and discussed water management challenges, opportunities and priorities. WaterSMART also shared the projected implications of changing climatic conditions on water resources at each of the three Prairie water workshops to validate the findings, identify gaps, and inform discussions on water management issues and opportunities. Based on these workshops, common challenges and opportunities were identified.

- Indigenous rights-holders and stakeholders in the Prairies want to be involved in water management planning that represents diverse perspectives, protects water quality, and builds resilience to extreme events. Public education and outreach to raise awareness and understanding of water management issues are needed to facilitate increased and meaningful stakeholder involvement.
- Provincial water managers need trustworthy, real-time and consistent data and tools to make informed decisions that align with thoughtful planning objectives.



- Inter-provincial, coordinated planning objectives across the Prairies are critical to ensure long-term sustainability of shared water resources at risk from changing climatic conditions.

One example of a successful multi-stakeholder approach to water resource coordination and management is the Northwest Territories (NWT) Water Stewardship Strategy. Since 2008, The NWT has been refining and implementing this comprehensive freshwater strategy along with all of their water partners.<sup>51</sup> Similar to the Prairies, the water basins across the NWT are large and highly interconnected. This has required a coordinated approach, given the transboundary implications, the diverse water responsibilities and roles among the stakeholders, and the need to enhance the capacity of water partners in the region. The NWT Water Stewardship Strategy is an iterative strategy that focuses on key outcomes, and tracks their progression over time. These include the collection and dissemination of data on the state of water resources, involving local communities in the research and monitoring initiatives, public education and communication, and many others. The NWT Water Stewardship Strategy recognizes that the freshwater resources of the NWT territories are too dispersed and too important for water partners to manage as silos – it requires the combined and coordinated effort of all water partners in the region. A similar approach could greatly benefit the Prairie provinces.

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<sup>51</sup> Government of Northwest Territories, [\*Northern Voices, Northern Water: NWT Water Stewardship Strategy\*](#) (2018).