ALBERTA WATER COUNCIL

Protecting Sources of Drinking Water in Alberta

COMPANION DOCUMENT

About the Alberta Water Council

The Alberta Water Council (AWC) is a multi-stakeholder partnership with members from governments, industry, and non-government organizations. All members have a stake in water.

The AWC is one of three partnerships established under the *Water for Life* strategy: the others are Watershed Planning and Advisory Councils and Watershed Stewardship Groups.

The AWC regularly reviews the implementation progress of the *Water for Life* strategy and champions the achievement of the strategy's goals. The AWC also advises the Government of Alberta, stakeholders, and the public on effective water management practices, solutions to water issues, and priorities for water research. However, the Government of Alberta remains accountable for implementing the *Water for Life* strategy and continues to administer water and watershed management activities throughout the province.

Alberta Water Council
14th Floor, Petroleum Plaza South Tower
9915-108 Street
Edmonton, AB T5K 2G8

Tel: 780-644-7380
Email: info@awc-casa.ca
Web: www.awchome.ca

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Contents

List of Tables 2
List of Figures 2
Acronyms 3
Executive Summary 4
1.0 Introduction 6
2.0 Source Water Protection Practices, Processes, and Risks to Drinking Water Sources 13
3.0 Complementary Source Water Related Initiatives 61
4.0 Source Water Protection Approaches and Risk Management Models in Selected Jurisdictions 64
5.0 Identified Successes, Gaps, Barriers, Redundancies, and Lessons Learned 73
6.0 A Guidance Document 88
Appendices 90
Appendix A Terms of Reference 91
Appendix B Acknowledgments. 94

List of Tables

Table 1: Similarities and Difference between DWSPs and SWP plans. 27
Table 2: Drinking Water Risks; Common Practices; and Risk Management Approaches, Tools, and Resources 30
Table 3: Focus on Source Water Protection Approaches 46
Table 4: Drinking Water Testers 52
Table 5: Key Findings from Complementary Source Water-Related Approaches 61
Table 6: Comparison of Jurisdictional Findings to the Alberta Context. 67

List of Figures

Figure 1: Components of the Multi-Barrier Approach to Protecting Drinking Water (Adapted from Canadian Council of Ministers of the Environment (CCME), 2004).. 9
Figure 2: Alberta Drinking Water Systems and WPAC Regions 16
Figure 3: Number of AEP Regulated Drinking Water Systems by Land-Use Region in Alberta. 19
Figure 4: Water Sources Used by Drinking Water Systems in Alberta (regulated by AEP). 20
Figure 5: Number of Drinking Water Systems Regulated by AEP and the Source Water Type used in each Land-Use Region in Alberta 21
Figure 6: Existing Source Water Protection Plans by Land-Use Region. 25
Figure 7: Source Water Protection and Integrated Watershed Management in Alberta (Adapted from the City of Calgary's Source Water Protection Plan 2018). 26
Figure 8: Involvement in Source Water Protection 45
Figure 9: Source Water Protection Target Audiences. 47
Figure 10:Ranking of Source Water Protection Tools 49
Figure 11:Type of Drinking Water Source 51

Acronyms

AAF	Alberta Agriculture and Forestry
AEP	Alberta Environment and Parks
AUMA	Alberta Urban Municipalities Association
AWC	Alberta Water Council
AWWA	American Water Works Association
AWWOA	Alberta Water and Wastewater Operators Association
DWSP	Drinking Water Safety Plan
GoA	Government of Alberta
GoC	Government of Canada
GWUDI	Groundwater Under the Direct Influence (of Surface Water)
IWMP	Integrated Watershed Management Plan
NGO	Non-government Organization
RMA	Rural Municipalities of Alberta
SWP	Source Water Protection
WPAC	Watershed Planning and Advisory Council
WSG	Watershed Stewardship Group

Executive Summary

In 2018, the Alberta Water Council established a project team to provide guidance for protecting public, private, and individual drinking water sources across the province. This work is intended to advance outcomes of the *Water for Life* strategy; Our Water, Our Future – A Plan for Action; applicable regional plans; and other pertinent initiatives.

The project team documented source water protection (SWP) practices and processes, risks to drinking water sources, and complementary source water related initiatives in Alberta. A jurisdictional scan examined SWP approaches in selected areas to identify what could be applied in the Alberta context. Using this information, the team synthesized challenges and opportunities in protecting drinking water sources and compiled a list of common practices.

Across Alberta, SWP is a voluntary and collaborative process using several approaches and spearheaded by drinking water providers together with Indigenous communities and watershed organizations. Although some regional initiatives have been undertaken to support SWP, there was no common provincial guidance on how to undertake SWP planning and integrate this work with other land and water management approaches. The fundamentals of SWP exist in policies, legislation, and planning processes that are administered by various levels of government in Alberta. However, a more integrated approach that considers upstream and downstream users is required to address current issues and plan for future risks.

Key findings from this work highlight a need to:

- Designate a champion or lead to form a committee with clearly defined roles and responsibilities to develop a SWP plan among public, private, and individual drinking water providers, and other key groups.
- Align SWP plans with Drinking Water Safety Plans (DWSPs) when developing, implementing, and evaluating both plans.

- Bolster collaboration among drinking water providers, governments, Indigenous peoples, watershed groups, and other key groups (e.g., research and academia) when developing a SWP plan.
- Secure funding and technical support and develop centralized tools to encourage and support SWP planning (e.g., risk mapping tools and real-time water quality data).
- Strengthen public awareness about the importance of drinking water sources and why we must protect them.
- Clarify how SWP plans should be integrated with other initiatives in the province (e.g., DWSPs, water management plans, Integrated Watershed Management Plans (IWMP), regional land-use plans, and municipal development plans).

This companion document summarizes the findings to be considered when protecting public, private, and individual drinking water sources in Alberta. The report should be used together with the *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning*[1] that provides advice to drinking water providers on how to develop a SWP plan in collaboration with key groups in their source water area.

1 Alberta Water Council, 2020. Protecting Sources of Drinking Water in Alberta Guide to Source Water Planning. Available online: https://www.awchome.ca/projects/protecting-sources-drinking-water-alberta-2/.

1.0 Introduction

Having access to safe and secure drinking water sources is important for the health and well-being of Albertans as stated in the Government of Alberta's *Water for Life* strategy. Many factors including a growing population, climate change, aging infrastructure, and increasing development have increased the need for a more integrated approach to protecting sources of drinking water in Alberta. Protecting these sources can minimize the costs of drinking water treatment, reduce public health risks, and strengthen natural ecosystems. As the following case studies demonstrate, contamination of drinking water sources because of poor management practices has led to human illness and death, disruption in public services, unbudgeted costs, and damage to the environment.

Case Studies: Walkerton and North Battleford Drinking Water Incidents

Walkerton, Ontario

The Town of Walkerton, with a population of almost 10,000, is located on the Saugeen River in Ontario and is part of the Municipality of Brockton. Walkerton's drinking water is supplied from groundwater wells located around the town. In May 2000, a waterborne disease outbreak occurred in Walkerton. Over 2,300 people became ill and seven died because of bacterial contamination of their drinking water. The subsequent inquiry determined that a well became contaminated by agricultural runoff after a heavy rainfall event that was not properly monitored and reported by the water provider. The contaminated water was not detected by officials until an investigation was concluded after many residents suddenly became sick. The inquiry recommended source water protection (SWP) training for operators, improved management systems, and more enforcement.

North Battleford, Saskatchewan

In 2001, the City of North Battleford, a rural community of nearly 15,000 people, in Saskatchewan experienced a drinking water disease outbreak. This community uses the North Saskatchewan River as its drinking water source. The city's water treatment plant did not satisfactorily remove suspended solids from the source water, resulting in a filter failure. Water contaminated with a pathogen was released into the system. After the solids contact unit was emptied for inspection, cleaning, and repairs, there was no settling of solids in the unit despite the many efforts of the treatment plant staff. As a result, more than 7,000 people became ill (including about 50 who were hospitalized) with nausea, vomiting, and diarrhea after consuming this water. It was discovered that *Cryptosporidium* was the contaminant. The underlying causes had been recognized as a problem for decades before the outbreak. The outbreak prompted the Province of Saskatchewan to change the way it regulated municipal water utilities. This case study provides a strong argument for a multi-barrier approach and SWP.

1.1 Importance of Source Water Protection

Drinking water sources are susceptible to contamination by various point and non-point source pollutants. Pollutants can come from natural origins or from human activities. Both water quantity and quality influence the condition of drinking water sources. For the purposes of this project, the focus was on water quality. Microbial toxins and infectious pathogens in drinking water can cause gastrointestinal illness, fever, diarrhea, and dehydration, among other things.[2] Extensive or repeated exposure to chemical contaminants can also cause adverse health impacts. Moreover, variations in geography, climate, and the hydrological cycle can create areas and periods of fluctuating water levels that can influence drinking water quality and quantity. For example, drought can lead to lower water levels in aquifers and reduced streamflow in rivers.

2 Water Research Foundation, 2010. *Drinking Water Source Protection Through Effective Use of TMDL Processes*. Available online: http://www.waterrf.org/PublicReportLibrary/4007.pdf. Accessed September 2018.

Floodwater and stormwater can increase water levels and contaminate wells with toxins, chemicals, animal carcasses, septic seepage, and municipal sewage.[3]

Source Water Protection Defined

The project team developed the following definition of source water protection to guide its work:

Source water is untreated, raw water from surface or groundwater sources used for drinking water or other uses. SWP is a risk management process. It is designed to maintain or improve the conditions (quality and quantity) of water through proactive and collaborative identification, assessment, and management of risk.

To safeguard human health, drinking water must be kept clean, safe, and reliable. Consequently, the source, the drinking water treatment plant, the distribution system, and upstream and downstream users must be understood and managed in a holistic manner.

SWP is part of a multi-barrier approach to reduce the risk of contaminating drinking water and increase the feasibility and effectiveness of remedial controls or preventative options.[4] This multi-barrier approach is illustrated in Figure 1. In the United States, reducing the threat of waterborne illnesses can save hundreds of millions of dollars annually by reducing costly healthy care expenses, lost wages, work absences, decreased job productivity, and additional treatment cost incurred by public water systems that are required to meet federal drinking water quality standards[5] The American Water Works Association (AWWA) has produced a new toolkit to help justify the importance of SWP.[6] This toolkit can help drinking water providers and others

3 Water for the Ages, 2008. *Flood Drinking Water Contamination: Risk Factors*. Available online: https://waterfortheages.org/2008/01/05/flood-drinking-water-contamination-risk-factors/. Accessed September 2018.

4 Canadian Council of Ministers of the Environment, 2004. *From Source to Tap: Guidance on the Multi-Barrier Approach to Safe Drinking Water*. Pg. 15. Available online: https://www.ccme.ca/files/Resources/water/source_tap/mba_guidance_doc_e.pdf. Accessed September 2018.

5 United States Environmental Protection Agency, 2002. *Consider the Source: A Pocket Guide to Protecting Your Drinking Water*. Available online: https://www.epa.gov/communityhealth/consider-source-pocket-guide-protecting-your-drinking-water-drinking-water-pocket. Accessed September 2018.

6 American Water Works Association, 2019. *Source Water Protection Justification*. Available online: https://www.awwa.org/AWWA-Articles/new-awwa-toolkit-highlights-source-water-protection. Accessed September 2018.

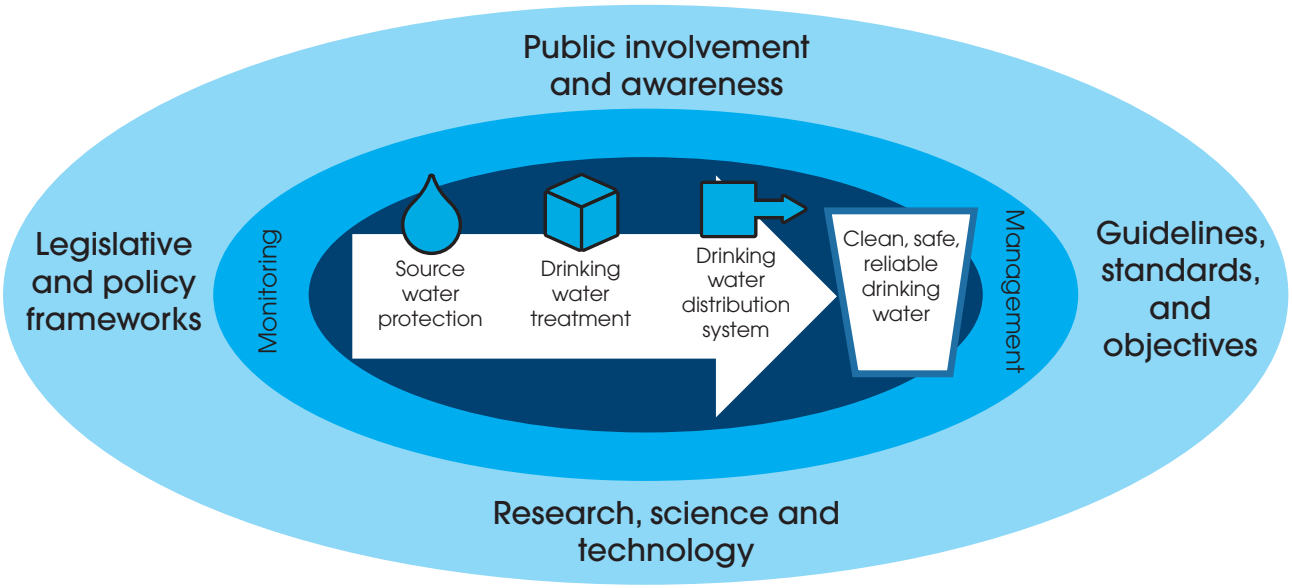


Figure 1: Components of the Multi-Barrier Approach to Protecting Drinking Water (Adapted from Canadian Council of Ministers of the Environment, 2004)

build a business case for SWP and develop or expand their programs. A key driver for undertaking SWP planning is the potential to minimize costs, including operational costs for water treatment or deferred capital costs for future upgrades to treatment infrastructure.[7] Securing access to enough water from high-quality sources and protecting those sources is a priority for all water suppliers and communities. The main objective of SWP is to maintain and improve the quality of a given water source. Other benefits of SWP include the following:

- improving public health, which results in economic benefits from reduced illnesses, mortalities, health care costs, and productivity losses
- reducing uncertainties presented by the growing number of unregulated or unknown emerging contaminants that might not be removed by water treatment systems

7 City of Calgary, 2019. Source Water Protection Plan. Available online: https://www.calgary.ca/UEP/Water/Pages/Watersheds-and-rivers/Souce-Water-Protection.aspx Accessed June 2019.

- reducing costs (e.g., water treatment costs; expenses from contamination remediation; monitoring, engineering and legal expenses; and indirect costs of real estate devaluation)
- increasing the likelihood of complying with drinking water regulations
- improving source water quality for other benefits
- meeting public expectations and maintaining customer confidence
- improving the health of the watershed or aquifer for current and future generations
- improving communication and collaboration among stakeholders and neighbours
- maintaining the cultural importance of water to Albertans including Indigenous peoples

The goals of the *Water for Life* strategy are to ensure safe and secure drinking water, healthy aquatic ecosystems, and reliable, quality water supplies for a sustainable economy.[8] The *Water for Life* action plan includes a commitment to work with Watershed Planning and Advisory Councils (WPACs) to incorporate SWP activities into watershed planning. The 2013 Water Conversations led by the Government of Alberta (GoA) heightened the need for enhanced SWP. In response, Our Water, Our Future – A Plan for Action was released in 2014 with a strategic action to develop a common approach for establishing SWP plans for watersheds in Alberta. The South Saskatchewan Regional Plan (Strategy 4.7) encourages the development of SWP plans and use of SWP measures.

1.2 About This Project

A recurring comment from Albertans who participated in the Water Conversations was that drinking water sources should be rigorously protected. Albertans also stressed that protecting drinking water sources makes sense

8 Government of Alberta, 2003. *Water for Life: Alberta's Strategy for Sustainability*. Available online: https://www.alberta.ca/water-for-life-strategy.aspx. Accessed September 2018.

from an environmental and water management perspective.[9, 10] In response, the GoA came to the AWC in 2017 with a project idea that emphasized the need for a common approach to protecting drinking water sources and integrating planning and risk management processes.

Consequently, in 2017 the AWC approved terms of reference (Appendix A) for a project team to provide guidance for protecting public, private, and individual drinking water sources in Alberta. The team consisted of representatives from governments, non-government organizations, and industry (Appendix B). The project's objectives were as follows:

- synthesize SWP practices, processes, and risks to drinking water sources in Alberta
- document complementary source water related initiatives (i.e., legislation, plans, policies, programs in Alberta, and opportunities for integration and collaboration)
- examine SWP approaches and risk management models in selected jurisdictions
- identify successes, gaps, barriers, redundancies, and lessons learned
- develop a guidance document highlighting best practices

1.3 Methodology

Work on this project began in 2018 with a literature review to document SWP complementary source water related initiatives in Alberta. Several documents were reviewed for this project. The American Water Works Association's G300 SWP Standard was also used extensively to inform this work. Two online surveys were distributed: one to public and private drinking water providers and one to individual drinking water providers. The purpose of the surveys was to gather information about their SWP practices, processes, risks, successes, gaps, barriers, redundancies, lessons learned, and common

9 Government of Alberta, 2014. *Our Water, Our Future – A Plan for Action*. Pg. 14. Available online: https://open.alberta.ca/publications/9781460118900 Accessed September 2018.

10 Government of Alberta, 2014. *Our Water, Our Future; A Plan for Action – A Conversation with Albertans*. Summary of Discussions. Available online: https://open.alberta.ca/publications/9781460118887. Accessed September 2018.

practices.[11] A questionnaire was also sent to drinking water providers in 13 target communities across the province. A consultant worked with the team to conduct a jurisdictional scan of SWP approaches and risk management models in several places. Details on the methodology and results of this review appear in Section 3.

1.4 Purpose of This Companion Document

This work provides guidance for protecting public, private, and individual drinking water sources in Alberta. It synthesizes SWP practices, processes, and some risks to drinking water sources; documents complementary source water related initiatives in Section 2; examines SWP approaches and risk management models in selected jurisdictions in Section 3; and identifies challenges, opportunities, and common practices for improving drinking water protection in Section 4.

11 Based on their research, the team was unable to find best practices related to drinking water protection that were evidence-based or scientifically defensible. Because of this challenge, they decided that the term "common practices" would better reflect the findings.

2.0 Source Water Protection Practices, Processes, and Risks to Drinking Water Sources

Protecting sources of drinking water in Alberta through SWP has emerged voluntarily in communities using a variety of approaches led primarily by drinking water providers, Indigenous peoples, and watershed organizations. Elements of SWP are supported by policies, legislation, and planning processes that are administered by various governments in Alberta. Until now, however, there has been no provincial guidance on how to undertake SWP planning and integrate this work with other land and water management approaches. A more collaborative, integrated, and proactive approach that considers upstream and downstream users would avoid duplication of efforts, provide clarity on what other groups are doing, promote common practices, and fill information gaps. The information presented in this section represents a snapshot of data collected by the team's surveys, targeted questionnaire, and literature review and is not necessarily representative of all SWP work being undertaken in Alberta.

2.1 Inventory of Drinking Water Treatment Plants and Water Sources

The second key task of the project was to synthesize SWP practices, processes, and risks to drinking water sources. Part of this task was to inventory drinking water treatment plants and their water sources in Alberta. For more information about the project's tasks, please see terms of reference in Appendix A.

Alberta's drinking water is drawn from surface and groundwater sources. Surface water sources include lakes, reservoirs, rivers, streams, ponds, and wetlands. Groundwater is found beneath the earth's surface in fractures and pores within unconsolidated and consolidated materials, such as sand, gravel, or bedrock formations. According to Statistics Canada, 23.1 percent

of Albertans rely on groundwater for municipal, domestic, and rural use.[12] More than 600,000 rural Albertans depend on groundwater for drinking water purposes.[13]

Public, Private, and Individual Drinking Water Sources

All water in Alberta is owned by the Crown and managed by the Province under the *Water Act*, regardless of whether it occurs on public or private land. For the purposes of this project, the project team defined the various sources of drinking water for public, private, and individual use:

Public sources refer to water that is withdrawn, treated, and distributed by a publicly owned water system (e.g., utility, regional commission, or municipality) to water users who pay for this service.

Private sources refer to water that is withdrawn, treated, and distributed by a privately owned water system (e.g., company or water co-op) to water users who pay for this service.

Individual sources refer to water that is withdrawn and treated from water sources on private land (e.g., well or dugout).

Alberta's drinking water systems are public, private, or individual. Some systems typically serve a single privately owned residence or building, and the onus is on the owner to test and treat the water. Public systems provide drinking water to the general public. The raw water source and the size and type of the drinking water system determine if the system requires an approval from Alberta Environment and Parks (AEP). Public systems that do not require an AEP approval are regulated by Alberta Health and Alberta Health Services.

Under Alberta's Drinking Water Program, the GoA works with several partners to ensure safe drinking water for Albertans. AEP regulates all municipal drinking water systems and a portion of the non-municipal systems, which

12 Government of Canada, 2013. *Groundwater Use*. Available online: https://www.nrcan.gc.ca/earth-sciences/sciences/earth-sciences-water/groundwater-and-aquifers/10988 Accessed September 2018.

13 Government of Alberta, 2018. *Groundwater*. Available online: https://www.alberta.ca/groundwater-overview.aspx. Accessed September 2018.

together serve about 85 percent of Alberta's population. Approximately 700 of Alberta's drinking water treatment and distribution systems are regulated by AEP under the *Environmental Protection and Enhancement Act*. These include public and private systems that provide drinking water for a variety of users, such as municipalities, industrial facilities and sites, subdivisions, regional water commissions, watering points, and parks, among others. Figure 2 identifies the drinking water systems and water sources regulated by AEP in each of the main watersheds in Alberta.

The majority of remaining Albertans get their drinking water from systems regulated by regional health authorities, Alberta Health, federal agencies, or Indigenous and Northern Affairs Canada.[14] For example, Alberta Health Services regulates over 2,000 small drinking water systems (mostly using groundwater sources), which may include community halls, schools, museums, churches, rest stops, and campgrounds. Additionally, many landowners use their own private well or dugout for drinking water.

In recent years, there has been an increase in the number of regional drinking water systems and commissions, particularly in small and rural communities. Regionalization can help municipalities reduce costs by sharing the costs with others, but it can also have several challenges.[15] Alberta has more than 30 regional water commissions with 86 percent of these serving small and rural communities (Appendix C).

14 Government of Alberta, 2009. *Alberta Environment's Drinking Water Program*. Available online: https://open.alberta.ca/publications/alberta-environment-s-drinking-water-program-a-source-to-tap-multi-barrier-approach. Accessed April 2019.

15 Alberta Urban Municipalities Association, 2011. *Municipal Water Primer and Discussion Paper*. Available online: https://www.auma.ca/sites/default/files/Advocacy/Programs_Initiatives/Water/waterprimerdiscussionpaper_final_october_24.pdf. Accessed September 2019.

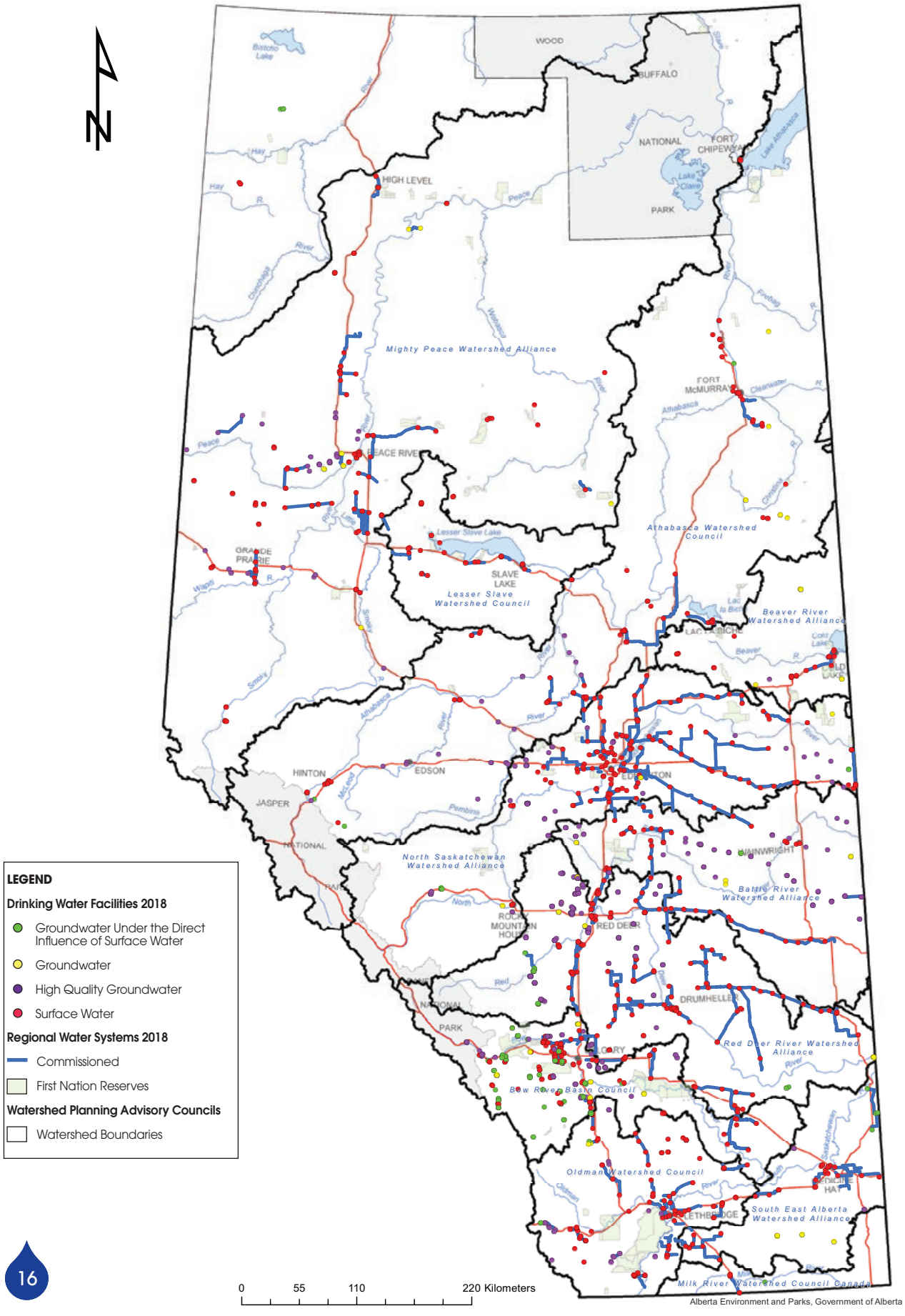


Figure 2: Drinking Water Systems Regulated by Alberta Environment and Parks (AEP)

Water co-operatives have increased through the Alberta Federation of Rural Water Co-operatives (AFRWC) Ltd. With roughly 170 water co-operatives, the AFRWC helps address the water needs of rural Albertans by encouraging the pooling of resources, the sharing of ownership, costs, and the other benefits of a self-owned system.[16]

One should always assume that surface waters are unsafe to drink unless treated. The main reason for treating or disinfecting public water supplies is to kill pathogens (disease-causing micro-organisms, such as *E. coli* and *Giardia*). In Alberta, the minimum level of treatment is either chemically assisted filtration and disinfection, or slow sand filtration and disinfection. Occasionally additional treatment is required, depending on the nature of the water source. The level of required water treatment depends on whether the water is obtained from surface water, groundwater under the direct influence (GWUDI) of surface water, or groundwater (also referred to as non-GWUDI) sources. GWUDI sources are vulnerable to contamination from surface water and thus require the same level of treatment as surface water sources. The assessment for determining whether a source is GWUDI or non-GWUDI is carried out by a qualified hydrogeologist or groundwater engineer.[17]

AEP uses a multi-barrier approach to ensure the safety of drinking water for Albertans. This approach consists of legislation, drinking water systems, knowledge and awareness, performance assurance, and protection. Drinking water utilities are required to submit monthly and annual reports to AEP. These reports summarize the results of monthly drinking water testing conducted by licensed laboratories.[18] Groundwater that is assessed as "high-quality groundwater" does not require the same level of treatment and frequency of monitoring as GWUDI sources do.

16 Alberta Federation of Rural Water Co-operatives Ltd., 2018. *Who We Are*. Available online: https://abwaterco-op.com/about-us/who-we-are.html. Accessed September 2018.

17 Government of Alberta, 2012. *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*. Available online: https://open.alberta.ca/publications/5668185. Accessed April 2019.

18 Government of Alberta, 2018. *Taking Care of Your Drinking Water and Wastewater: A Guide for Members of Municipal Councils*. Available online: https://open.alberta.ca/publications/9781460100509. Accessed April 2019.

In Alberta, the Land-use Framework[19] sets out an approach to manage public and private lands and natural resources to achieve long-term economic, environmental, and social goals. Figure 3 illustrates that most of the regulated systems (223) are in the South Saskatchewan Region while the fewest (31) are in the Lower Athabasca Region. The South Saskatchewan Region is home to 45 percent of Alberta's population (i.e., roughly 1.8 million residents)[20] with several urban centres, such as Calgary, Lethbridge, Medicine Hat, Airdrie, Okotoks, Cochrane, Brooks, Canmore, High River, and Strathmore. Substantial population and economic growth in this region has contributed to increased water demands and more drinking water systems. In dry years, for short periods, peak demand for water can exceed available supply.[21]

The Lower Athabasca Region has a smaller population of 117, 800 and fewer developed centres, such as Fort McMurray, Fort Chipewyan, Cold Lake, and Lac La Biche, resulting in a lower demand for drinking water systems.

19 Government of Alberta, 2008. *Land-use Framework*. Available online: https://open.alberta.ca/publications/9780778577140. Accessed September 2019.

20 Government of Alberta, 2018. *South Saskatchewan Region-Population*. Available online: https://regionaldashboard.alberta.ca/region/customregion/5/population/#/?from=2012&to=2016. Accessed September 2018.

21 Government of Alberta, 2009. *Profile of the South Saskatchewan Region*. Available online: https://landuse.alberta.ca/LandUse%20Documents/Profile%20of%20the%20South%20Saskatchewan%20Region%20-%202009-11.pdf. Accessed September 2018.

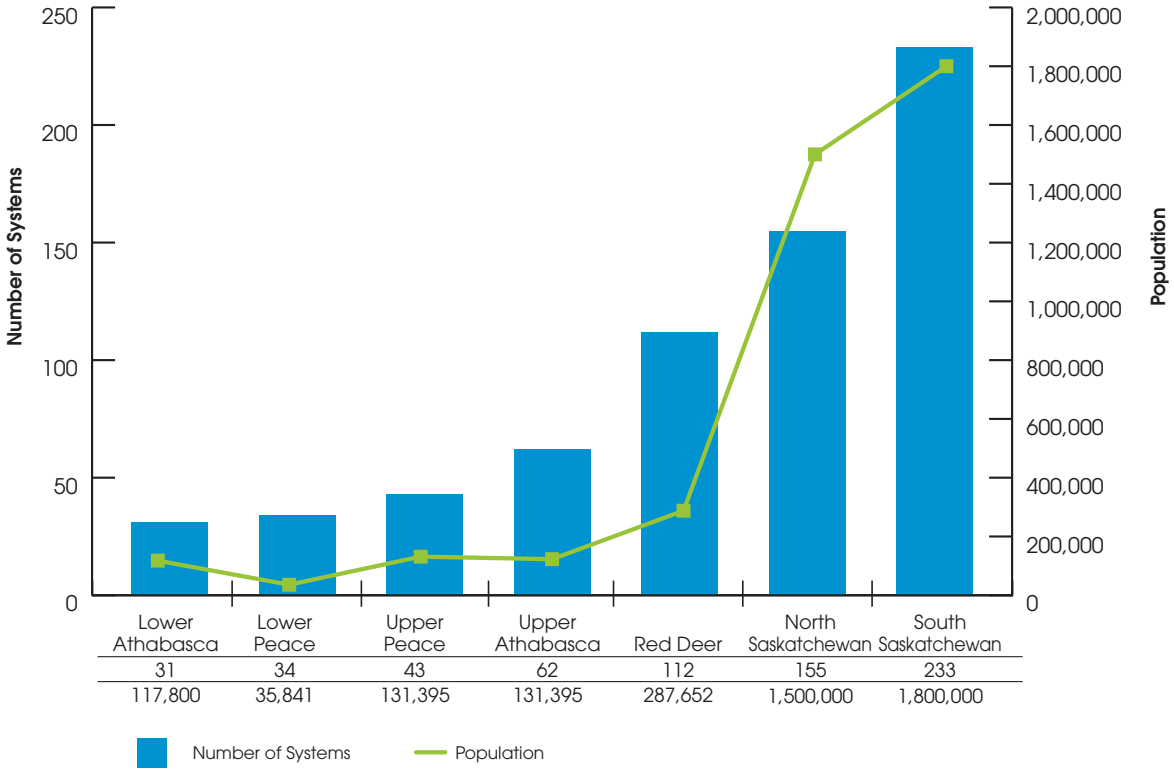


Figure 3: Number of AEP Regulated Drinking Water Systems by Land-Use Region in Alberta

An analysis of drinking water treatment systems regulated by AEP (Figure 4) revealed that 64 percent of systems treated surface water for drinking, while 29 percent relied on groundwater, and 7 percent treated GWUDI sources.

Figure 5 indicates the number of drinking water treatment systems regulated by AEP and the water sources used in each land-use region in Alberta. The main trends are as follows:

- Surface water is the main source used for drinking water in all land-use regions.

- Groundwater is used as a source of drinking water in all land-use regions, but to a lesser extent.
- Most land-use regions rely on GWUDI sources to a small degree, except for the Lower Athabasca and Upper Peace Regions.
- The South Saskatchewan Region has the highest number of drinking water systems and the highest number of systems that use GWUDI sources.

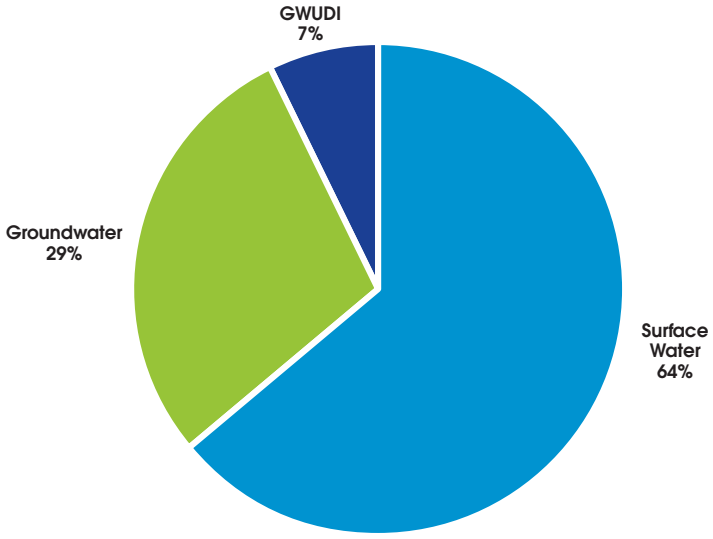
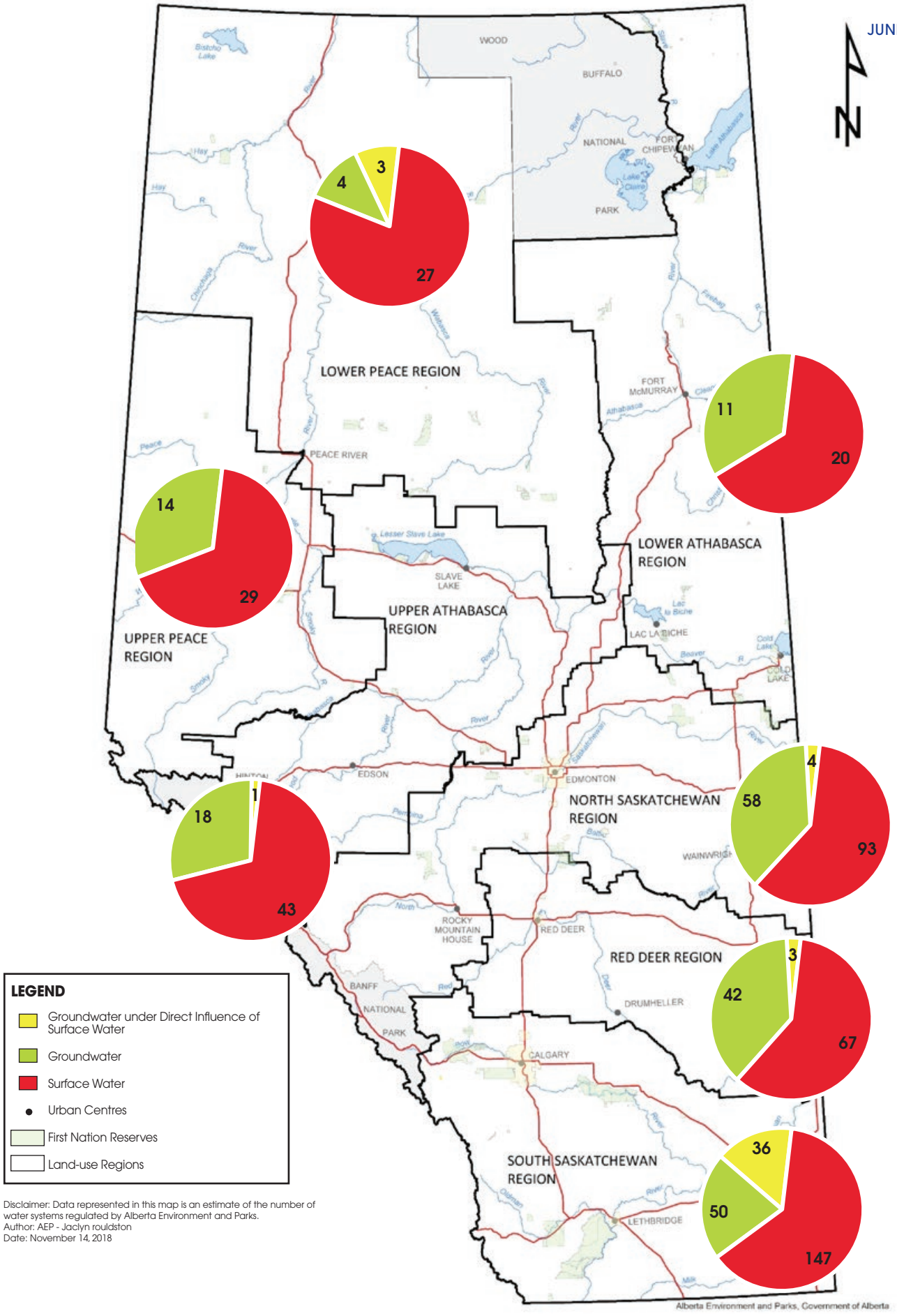


Figure 4: Water Sources Used by Drinking Water Systems in Alberta (regulated by AEP)



Disclaimer: Data represented in this map is an estimate of the number of water systems regulated by Alberta Environment and Parks.
Author: AEP - Jaclyn rouldston
Date: November 14, 2018

Figure 5: Number of Drinking Water Systems Regulated by AEP and the Source Water Type Used in Each Land-Use Region in Alberta

2.2 Targeted Questionnaire Findings

Another component of the second key task was to conduct surveys and interviews[22] among water treatment plant operators, GoA and provincial authorities, municipalities, Indigenous communities, WPACs, Alberta Health Services, and other upstream and downstream users.

To characterize the state of SWP in Alberta, the team designed and distributed an online survey to public and private organizations[23] and another survey to individuals.[24] A targeted questionnaire was distributed to drinking water providers[25] in selected communities. The survey and questionnaire results are described in Section 2.4.

SWP approaches include any practice, process, or tool used to protect sources of drinking water. In Alberta, several SWP approaches are in place or available to help protect sources of drinking water, including the Government of Canada's Guidelines for Canadian Drinking Water Quality. These guidelines deal with microbiological, chemical, and radiological contaminants and also address concerns with physical characteristics of water, such as taste and odour.[26] They set out basic parameters that every water system should strive for to provide the cleanest, safest, and most reliable drinking water possible, and they can be used as markers to make sure the barriers are working and that the treated drinking water is safe.

As of 2013, drinking water utilities regulated by AEP are required to develop DWSPs, which can act as the foundation for developing SWP plans for their systems. DWSPs are a proactive method of assessing risk to drinking water

22 Instead of interviews, a targeted questionnaire was emailed to 13 drinking water providers across the province to save time and resources.

23 The public and private survey was distributed electronically to collect data from targeted organizations involved in, or supporting, initiatives to develop, implement, and evaluate SWP efforts (e.g., plans, programs, policies, legislation, or tools) that focus on protecting drinking water sources in public and private drinking water systems.

24 The individual survey was distributed electronically to collect data from targeted individuals who rely on a private source of drinking water (e.g., well, dugout, or other) on their property.

25 The targeted questionnaire was distributed to drinking water providers in municipalities, utility companies, and regional water commissions in 13 communities across Alberta.

26 Government of Canada, 2018. *Canadian Drinking Water Guidelines*. Available online: https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html. Accessed December 2018.

quality and serve to better protect public health. DWSPs are based on an assessment of risk factors that could adversely affect the sources, treatment, storage, and distribution of drinking water. These plans do not replace the Canadian Drinking Water Quality Guidelines or the drinking water monitoring and reporting requirements under the *Environmental Protection and Enhancement Act*. Rather, DWSPs are meant to complement and enhance drinking water quality standards and procedures.[27]

The source water risks and issues identified in DWSPs can be used as the starting point for developing SWP plans for drinking water systems. SWP plans outline the steps that a public, private, or individual drinking water provider needs to take to control or minimize the potential for introducing chemicals or contaminants in drinking water sources. SWP is often referred to as the equivalent of an integrated watershed management plan and is the first line of defence in the multi-barrier approach. In Alberta, several SWP plans have been or will be created and are in the early stages of implementation. Some SWP plan examples include City of Calgary, City of Camrose, City of Edmonton, Frog Lake First Nation, Hamlet of Grande Cache, Grimshaw Gravels Aquifer, Siksika Nation, Piikani Nation, Bigstone Cree Nation, and Saddle Cree Nation. Indigenous groups have approximately a dozen SWP plans in progress that are not currently publicly available. Figure 6 illustrates the number of current SWP plans in Alberta by watershed.

2.2.1 SWP Governance

Given the broad scope of SWP and its connections with land and water management, it is often a challenge to discern a clear-cut relationship between the two. A study undertaken by the Water Policy and Governance Group of the University of Waterloo suggests that SWP is most closely linked with drinking water safety. However, the group advocates that a more integrated perspective is appropriate. From this perspective, they were concerned with protecting sources of water for all human uses and recognized that protection of source waters for people contributes to the maintenance of watershed conditions that

27 Government of Alberta, 2015. *Drinking Water Safety Plan*. Available online: http://www.environment.alberta.ca/apps/regulateddwq/dwsp.aspx. Accessed December 2018.

support aquatic and terrestrial ecosystems. They further note that SWP is a highly complex task involving a range of actors and responses. Governance for SWP requires different tools and approaches to account for the many ways in which human activities affect land and water resources.[28]

In Alberta, SWP is a voluntary, collaborative process with no mandated lead agency to facilitate SWP planning, implementing, and evaluating. Drinking water providers, Indigenous peoples, and watershed organizations may be best positioned to lead SWP work. An array of land and water legislation, plans, policies, and programs exist to directly or indirectly support SWP planning. However, some public, private, and individual drinking water providers lack the capacity to accurately identify and address the risks associated with their source waters. Consultants are often hired to complete DWSPs or risk assessments, resulting in less ownership and understanding of the risks by the drinking water provider.

For SWP to be effective, it must be better aligned with existing approaches. Figure 7 provides an overview of how SWP is integrated across various scales in the province. Several WPACs and WSGs in the region have initiated watershed planning processes and activities to address water issues for headwaters, tributaries, lakes, reservoirs, and groundwater aquifers. Thus, the integration and alignment of SWP initiatives with watershed management and municipal planning processes will inevitably strengthen and streamline these processes.

28 University of Waterloo, 2012. *Governance for Source Water Protection in Canada*. Synthesis Report. Available online: https://uwaterloo.ca/water-policy-and-governance-group/sites/ca.water-policy-and-governance-group/files/uploads/files/cwn_project_synthesis_report_0.pdf. Accessed December 2018.

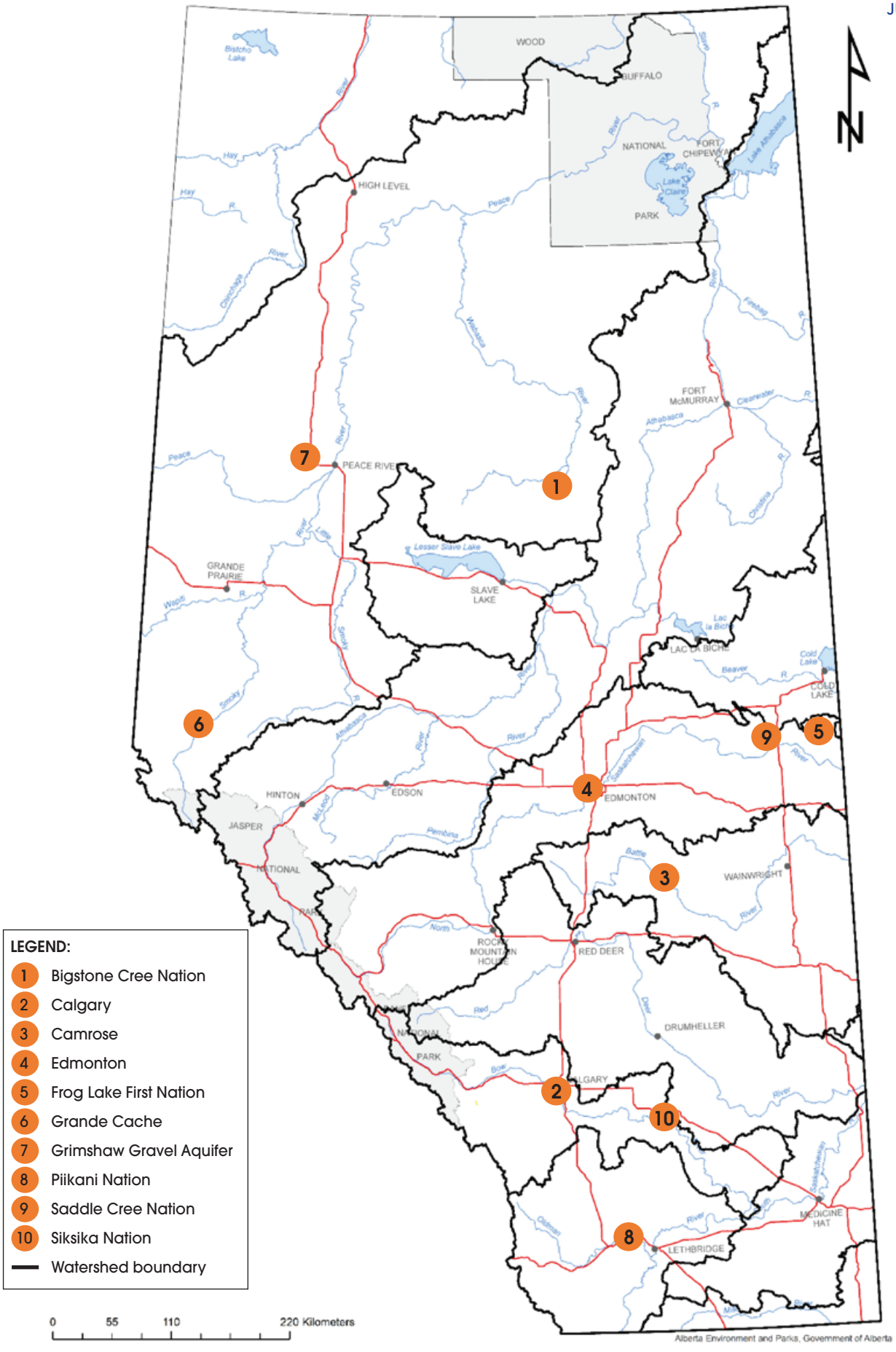


Figure 6: Existing Source Water Protection Plans by Watershed

For example, the *South Saskatchewan Region Surface Water Quality Management Framework*, published in 2014, was developed to set triggers and limits on water quality and to help identify and address negative trends. This proactive approach will help to ensure the environment remains healthy for residents and the ecosystem. A management response is required if monitoring indicates that triggers or limits has been exceeded in the region. A SWP plan may be considered as part of a management response.

2.2.2 Integrating SWP Plans and DWSPs

SWP plans and DWSPs are often confused by many working in this area. Although both types of plans share a similar goal to protect drinking water sources, they differ slightly in how they do so, and there are opportunities for integration and collaboration. Table 1 outlines similarities and differences between SWP plans and DWSPs while Figure 7 illustrates how SWP planning fits with integrated watershed management.

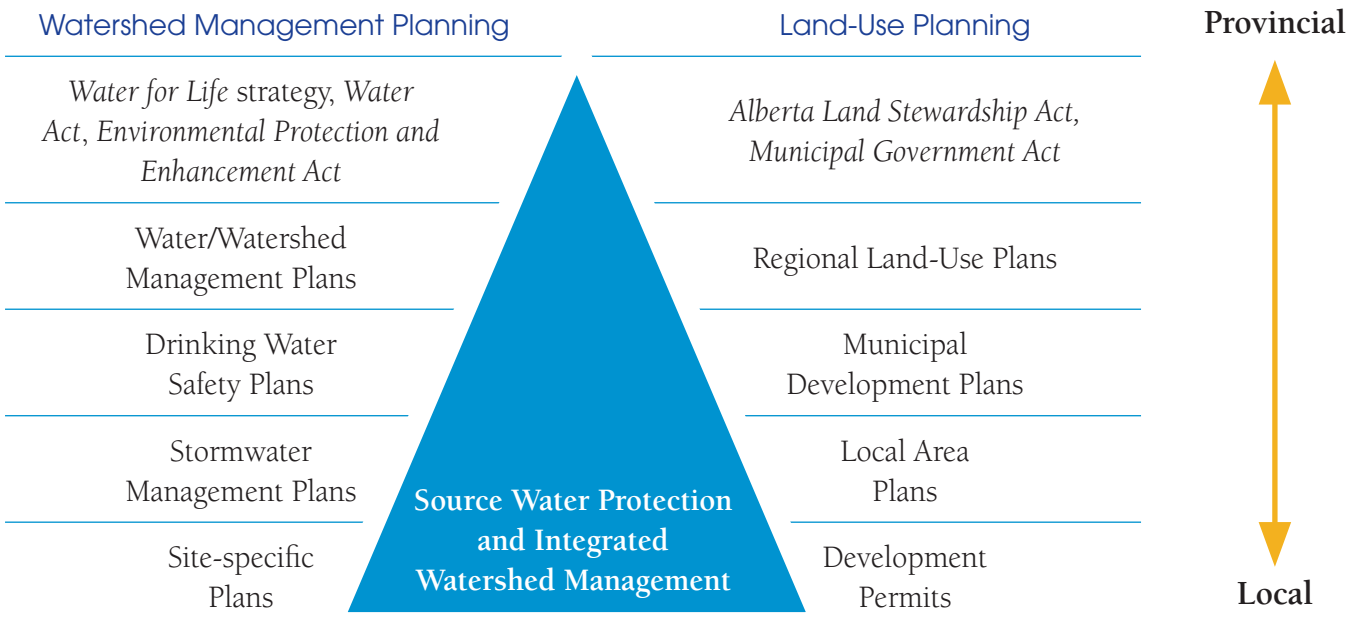


Figure 7: Source Water Protection and Integrated Watershed Management in Alberta (Adapted from the City of Calgary's Source Water Protection Plan, 2018)

The project team identified the following potential areas for integration and collaboration between SWP plans and DWSPs:

- SWP plans can be used to reduce drinking water risks identified in DWSPs.
- DWSPs can be directly integrated into SWP plans depending on the delineation of the source water area.
- SWP plans can build on drinking water risks and their assessment, as included in DWSPs.

Table 1: Similarities and Difference between DWSPs and SWP plans

Drinking Water Safety Plans	Source Water Protection Plans
■ mandatory	■ voluntary
■ developed by water providers often without input from other groups	■ developed by water providers in collaboration with other groups
■ water supply systems-wide approach	■ source water area approach
■ public health focus	■ public health and environmental focus
■ often focus mostly on treatment systems	■ sub-regional or watershed level
■ updated annually or as incidents occur	■ updated at least every five years
■ short-term focus (four to five years), but often lack a long-term vision and goals	■ long-term focus (five to twenty years) guided by a vision statement and site-specific goals

- SWP plans can provide data and identify expertise for drinking water operators to apply in their operations.
- WPACs and drinking water operators can help guide the development, implementation, and evaluation of SWP plans and DWSPs through engagement activities, networking, and facilitating multi-stakeholder input, thereby applying a watershed "lens" to this work.
- Connections with municipal development plans and creating and enforcing bylaws can help with risk management actions related to SWP plans and DWSPs.
- Delineating source water areas has been done by the GoA to some extent, and some of this information can be made available through WPACs and municipalities.

Conclusions

The following findings emerged from the team's work to synthesize SWP approaches in Alberta:

- The majority of regulatory tools related to SWP approaches are spearheaded by the GoA.
- SWP plans are developed mostly at a sub-regional or watershed level, largely by drinking water providers, watershed organizations, and Indigenous peoples.
- Target audiences for SWP approaches are mainly public, private, and individual drinking water providers.
- SWP approaches are mostly in the form of policy advice, guidance, protocols, and education programs.
- Several SWP plans are in progress with most in the planning or early implementation stages.
- Available SWP tools (e.g., risk mapping tools) are perceived as insufficient to help with SWP planning.
- Real-time data for drinking water quality and quantity (particularly groundwater) seem to be missing or inaccessible for some areas, and monitoring and data collection programs to support SWP are minimal.
- Most SWP approaches appear to place greater emphasis on water quality than on water quantity.
- Examples of SWP approaches and tools in Alberta include the following:
  - A Guidance Framework for the Production of Drinking Water Safety Plans
  - A Source to Tap, Multi-Barrier Approach – Drinking Water Program
  - Action Protocol for Exceedance of Chemical Health Parameters in Drinking Water
  - Potable Water Regulation
  - Rural Water Quality Information Tool
  - A Toolkit for Protecting Source Water Quality in the Red Deer River Watershed
  - Working Well Program
  - Vulnerability Risk Assessment Tool for Wells

See Appendix D for a complete inventory of approaches.

2.3 Risks to Drinking Water Sources

This project examined drinking water risks, common practices,[29] and potential risk management approaches, several of which were reported through the surveys and targeted questionnaire with drinking water providers. Given the limited resources and time, the project team prioritized the top ten commonly identified risks.

Given the scope of the project, drinking water risks were focused on the source and not on the treatment, the network, or the consumer. While there are myriad water treatment strategies and technologies available to address drinking water risks, the focus of this document is SWP, and examining activities that may occur at the water treatment plant is beyond the scope of this project. For a more extensive review of other types of risks and management approaches in Alberta beyond the source, a *DWSP Data Assessment* report is available.[30] Some of the information in that report was cross-referenced with the information in this one. Several risk management approaches were also documented in Table 2. The information captured here is based on the team's knowledge and not scientifically defensible. It is not an exhaustive list and does not capture all drinking water risks in Alberta, nor is it specific to any one area.

29 Based on their research, the team was unable to find best practices related to drinking water protection that were evidence-based or scientifically defensible. Because of this challenge, they decided that the term "common practices" would better reflect the findings.

30 Associated Engineering, 2015. *DWSP Data Assessment (Evaluation of Initial Intake of Data Received)*. Available online: https://open.alberta.ca/dataset/95520e2c-dbd1-40ac-94b7-e1f929666fbb/resource/9f8ee9c9-ed12-4b7a-b125-61a83736c0b3/download/drinkingwatersafetyplanassessment-mar2015.pdf. Accessed March 2019.

Table 2: Drinking Water Risks, Common Practices, and Risk Management Approaches, Tools, and Resources

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
1. Being reliant on a single drinking water source: For small and rural communities, one source is often used for drinking water. A backup source can be a contingency measure in a drought, extreme contamination (e.g., an oil or chemical spill), or other circumstances. Not having a backup source can be risky. For example, the Town of Milk River's drinking water source is fed by a water diversion situated in the U.S.	**Public and Private** ■ Work with upstream users to create a water sharing arrangement. ■ Consider becoming part of a regional water system. ■ Apply for funding and invest in expanding your drinking water infrastructure to include an alternative water source. ■ Supplement existing water sources with hauled water as a contingency measure. ■ Undertake a water audit to investigate ways to reduce raw water needs (i.e., determine areas of water loss and assess water consumption patterns). ■ Investigate alternative water sources. ■ Explore reuse and recharge possibilities.	**Public and Private** ■ Water sharing agreements: – American Society of Civil Engineers Guideline for Development of Effective Water Sharing Agreements – Global Water Partnership *Handbook for Integrated Water Resources Management in Basins* ■ Regional water systems: – Alberta's Regional Water Systems – *Water for Life* – New Regional Water Systems ■ Funding for infrastructure: – Alberta Municipal Water/Wastewater Partnership – Rural and Northern Communities Infrastructure ■ Starting and operating potable water hauling: Alberta Health Services Guidelines ■ Alternative water sources: Organization for Economic Co-operation and Development: Alternative Ways for Providing Water ■ Water audit: First Steps and Resources from the AUMA ■ Water reuse: – Overview, Regulatory Framework, and Case Studies from Alberta WaterSmart – AUMA's Water Recovery, Reclamation, Reuse, and Recycle Programs

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Supplement existing water supply with hauled water. ■ Drill new wells on your property where feasible. ■ Construct dugouts on your property where feasible. ■ Join a water co-operative.	**Individual** ■ Starting and operating potable water hauling: Alberta Health Services Guidelines ■ Water well information: – Working Well Program – Drilling Water Wells in Alberta Guidelines – Alberta Water Wells Web Application – Water Well Drilling Agreements – Alberta Water Well Drilling Association – Wells that Last ■ Dugouts: – Quality Farm Dugouts – Farm Water Supply ■ Water co-operatives: Alberta Federation of Rural Water Co-operatives Ltd.
2. Contaminants from flood runoff: During a flood, contaminants, such as bacteria, fuel, chemicals, nitrates, and other pollutants, can flow from farmland, septic systems, and other sources into drinking water supplies, aided by rain and gravity. These contaminants can be a significant risk to anything the floodwater has contacted, including drinking water wells or drinking water systems. For example, in the County of Lac La Biche, periodic flooding of low-lying areas poses a risk to their drinking water sources.	**Public and Private** ■ Map flood-prone locations in your source water area and share the findings with others. ■ Monitor the state of water resources in your source water area. ■ Inventory and know potential harmful effects of hazardous materials in your source water area. ■ Determine ways to safely store hazardous materials. ■ Regulate development in high-risk source water areas. ■ Implement stewardship activities to minimize or prevent the impacts of flood runoff on drinking water. ■ Implement flood response measures to minimize impacts on source waters.	**Public and Private** ■ Flood mapping: – Flood Hazard Mapping Application – GeoDiscover Water Mapping ■ Real-time information about Alberta's water resources: – Alberta Water Tool – Alberta River Basins ■ Stewardship activities: – Living by Water Program – Stepping Back from the Water – Lake Stewardship Guide – Alberta Stewardship Network ■ Flood response: – Municipal Flood and Drought Action Planning Primer – Provincial Flood Recovery Framework – Assistance and Recovery Support

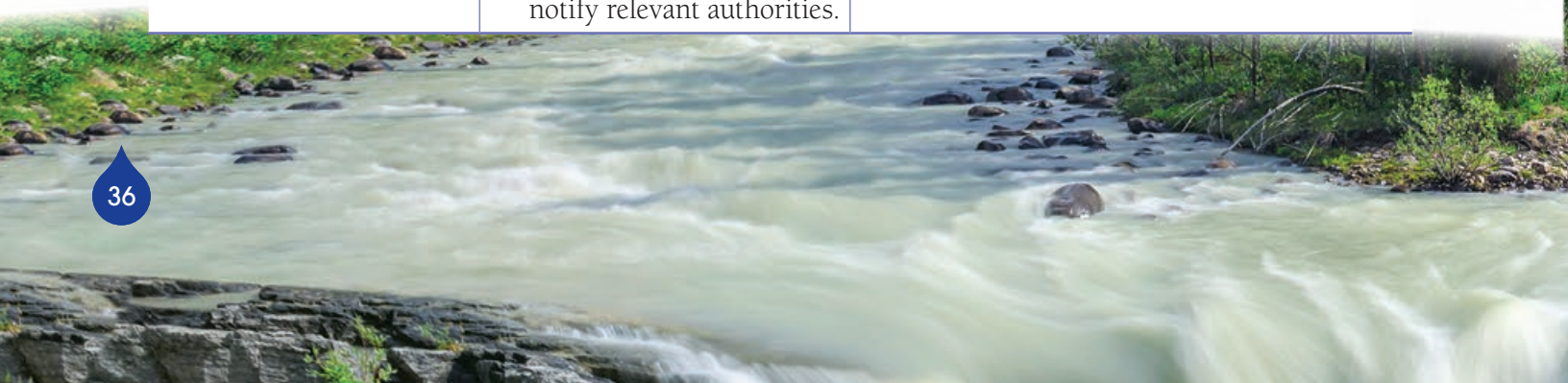
Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Practise flood precautions in times of an extreme event. ■ Implement appropriate recovery actions after a flood. ■ Regularly clean and test your water supplies. ■ Use disinfectants to make water safety if required. ■ Safely store chemicals so they do not mix and produce dangerous reactions during a flood. ■ Use secondary containment for fuel tanks and pesticide storage to provide extra protection from spill. ■ Tie down fuel or propane tanks and other loose equipment or material if possible.	**Individual** ■ Flood water precautions: Alberta Health Services Flood Water Precautions ■ Flood recovery: – What Do I Do if My Private Water Well Has Flooded? – What to Do with Your Well After a Flood – Flood Recovery Q & A for Water Sources – Shock Chlorination Information for Private Water Wells – Assistance and Recovery Support ■ Cleaning and testing of water supplies: – How to Clean and Disinfect a Cistern – Cistern Cleaning – Testing your Water after your Well has Flooded ■ Disinfectants: Using Disinfectants to Make Drinking Water Safe When you Can't Boil It ■ Use household chemicals safely: Government of Canada ■ Safe storage of household chemicals: City of Calgary

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
3. Point source pollution from an upstream pipeline: Industrial activity on land has the potential to affect water quality. Operations must be carefully managed to avoid affecting the quality of surface and groundwater. Water with a high hydrocarbon content may have a negative effect on the kidneys and liver of the water user. The City of Red Deer identified this as one of several risks to their drinking water source.	**Public and Private** Map pipeline locations in your source water area and share the findings with others. ■ Be aware of any ongoing pipeline incidents in your source water area. ■ Report pipeline incidents if required, as soon as possible. ■ Involve energy producers in the SWP planning processes to exchange ideas on how to minimize or prevent spills in your source water area by developing an emergency response plan. (The plan can focus on operating/ permitted and abandoned/ discontinued pipelines that cross rivers and other tributary stream crossings in your source water area.) ■ Collaborate with the Alberta Energy Regulator, Orphan Well Association and landowners to decommission abandoned oil and gas wells and pipelines in the source water area.	**Public and Private** Pipeline mapping and awareness: – Pipelines in Alberta – Alberta Energy PDF Maps – National Energy Board's Interactive Pipeline Map – About Pipelines Map – Upstream Pipelines in Alberta ■ Energy incidents in Alberta –compliance dashboard ■ Pipeline incident reporting ■ Information and resources from the Alberta Energy Regulator ■ Orphan Well Association ■ Orphan energy sites ■ Alberta Energy Regulator (AER) ■ AER's Emergency Planning, Preparedness, and Response Fact Sheet
	Individual ■ Be aware of ongoing pipeline incidents in your source water area. ■ If required, report pipeline incidents as soon as possible.	**Individual** ■ Energy incidents in Alberta – compliance dashboard ■ Pipeline incident reporting

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
4. Debris, nutrients, and chemicals associated with wildfires: Possible effects of wildfires on drinking water include changes in the amount and timing of snowmelt and runoff from storms; changes in water quality from build-up of ash, soil erosion, and fire debris; changes in the taste, colour, and smell of drinking water; if fire retardant is present, there may also be a possible rise in soil and water chemical levels, such as phosphate, nitrate, and nitrite. The 2016 wildfire in the Regional Municipality of Wood Buffalo created significant challenges in restoring the functionality of Fort McMurray's drinking water infrastructure, with source water quality being a concern.	**Public and Private** ■ Map and be aware of wildfire hazard locations in your source water area and share the findings with others in your area. ■ Determine the vulnerability of your drinking water area to a wildfire by developing an emergency response plan. ■ Regulate wildfire hazards that are close to, or upstream of, drinking water sources by creating a wildfire protection plan for your drinking water area. ■ Promote wildfire prevention measures to reduce wildfire threat (e.g., designed forest riparian buffer strips, reduction of hazardous fuels in the source water area, and forest management to ensure the appropriate species composition to help with water quality).	**Public and Private** ■ Wildfire mapping and awareness: – Wildfire Hazard Identification Tool (WHIT) and User Manual – Wildfire Status Map – WHIT Support – Alberta Fire Bans – Alberta Fire Ban System – Wildfire Danger Forecast – Wildlife Situation Report – Other Resources ■ Water Research Foundation and Cadmus Group Inc. 2013 Report: Effects of Wildfire on Drinking Water Utilities and Effective Practices for Wildfire Risk Reduction and Mitigation Compliance and enforcement - Alberta Wildfire ■ Water Research Foundation: Wildfires Impact Drinking Water: Study Helps Water Utilities Prepare and Respond ■ Fire prevention measures: – FireSmart Resources – Best Management Practices for Wildfire Prevention – Wildfire Prevention Engineering – FireSmart for Communities

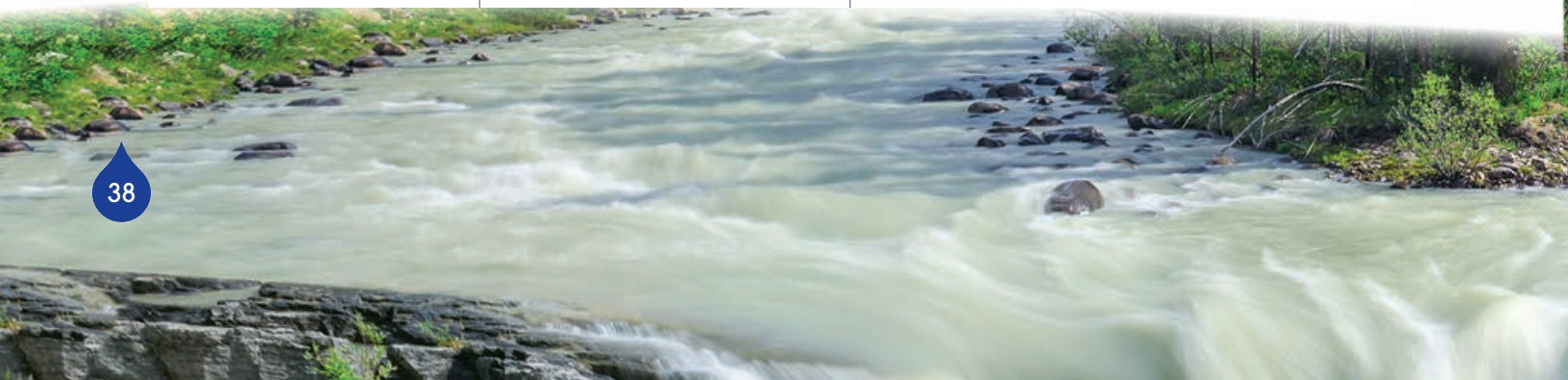
Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Be aware of wildfire hazard locations in your source water area and share the findings with others. ■ Promote and participate in wildfire prevention measures to reduce wildfire threat in communities.	**Individual** ■ Wildfire mapping and awareness: – Wildfire Status Map – WHIT Support – Alberta Fire Bans – Alberta Fire Ban System – Wildfire Danger Forecast – Wildlife Situation Report – Other Resources ■ Fire prevention measures: – FireSmart Community Planning and Guidebook for Community Protection – FireSmart Community Members and Guide to Landscaping

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
5. Degraded water quality due to aquatic invasive species: Aquatic invasive species (AIS) are species that are non-indigenous to a region or body of water that affect or pose threats to the environment, the economy, or human health. In Alberta, zebra and quagga mussels pose such a threat and have affected irrigation and hydropower generation infrastructure in other jurisdictions. AIS can degrade water quality by increasing turbidity, concentrating toxins, and altering nutrient and energy flows within the food web. For the Newell Regional Services Corporation, AIS poses a risk to their drinking water sources.	**Public and Private** Implement existing resources for controlling and/or preventing AIS in drinking water sources. ■ Promote AIS management measures to prevent, combat, and manage AIS in communities by developing an AIS management plan. ■ Educate water users in the source water area about how to identify AIS and ways to prevent their spread.	**Public and Private** AIS resources: – Decontamination Protocol for Watercraft and Equipment – AIS Pocket Guide – Map of Invasive Mussel Sightings – Zebra and Quagga Mussels ■ AIS management measures: – AIS Program – Don't Let it Loose Campaign – Clean, Drain, and Dry Your Boat – AIS Pocket guide
	Individual ■ Promote and participate in AIS management measures to prevent, combat, and manage them in communities. ■ Learn to identify AIS and notify relevant authorities.	**Individual** ■ AIS management measures: – Don't Let it Loose Campaign – Clean, Drain, and Dry Your Boat – AIS Pocket guide



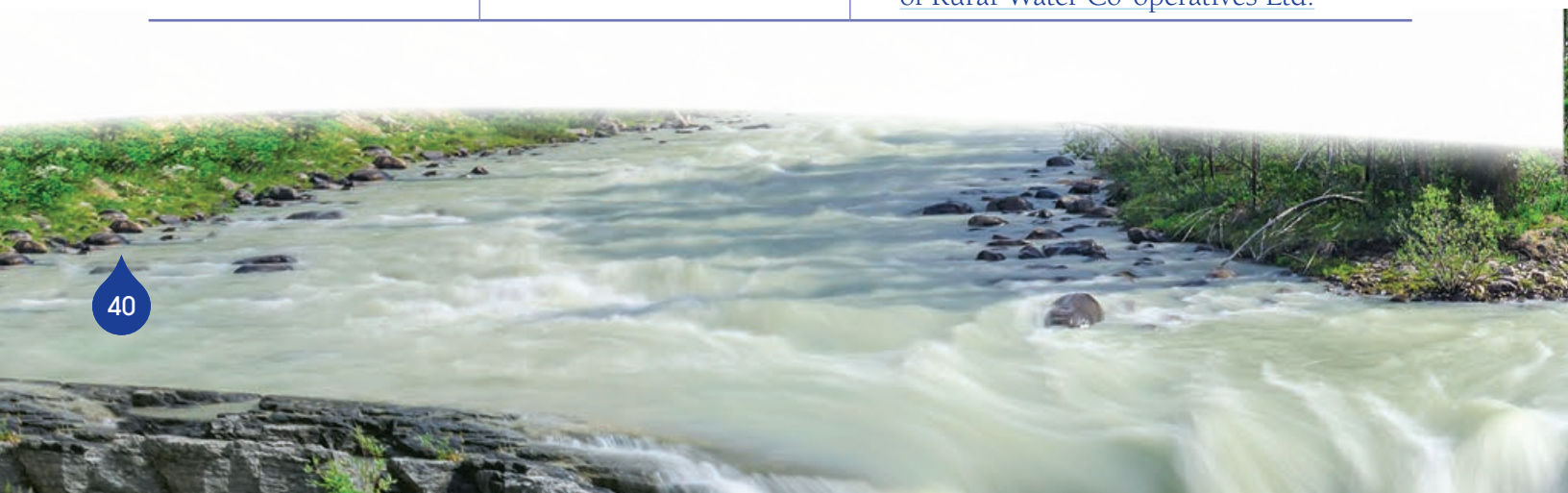
Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
6. Extended periods of low water levels: In times of drought, the water source can shrink while demand remains the same or increases. This shifting balance can make it a challenge for drinking water providers to balance the needs of growing communities. Lower water levels due to dry periods also result in higher contaminant concentrations. For example, extended droughts can cause the Town of Banff's aquifer to shrink, resulting in water shortages. In addition, lower water levels due to dry periods also result in higher contaminant concentrations.	**Public and Private** Implement water conservation and curtailment measures when necessary. ■ Invest in water conservation projects in your source water area. ■ Develop a drought response plan with members of the source water area. ■ Encourage rainwater harvesting among residents.	**Public and Private** ■ Water conservation and curtailment measures: – Municipal Tools and Practices for Water Conservation: □ Water Audits □ Operations and Management Tools □ Legal Tools □ Economic and Financial Tools □ Education and Outreach and examples □ Water Conservation, Efficiency, and Productivity Plans ■ Invest in water conservation projects (e.g., water treatment plant upgrades to include reused water in the treatment process) ■ Drought response: – Municipal Flood and Drought Action Planning Primer – Guide to Building Resiliency to Multi-Year Drought in Alberta (in progress) – AWWA's M60 Drought Preparedness and Response

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Use low-flush toilets in your home. ■ Use low-flow showerheads and faucets in your home. ■ Invest in Energy Star appliances (e.g., dishwashers, kitchen fixtures, and washing machines). ■ Invest in WaterSense labelled toilets. ■ Detect and fix leaks immediately around the home. ■ Encourage rainwater harvesting among residents.	**Individual** ■ Water conservation techniques: – Efficiency and Conservation – Changes Homes for Climate – High Efficiency Appliances – WaterSense – Water Saving tips for Homes – Farm Water Supply
7. Over-extraction: This is particularly risky in relation to groundwater in aquifers when water is pumped faster than it is replenished. This can result in sinking water tables, empty wells, and higher pumping costs. Drought can also be an exacerbating factor. This was identified as a risk for the Town of Grimshaw as it relies heavily on aquifers for drinking water.	**Public and Private** Become part of a regional water system. ■ Develop and implement a water audit program for examining potential water losses and assessing water consumption. ■ Create an emergency plan with options for using alternative drinking water sources. ■ Develop a water sharing agreement with users in your source area. ■ Develop water shortage procedures, a response plan or a bylaw, and implement water conservation and curtailment measures when necessary.	**Public and Private** Regional water systems: – Alberta's Regional Water Systems – *Water for Life* – New Regional Water Systems ■ Options for alternative drinking water sources: – Taking Care of Your Drinking Water and Wastewater: A Guide for Members of Municipal Council – Emergency Response Plan for Drinking Water Systems in First Nation Communities – Planning for an Emergency Drinking Water Supply – Emergency Water Supply Preparation – Emergency Response and Contingency Planning for Small Water Systems



Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	■ Apply for funding and invest in expanding your community's drinking water infrastructure. Supplement existing water sources with hauled water as a contingency measure. ■ Encourage rainwater harvesting among residents in the community. ■ Invest in water conservation projects in your source water area. ■ Develop a drought response plan with members of your community. ■ Monitor activities in your source water area by obtaining periodic reports from AEP and AER.	■ Water sharing agreement: – Guideline for Development of Effective Water Sharing Agreements ■ Water shortage: – Water Shortage Procedures for the South Saskatchewan River Basin – Preparing Water Shortage Response Plans ■ Water conservation and curtailment measures: – Municipal Tools and Practices for Water Conservation: □ Water Audits □ Operations and Management Tools □ Legal Tools □ Economic and Financial Tools □ Education and Outreach and examples □ Water Conservation, Efficiency, and Productivity Plans ■ Water audits and resources and examples ■ Funding for infrastructure: – Alberta Municipal Water/Wastewater Partnership – Rural and Northern Communities Infrastructure ■ Starting and operating potable water hauling: Alberta Health Services Guidelines ■ Rainwater harvesting: – Rainwater Harvesting Guidelines – Rainwater Harvesting Handbook ■ Invest in water conservation projects (e.g., water treatment plant upgrades to include reused water in the treatment process)

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Supplement existing water supply with hauled water as a contingency measure. ■ Drill new wells on your property where feasible. ■ Construct new dugouts on your property where feasible. ■ Join a water co-operative. ■ Encourage rainwater harvesting among residents in the community.	**Individual** ■ Starting and operating potable water hauling: Alberta Health Services Guidelines ■ Water well information: – Working Well Program – Drilling Water Wells in Alberta Guidelines – Alberta Water Wells Web Application – Water Well Drilling Agreements – Alberta Water Well Drilling Association – Wells that Last ■ Dugouts: – Quality Farm Dugouts – Farm Water Supply ■ Water co-operatives: Alberta Federation of Rural Water Co-operatives Ltd.



Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
8. Accidental spills or application of substances from transportation corridors: Roads that intersect drainage basins generally modify the natural flow of surface water by concentrating flows at certain points and, in many cases, increasing the speed of flow. Sedimentation, changes in biological activity in streams and on their banks, uncontrolled construction activities, and chemical and pollutant spills have adverse effects on roadside water quality. Pollution results from the salting of roads for winter maintenance and during periods of low stream flow. The Town of Hardisty identified this as a key risk to their drinking water source.	**Public and Private** ■ Map and be aware of road networks and dangerous goods routes and inspections in and around your source water area and share the findings with others. ■ Develop a dangerous goods transportation bylaw to regulate activities in the source water area. ■ Ensure newer roads are constructed away from drinking water sources if possible. ■ Monitor road activities in your source water areas. ■ Report spills in your source water area. ■ Coordinate SWP planning activities with transportation organizations and other important groups. ■ Educate source water area residents about residential sidewalk clearing requirements, salt and sand application, and using environmentally friendly alternatives.	**Public and Private** ■ Road networks: – National Road Network Alberta – Province of Alberta Highway Network – Alberta EDGE – Alberta Transportation Maps ■ Road activities: – AMA Road Reports – 511 Alberta – Alberta Transportation Safety Bulletins – Dangerous Goods Route Selection Criteria ■ Report an incident: Alberta EDGE

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Monitor road activities in your source water areas. ■ Report any accidental or purposeful spills in your source water area. ■ Use environmentally friendly alternatives when applying salt and sand to sidewalks.	**Individual** ■ Road activities: – AMA Road Reports – 511 Alberta – Alberta Transportation Safety Bulletins ■ Report an incident: Alberta EDGE
9. Stormwater: Stormwater is rainwater and melted snow that flows off lawns, streets, and other land surfaces. With increased urbanization, stormwater can introduce sediments, oil, grease, pesticides, nutrients from lawns, gardens, pets (e.g., gold fishes), failing septic systems, viruses, bacteria, road salts, heavy metals from vehicles, roofs, and thermal pollution from dark impervious surfaces, such as rooftops and streets. For the City of Calgary, this is a major concern that their SWP plan is hoping to address.	**Public and Private** Develop a stormwater management plan for your source water area including options for stormwater reuse, green infrastructure, and low impact development. ■ Apply for funding to help with projects to offset impacts. ■ Create awareness among involved groups and the public about the impacts of stormwater on drinking water sources. ■ Coordinate SWP planning activities with municipal planners and engineers. ■ Consider location when placing wastewater outfalls in communities. ■ Encourage developers to incorporate stormwater management techniques that are low impact into new developments.	**Public and Private** ■ Stormwater management: – Wastewater and Stormwater Management – Overview – Stormwater Management Guidelines for the Province of Alberta – Stormwater Management Examples and Resources in Alberta – Low Impact Development Stormwater Management Planning and Design Guide – Stormwater Pollution Prevention Handbook – Alberta Low Impact Development Partnership ■ Funding: – Green Infrastructure – Green Municipal Fund – Watershed Resiliency and Restoration Program – Alberta Community Resilience Program

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Learn about and incorporate low impact development practices.	**Individual** ■ Pigeon Lake Watershed Association's Clean Runoff Action Guide ■ Nature Alberta's Living by Water Program ■ Alberta Low Impact Development Partnership LID Toolbox
10. Toxins from algal blooms: Algal blooms occur when nutrients get into water and cause rapid growth of the algae already present. They are influenced by water composition, temperature, and light intensity. Toxins from algal blooms can contaminate drinking water sources and treatment facilities. When water with algal blooms is extracted for treatment, it can cause filter blockages and odours to develop in treated water and can be a human health risk. For the Newell Regional Services Corporation, algal blooms have become a risk to their drinking water sources.	**Public and Private** ■ Understand and manage conditions (where possible) that trigger harmful algal blooms. ■ Monitor source waters for algal blooms. ■ Explore and implement options for treating algal blooms in source water (e.g., apply beneficial bacteria, provide biological augmentation, aerate water, and reduce excess nutrient loading). ■ Create buffers to prevent runoff that contains sediments, trash, and organic materials from entering drinking water sources. ■ Manage phosphorus for protecting water quality. ■ Create awareness about detecting, treating, and monitoring for algal blooms.	**Public and Private** Information about algal blooms: – A Water Utility Manager's Guide to Cyanotoxins – Cyanobacterial Harmful Algal Blooms in Water – what they are, impacts, detection, causes and prevention, resources, and control and treatment – Managing Phosphorus to Protect Water Quality – Alberta Cyanobacteria Beach Monitoring – Blue-Green Algae (Cyanobacteria) in Surface Water Sources for Agricultural Usage – Cyanobacterial Toxins in Drinking Water

Drinking Water Risks	Common Practices	Risk Management Approaches, Tools, and Resources
	Individual ■ Properly dispose of organic materials, e.g., leaves, grass, and debris from yard work should be bagged and not left to decay. ■ Create buffers to impede runoff that contains sediments, trash, and organic materials from entering drinking water sources. ■ Watch for cyanobacteria advisories.	**Individual** ■ Alberta Health Services – Advisories ■ My Health Alberta ■ Frequently Asked Questions

2.4 Survey Findings

The results from the public and private survey, the individual survey, and the drinking water provider targeted questionnaire were compiled, and key findings are presented in this section. (See Appendix F for details.)

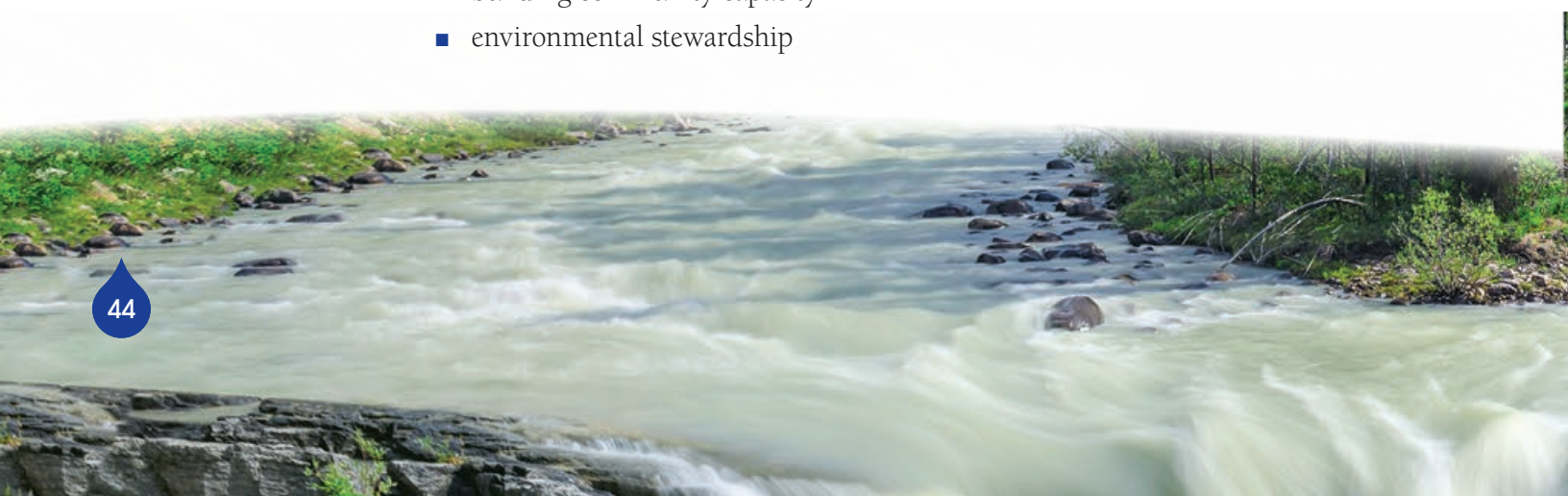
2.4.1 Results of the Survey of Public and Private Organizations

This survey targeted organizations involved in, or supporting, initiatives to develop, implement, and evaluate SWP efforts that focus on protecting drinking water sources in public, private, and individual systems.

Types of Organizations

Most of the work is spearheaded by municipalities, followed by other NGOs and private organizations. Aside from WPACs and WSGs, other NGOs who participated in the survey focus on the following areas as part of their mandate:

- land and water protection
- wildlife and habitat conservation
- building community capacity
- environmental stewardship



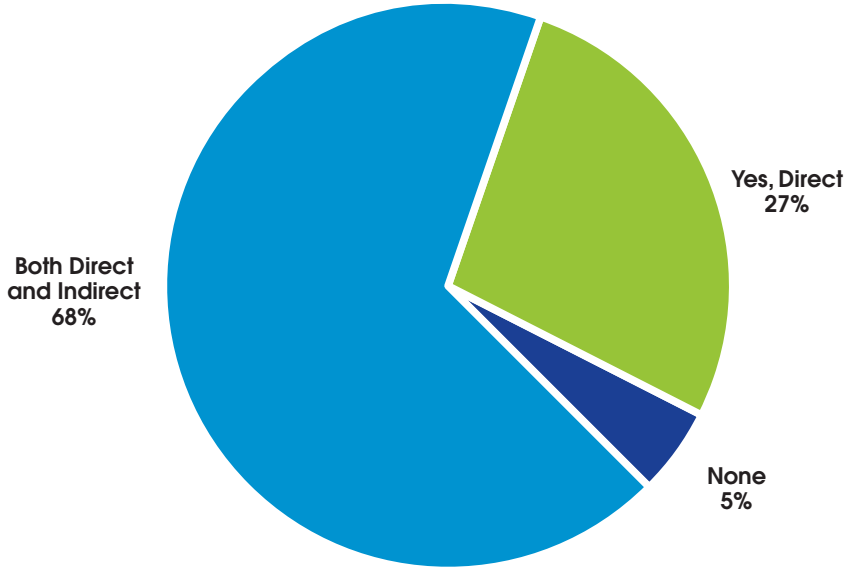


Figure 8: Involvement in Source Water Protection

Involvement in SWP

Figure 8 illustrates that 68 percent of participants indicated they have both a direct (i.e., a SWP program or plan) and indirect (i.e., stewardship or collaboration) focus on drinking water protection, while 27 percent have only a direct focus. This latter value seemed somewhat high considering that the team was aware of only a few municipalities that have developed SWP programs or plans. Five percent of participants indicated that SWP is not a focus for their organization because they are responsible for water distribution and not water treatment.

SWP Drivers

Regarding the primary drivers for undertaking SWP, most participants noted environmental reasons, followed by social and public health reasons. Economic drivers were also a concern but not the primary reason for public and private organizations who are not involved in drinking water treatment and distribution.

Geographical Scale of Work

Most SWP work is being done at a sub-regional or watershed level by WPACs, WSGs, other NGOs, and private organizations, followed by government work at municipal and provincial levels.

Focus of SWP Approaches

SWP approaches reflected a focus on providing information about the topic and training; being involved with legislation, policies, plans, processes, or guidance; and implementing and promoting best management practices. Less focus was placed on researching and monitoring the source, as seen in Table 3.

Table 3: Focus on Source Water Protection Approaches

Focus	Number
Research and monitor drinking water sources	14
Implement or promote best management practices	19
Engage with legislation, policies, plans, processes, or guidance	20
Provide information and/or training	21
Other	4

Many public and private organizations that are not government or that do not have decision-making authority are involved with legislation, policies, plans, processes or guidance on SWP. Examples of other areas of SWP focus include the following:

- demonstration sites (e.g., residential Clean Runoff approaches, community rain gardens, and shorelines)
- Living by Water Program
- Love Your Lake shoreline assessments

Target Audiences

The survey results showed that decision makers are the priority target audience for SWP activities, followed by the public, and landowners and agricultural producers (Figure 9). The least-targeted audiences are educators and researchers. Regarding the type of decision makers, municipal decision makers are most targeted by public and private organizations for SWP work, followed by provincial and federal decision makers.

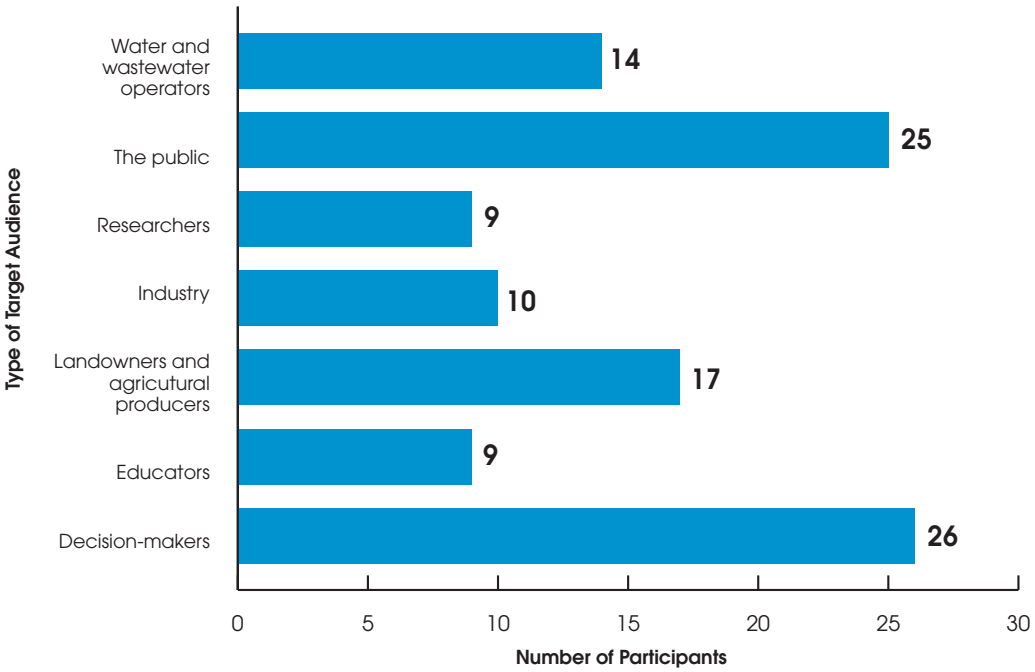


Figure 9: Source Water Protection Target Audiences

Collaboration

Eighty-one percent of public and private organizations that participated in the survey are collaborating with other groups on SWP approaches at various geographical levels. Of note are the following:

- More collaboration is occurring at the regional/watershed and municipal levels than at the provincial or federal levels.
- WPACs and WSGs are involved in most SWP initiatives that were identified, bringing together partners to work on watershed-level challenges.
- A growing number of collaborative groups of municipalities are working to tackle environmental challenges (e.g., the Alliance of Pigeon Lake Municipalities and the Red Deer River Municipal Users Group).
- Efforts focus on broader watershed and lake watershed management planning, stewardship projects, and education programs and less on SWP planning, research, and monitoring.
- Drinking water operators and public works staff of municipalities as well as water co-operatives and regional water commission staff are not as engaged in collaborating on SWP as other groups.
- Collaboration with Indigenous peoples is occurring but only in selected areas of the province.
- The coordination of SWP and other watershed-related work with regional land-use planning and municipal planning is not common.

Tools, Information, Networks, Groups, and Resources

Public and private organizations shared their views on both useful and inadequate tools, information, networks, and resources, as follows:

Useful

- Clean Runoff Action Guide
- Respect Our Lakes Program
- Alberta Invasive Species Council
- WPACs
- Groundwater Observation Well Network

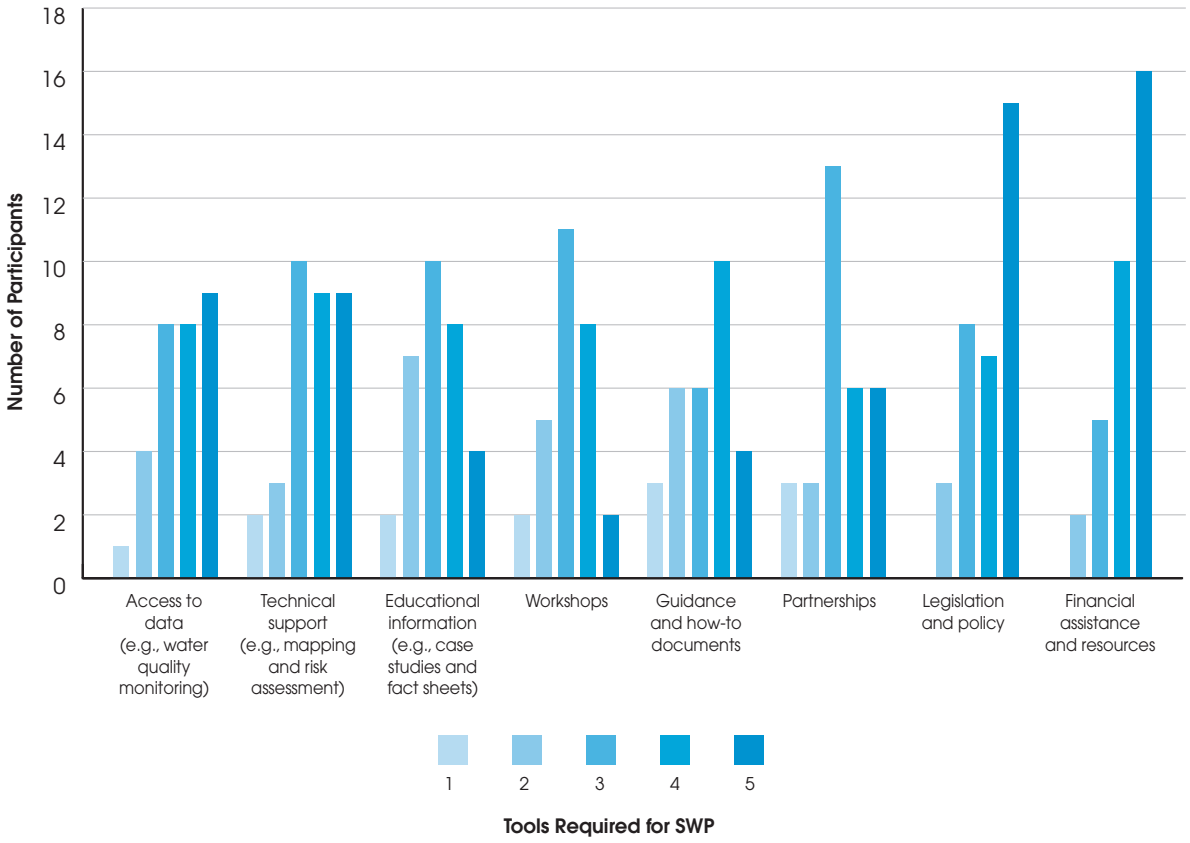


Figure 10: Ranking of Source Water Protection Tools

Inadequate

Participants were asked to rank what was least needed (1) to what was most needed (5). Figure 10 reveals that partnerships, legislation and policy, and financial assistance and resources are inadequate and most desired. Several participants also indicated a need for technical support (e.g., mapping and risk assessment) and access to data to support SWP activities

Conclusions

- Most SWP efforts are occurring at the watershed and municipal level.
- Environmental factors, followed by social and public health factors, are the primary drivers for protecting drinking water sources.
- Data showed that the focus of SWP approaches is more on providing information and training, as well as on legislation, policies, plans, processes, and guidance, and less on research and monitoring of the drinking water sources.
- Decision makers and the public are the main target audiences of SWP approaches.
- Collaboration is occurring among WPACs, WSGs, and municipalities, but important groups were missing, including Indigenous communities, regional water commissions, and water co-operatives.
- More SWP planning was reported and less implementation and evaluation.
- More tools and resources are required to support SWP initiatives. Partnerships, legislation, policy, financial assistance, and resources are insufficient but necessary to enhance SWP efforts.
- Multiple groups are spearheading initiatives, and there is no clear SWP lead agency.
- SWP plans, DWSPs, IWMPs, municipal development plans, and regional land-use plans are not well-connected and integrated.
- SWP plans are being developed by WPACs, municipalities, drinking water providers, and other types of collaborative groups, such as regional municipalities.

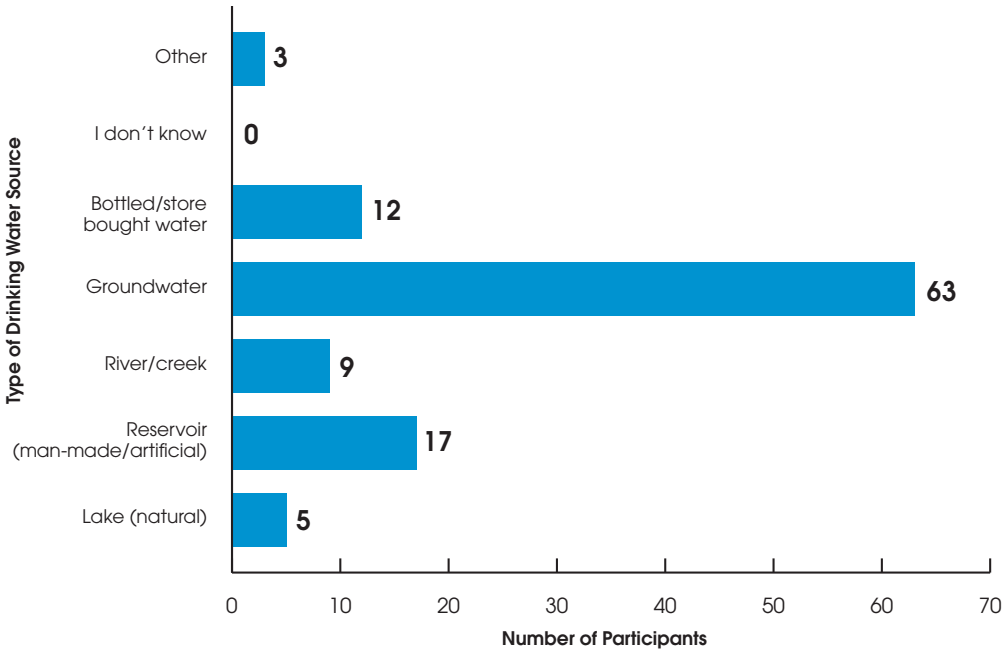


Figure 11: Type of Drinking Water Source

2.4.2 Results of the Individual Survey

Responses to this survey were received from nearly 100 individuals from most regions in Alberta who rely on a private source of drinking water (i.e., well, dugout, other) on their property. The results are summarized here, and the details appear in Appendix F.

Source of Drinking Water

Figure 11 illustrates the various sources of drinking water as noted by survey participants. Most participants get their drinking water from groundwater; a minority obtain it from reservoirs, lakes, rivers, creeks, and bottled water purchased from stores. A few said their drinking water comes from other sources, such as town water in buckets, hauled or trucked water, and filtered rainwater. Participants indicated that they know where their drinking water comes from.

Perceived Safety of Drinking Water

Participants ranked how safe they felt their drinking water source is on a scale of 1 (not very safe) to 5 (very safe). Most thought their drinking water was very safe. When asked to explain the reason for their ranking, the following examples were shared:

- We have a deep well that is usually undisturbed.
- We use filtered well water in a rural area.
- We ensure that our drinking water is tested often.
- We have a commercial treatment system.
- We disinfect the cistern every two years.
- We try very hard to follow best practices to ensure good water quality.
- We don't have asbestos water pipes.
- We have a new well with new casing and clean supply.

Frequency of Water Testing

Thirty-two percent of participants have their drinking water tested every two to five years, twenty-seven percent have it tested annually, and nineteen percent did not have it tested often (more than five years ago). Respondents said most of the testing is done by the local health centre as indicated in Table 4. A few participants were unsure who was responsible for testing, and others mentioned the following as doing the testing:

- Down to Earth Laboratories
- oil company
- county
- drinking water treatment plant

Table 4: Drinking Water Testers

Who Is Doing the Testing?	Percentage
Health centre	70 %
Private consultant or laboratory	20%
Unsure	8%
Other	2%

Cooperating with Others

Sixty-five percent of participants are working with neighbours, friends, and other groups nearby to protect their drinking water source. When asked who they were working with, respondents mentioned the following:

Community Members

- neighbours
- community association
- municipalities

Watershed Groups

- North Saskatchewan Watershed Alliance
- Gull Lake Watershed Society
- Boundary Creek Landowners Association

Environmental NGOs

- ReThink Red Deer
- Alberta Riparian Habitat Management Society (Cows and Fish)
- Lakeland Industry and Community Association

Others

- water co-operative
- oil company
- Alberta Health Services

Tools, Information, Networks, Groups, and Resources

Individuals shared their thoughts about useful and inadequate tools, information, networks, and resources, as noted below.

Useful

- Working Well Program
- fencing dugout and riparian areas
- off-site watering of cattle away from the drinking water source

Inadequate

Respondents identified three main areas where more work is needed and proposed ideas in each category.

Access to Information, Data, Equipment, and Technology

- information on well shocking
- where to find information about drinking water quality
- access to equipment that can help an individual (e.g., cottage owner) chlorine shock a well
- understanding the responsibilities of municipal government for managing land use to protect drinking water sources

Create Awareness about Protecting Drinking Water Sources

- periodic updates and notices from the drinking water provider to remind people of the need to test water often
- use of advertising and education to raise awareness about protecting drinking water
- workshops and seminars about SWP hosted by the county

Provide More Resources and Support

- lack of government grants for drilling new wells
- bursaries for farmers to bring their drinking water supplies up to a safe level
- more places to get testing done and information on where to drop off samples and pick up results
- free testing of water wells

Conclusions

- Groundwater from a water well system is the main source of drinking water for individuals in rural areas.
- The most defined risks to drinking water are extreme weather events (e.g., drought or flood) followed by oil and gas activities, other industrial activities and spillages, construction and development, and livestock activities.

- Lack of money and unpredictable water supply are barriers to protecting drinking water sources.
- Most participants believe their water source is safe for drinking.
- Water testing every two to five years is common among participants.
- Co-operation between participants and others (e.g., WPACs, WSGs, municipalities, and neighbours) is occurring.
- Greater access to information, data, equipment, and technology is needed along with more support and resources.
- Data collection, information, and monitoring of the source as well as more restrictions on harmful upstream activities are needed.
- Awareness about the importance of SWP, the watershed, and regular water testing must be better promoted.

2.4.3 Results of the Targeted Questionnaire to Drinking Water Providers

Given the limited time and resources, the team was able to survey only a small cross-section of drinking water providers in Alberta. They sorted several communities by the following criteria:

- municipality
- Indigenous community
- drinking water sources (e.g., lake/reservoir, river, GWUDI, groundwater)
- geographic location (e.g., urban, rural, north, central, south)
- size of drinking water treatment plant (big, medium, small)

A targeted questionnaire was sent to drinking water providers in 13 selected communities: the Aspen Regional Water Services Commission, City of Red Deer, Town of Hardisty, Newell Regional Services Corporation, City of Calgary, County of Lac La Biche, Town of Banff, Town of Sedgewick, Town of Sundre, Town of Grimshaw, Regional Municipality of Wood Buffalo, Town of Milk River, and City of Edmonton. The questionnaire was also sent to drinking water providers in selected Indigenous communities and several dialogues were facilitated, but no responses to the questionnaire was received in writing. However, several Indigenous communities indicated that they were undertaking SWP work. The results are summarized here, and details can be found in Appendix F.

Size of Drinking Water Treatment Systems

Figure 10 indicates that of the 13 drinking water providers, 54 percent have large systems (>10,000 population), 23 percent have medium systems (1,501 to 10,000 population), and 23 percent have small systems (<1,500 population), thus ensuring that a cross-section of drinking water systems was examined for this study. The population of cities such as Calgary and Edmonton makes larger drinking water systems necessary. There has been a growing trend towards regionalization in which larger systems provide drinking water to users outside their municipal boundaries in neighbouring municipalities, regional water systems, water co-operatives, and others.

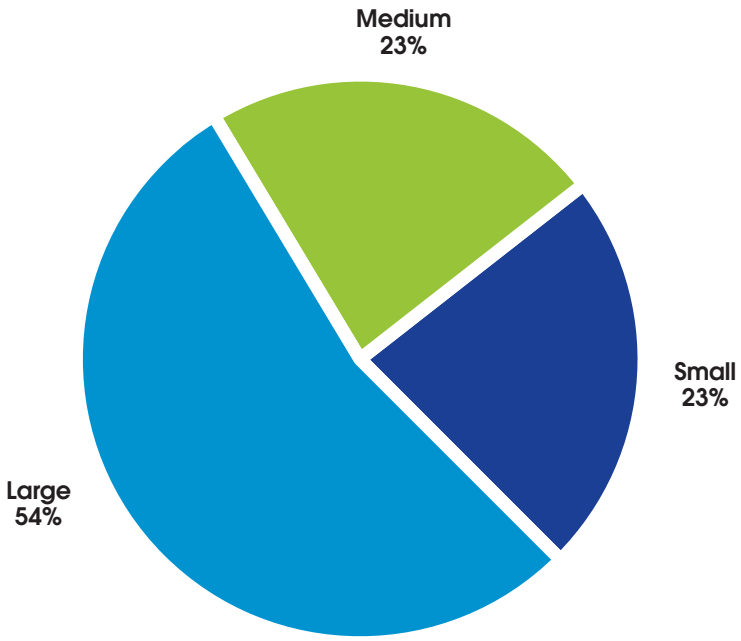


Figure 12: Size of Drinking Water Treatment System

Collaboration

Thirty-eight percent of drinking water providers indicated that they are collaborating with other groups while sixty-two percent are not although drinking water providers do collaborate with the GoA to create DWSPs. In addition to the GoA, the following groups were noted as collaborators:

- Alberta Health Services
- WPACs
- WSGs
- irrigation districts
- municipalities
- regional water systems
- environmental NGOs (e.g., Alberta Lake Management Society, Alberta Alternative Land Use Services, Alberta Low Impact Development Partnership, Clearwater Landcare, Trout Unlimited, Riverwatch, and The Water Network)
- water co-operatives
- research institutions and academia (e.g., Prairie Adaptation Research Collaborative, The University of Victoria, and The University of Calgary)
- industry
- Environment Canada
- Indigenous communities

Drinking water providers who serve larger communities and have more staff, time, and resources were found to collaborate more with a larger cross-section of groups than those who serve smaller communities with limited resources. The main reasons for collaborating are as follows:

- to ensure coordinated SWP efforts among neighbouring municipalities
- to assist with research projects
- to minimize upstream impacts on downstream drinking water sources
- to raise awareness about SWP efforts through public education programs
- to find partners to help with SWP (e.g., share information, research, and networks)
- to participate in a benchmarking initiative (e.g., a comparative study about several Albertan communities)

Tools, Networks and Groups, and Information and Resources

Drinking water providers shared what they think are both useful and insufficient tools, networks and groups, and information and resources, identifying several categories in each area.

Useful

Tools

- Real-Time Hydrometric Data from Environment Canada
  https://wateroffice.ec.gc.ca/mainmenu/real_time_data_index_e.html
- Alberta Rivers Application from the Government of Alberta
  https://itunes.apple.com/ca/app/alberta-rivers/id888325071?mt=8
- Wildfire Burn Probability Model and Mapping by Alberta Agriculture and Forestry
  http://wildfire.alberta.ca/firesmart/firesmart-landscapes/fire-regime-analysis.aspx

Networks and Groups

- Water North Coalition
  http://nadc.ca/our-business/partnerships/water-north-coalition/
- Alberta Water and Wastewater Operators Association (AWWOA) (e.g., annual operators' seminar, Water Week Conference, and annual golf tournament)
  https://awwoa.ca/
- Red Deer River Municipal Users Group (RDRMUG)
  http://rdrmug.ca/

Information and Resources

- DWSPs and supporting materials (e.g., guidance framework and notes, training courses, and templates) by AEP
  http://environment.alberta.ca/apps/regulateddwq/DWSP.aspx
- AWWOA Training Courses
  https://awwoa.ca/training/courses-offered

- Alberta Municipal Health and Safety Association (safety training courses and resources)
  https://www.amhsa.net/safety-training/browse/

Inadequate

Tools

- lack of real-time tools for data collection and monitoring (e.g., drinking water risk mapping tool; pollutant loading tool; and models and real-time data to estimate the origin, fate, and transport of contaminants into water bodies)

Networks and Groups

- a local SWP or watershed body that can bring together groups, Indigenous communities, governments, and drinking water providers to share information and better coordinate activities

Information and Resources

- mechanisms to address non-point source pollution through existing channels, such as implementing policy recommendations from the AWC, regional land-use plans, IWMPs, and lake watershed management plans
- public education about the importance of watersheds and protecting drinking water sources
- information on how watershed/sub-regional drinking water initiatives feed into regional and provincial plans and vice-versa

Several networks including the AWWOA bring together drinking water providers and offer training, guidance, and resources, but monitoring and data collection are not being undertaken or shared widely although this is important to inform management actions. There are not enough tools available for drinking water providers to strengthen their operational work (e.g., mapping tools, resource repository, and list of contacts).

Conclusions

- There is a disconnect when developing, implementing, and monitoring SWP plans and DWSPs.
- The roles and responsibilities of the drinking water provider in the SWP process are unclear.
- Collaboration between drinking water providers and other key groups (e.g., WPACs, WSGs, and research and academia) in small and rural communities is lacking.
- The ability to influence upstream activities is limited.
- More data collection and monitoring of the source are required.
- Managing water quality should be emphasized over water quantity.
- Information, resources, and guidance on SWP are readily available, but there are not enough tools.
- Limited resources (e.g., funding, training, and expertise) hinder the ability of drinking water providers in small and rural communities to protect the source.
- The lack of public awareness about the importance of a watershed impedes SWP efforts.
- How watershed/sub-regional, SWP, and DWSP initiatives are integrated with other land and water plans remains unclear.

3.0 Complementary Source Water Related Initiatives

To complete the third key task of the project, the team documented complementary source water related initiatives (i.e. legislation, plans, policies, programs, and education) in Alberta. These indirectly related initiatives contribute to or support protecting sources of drinking water.

Although SWP is not mandatory in Alberta, a range of provincial acts and regulations and some municipal bylaws support SWP. Various provincial guidance and standards are also in place for municipal utilities and specific industries but often lack a connection to SWP. Several organizations are involved in developing plans for sub-regional land use as well as for water and watershed management that complement SWP. Support is available at provincial and local levels through programs for education and outreach or research and stewardship activities. A few tools are available for basic applications, but they are not all easy to access or use. Table 2 summarizes the findings of the literature review. Table 5 summarizes the findings of the research.

Table 5: Key Findings from Complementary Source Water Related Approaches

Type of Initiative	Key Findings
Legislation and Regulation	■ predominantly provincial in scale with some municipal land-use bylaws (e.g., City of Edmonton Land-use Bylaw–Zoning Bylaw, Pigeon Lake Model Land Use Bylaw, and Town of Cochrane Land Use Bylaw) ■ no obvious redundancies ■ diverse audiences targeted—primarily governments, drinking water providers, industry, livestock and crop producers, and developers ■ mostly provincial acts (e.g., *Water Act, Alberta Land Stewardship Act, and Environmental Protection and Enhancement Act*) with some federal acts (e.g., *Federal Navigation Protection Act, Natural Resources Conservation Board Act*, and *Transportation of Dangerous Goods Act)*

Type of Initiative	Key Findings
Policy and Guidance	■ predominantly provincial in scale (e.g., Alberta Soil and Groundwater Remediation Guidelines, Forest Management Plans and Operating Ground Rules, and the *Water for Life* strategy) ■ fewer initiatives exist at the sub-regional or watershed level (e.g., *Workbook for Developing Lake Watershed Management Plans in Alberta*, *Clean Runoff Action Guide*, and *Best Management Practices for Stormwater Management Facilities*) ■ specific target groups (e.g., crop producers, wastewater treatment plant operators, and industries undertaking oilfield injection activities) ■ guidance documents more common than policy documents ■ best management practices more focused on agriculture and less on other types of industries (e.g., oil and gas, mining, and irrigation) ■ provincial in scale (e.g., Dam and Canal Safety Regulatory System, Surface Water Quality Guidelines and Objectives, and Environmental Quality Guidelines for Alberta Surface Waters) ■ primarily created by the GoA, fewer by the GoC ■ targets drinking water operators and municipalities ■ no obvious redundancies

Type of Initiative	Key Findings
Water-Related Plans	■ mostly sub-regional/watershed in scale (e.g., IWMPs and lake watershed management plans) ■ emphasis on lake watershed management planning ■ fewer regional land-use plans, municipal development plans, and inter-municipal development plans ■ diversity of organizations developing plans (e.g., GoA, WPACs, and WSGs) ■ drinking water protection not usually the focus of these water-related plans but considered part of a broader management approach ■ unclear how IWMPs, DWSPs, lake watershed management plans, municipal development plans, and regional land-use plans integrate and work together ■ unclear how collaboration occurs with respect to planning, implementation, and evaluation of desired outcomes for each plan
Program	■ evenly split between provincial and sub-regional or watershed level programs ■ created and implemented by mainly GoA, WSGs, and other types of NGOs ■ duplicated programs observed at the sub-regional or watershed level ■ primary uses include education, awareness, and outreach (e.g., Healthy Lake Lawn Care, Clear Water Landcare Program, and Living by Water Program) ■ fewer research, training, and funding programs available (e.g., Circuit Rider Training Program, Alberta Community Resilience Program, and Provincial Groundwater Inventory Program)
Tools	■ a few focused on specific areas and municipalities with provincial tools ■ developed primarily by GoA ■ fewer tools for protecting groundwater sources ■ specific tools for rivers observed

See Appendix E for an inventory of collected approaches.

4.0 Source Water Protection Approaches and Risk Management Models in Selected Jurisdictions

To complete the fourth key task of the project, the team worked with a consultant to examine SWP approaches and risk management models in selected jurisdictions in North America and Australia).

Five jurisdictions were examined for this work: Australia, British Columbia, Colorado, California, and Ontario. The review considered approaches that have worked well or not worked well in these jurisdictions and their potential application to Alberta. Based on the results of the review, this section provides guidance on how Alberta can strengthen activities to protect drinking water sources. The consultant's report was aligned with some of the steps detailed in the *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning,*[31] that adapts the American Water Works Association's Standard G300 SWP Standard.[32] The consultant's jurisdictional review report is presented in Appendix G.

4.1 Selection of Jurisdictions

Team members provided the consultant with a list of potential jurisdictions for this review. Several criteria were used to narrow down the list:

- similar geography to Alberta (land-locked areas, water scarcity, mountains, large rural areas)
- similar stakeholders (small municipalities, Indigenous communities)
- existing SWP planning system to provide learning opportunities
- experience with wildfires
- experience working with Indigenous communities on SWP work

31 Alberta Water Council, 2019. *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning.* Available online: https://www.awchome.ca/projects/protecting-sources-drinking-water-alberta-2/ Accessed September 2018.

32 For more information about the AWWA's G300 Standard, go to https://store.awwa.org/store/productdetail.aspx?productid=23946. Accessed September 2018.

Australia is a large country like Canada and has some similar geographic regions to Alberta, including mountains and a large and diverse agricultural land base. Australia also periodically experiences water scarcity. The landscapes of Colorado and California include a mix of urban areas, agriculture, and mountainous terrain and were identified as having detailed SWP guidance in place. British Columbia was selected because the constitutional framework for water management is the same as Alberta's, and it experiences similar challenges regarding water supply, especially for small communities. Ontario was reviewed by the project team rather than by the consultant, and relevant information was incorporated into this companion report where possible.[33]

4.2 Methodology

Early in the project, the team developed a preliminary questionnaire to focus the jurisdictional review and gather information. After the project started, an expert workshop was convened to:

- discuss the general status of SWP in Alberta at a high level and identify major drivers, issues, and knowledge gaps
- assess if the preliminary questions provided were enough to review SWP approaches and risk management models elsewhere
- develop additional questions that would be pertinent for the review if gaps were identified

The workshop was attended by the consultant's senior water engineers with experience developing municipal DWSPs, senior environmental scientists with experience in SWP plans, and key SWP project team members. Discussion points were used to amend the preliminary questionnaire, and a final questionnaire was developed.[34] This final version was used in gathering and analyzing information from the other jurisdictions.

33 Associated Environmental, 2019. *Source Water Protection Approaches and Risk Management Models in Selected Jurisdictions*. Available online: https://www.awchome.ca/projects/protecting-sources-drinking-water-alberta-2/ Accessed March 2019.

34 Associated Environmental, 2019. *Source Water Protection Approaches and Risk Management Models in Selected Jurisdictions*. Available online: https://www.awchome.ca/projects/protecting-sources-drinking-water-alberta-2/ Accessed March 2019.

4.3 Guidance for the Alberta Context

After reviewing the consultant's report, the team discussed the following questions in relation to some of the steps outlined in the *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning in Alberta:*

- What are other jurisdictions doing?
- What is Alberta doing in comparison to this?
- What could be applied in the Alberta context?

Table 6 summarizes these findings. Several suggestions on common practices for groups involved in SWP planning in Alberta to consider and apply, where feasible, were compiled.

The following common themes emerged from the jurisdictional scan:

- Drinking water providers usually lead SWP planning efforts, although this may be with direction from senior government health or environment agencies.
- Collaboration among stakeholders and rights holders is considered important but has been judged by other jurisdictions to require improvement.
- Clearly defined leadership, responsibilities, and roles of government (including Indigenous governments), land tenure holders, and stakeholders are critical to the creation and implementation of SWP plans.
- Financial assistance, technical and personnel resources, and centralized tools provided to municipalities, regional governments, and Indigenous groups by other governments strongly encourage SWP activities, even when they are voluntary.
- Implementing SWP on private land is challenging but can be overcome by integrating SWP information into stewardship initiatives and local land-use planning (e.g., official plans and bylaws).

Table 6: Comparison of Jurisdictional Findings to the Alberta Context

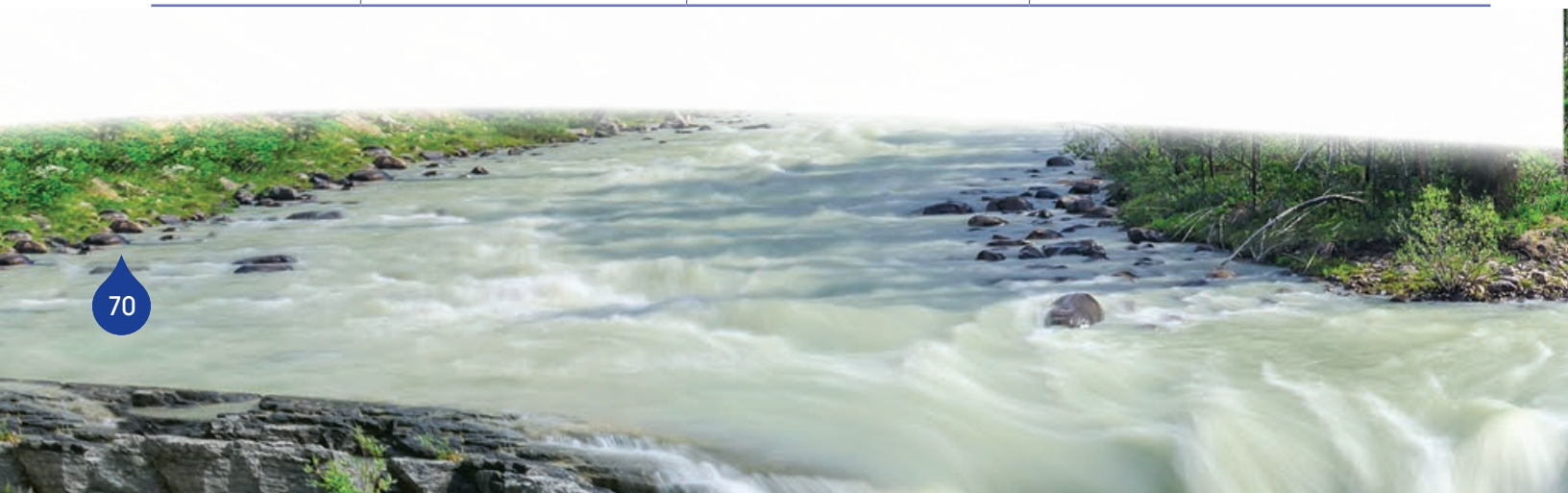
Step	What are Other Jurisdictions Doing?	What is Alberta Doing in Comparison to This?	What Could be Applied to the Alberta Context?
1: Involve Key Groups and Create a Vision	■ The U.S. has a federal requirement for states to complete source water assessments.[35] ■ Drinking water providers champion the SWP planning process in most jurisdictions. ■ In Ontario, the process is co-led by municipalities and conservation authorities.	■ The state of the watershed reporting is similar to source water assessments in the U.S. ■ We have the ability to delineate source water areas at different levels. ■ Leadership from municipalities, WPACs, water utilities, and Indigenous communities is apparent (e.g., City of Calgary, EPCOR Utilities, Siksika Nation, and Frog Lake Nation). ■ Greater tendency toward collaboration is observed in small and rural areas where internal capacity may be limited (e.g., Camrose County and Red Deer River Municipal Users Group).	■ Encourage (at the provincial level) a preliminary source water assessment to increase foundational knowledge of a source water area's characteristics and risks. This would be an extension to DWSPs that are the responsibility of drinking water providers. ■ Expand the DWSP process to examine more risks. Incorporate a requirement for SWP plans to be integrated into standards. ■ Encourage further collaborative efforts through existing portals (e.g., the AWWOA) or create a new, centralized one. ■ Designate a lead or plan champion for the SWP planning process. ■ WPACs can serve as a launching point for facilitating collaboration among municipalities and drinking water providers. ■ Create a template for drafting a SWP committee's terms of reference. This should include suggested roles and responsibilities in the overall process.

35 The Environmental Protection Agency refers to source water assessments to provide water utilities, community governments, and others with information needed to protect drinking water waters. Its *Safe Drinking Water Act* outlines six steps for conducting source water assessments for public water systems. These include delineating the source water protection area, inventorying known and potential sources of contamination, determining the susceptibility of the area, notifying the public about threats, implementing management measures, and developing contingency planning strategies. For more information, see https://www.epa.gov/sourcewaterprotection/basic-information-about-source-water-protection.

Step	What are Other Jurisdictions Doing?	What is Alberta Doing in Comparison to This?	What Could be Applied to the Alberta Context?
2: Characterize Your Source Water Area	■ Some jurisdictions modified their SWP planning approach based on source water area size (e.g., California). ■ Some jurisdictions centralize data so it is easy to find (e.g., the Source Water Collaborative in the U.S.). ■ Data and technical support, tools, and resources are readily available, especially for small and rural communities (e.g., information portal or webpage, tools, networks, and funding).	■ Data, information, and technology support are not easily available, accessible or shared widely. ■ The Canadian Drinking Water Guidelines set limits for protecting drinking water. ■ Consultants are hired to undertake this task if a drinking water provider cannot afford it. ■ The communities that cannot easily access data and information must make assumptions about what the risks are, and these assumptions might be wrong.	■ DWSPs provide a source water assessment where additional assessment for at-risk systems can be continued. ■ Centralize data and information for groups involved in SWP to access (e.g., guidance and technical documents) to small and rural communities that don't have resources (e.g., workshops, forms, and templates). ■ Undertake a capacity gap assessment to understand what to focus on when developing tools that can support the SWP planning process.

Step	What are Other Jurisdictions Doing?	What is Alberta Doing in Comparison to This?	What Could be Applied to the Alberta Context?
3. Set Goals and Develop an Action plan	■ Roles, responsibilities, and accountability in relation to the SWP planning process are clearly articulated to everyone involved and ensure effective coordination. ■ Post-fire mitigation efforts are incorporated as part of the SWP plan planning process. ■ Ongoing education and outreach are built into the process.	■ State of the watershed assessments are already in place.	■ IWMPs can provide a foundation to build on. ■ Provide a summary or list of SWP legislation and technical rules pertinent to risk identification; WPACs can be a good starting point.

Step	What are Other Jurisdictions Doing?	What is Alberta Doing in Comparison to This?	What Could be Applied to the Alberta Context?
4: Implement the Action Plan	■ Australia: – Catchment rangers undertake regular surveillance of the source water area, enforcing restrictions or violations where required. – Water licence trading is done to alleviate shortages during times of drought. ■ Ontario: – Land acquisition targets sensitive areas. – There is a Nutrient Load Management Strategy and associated plans. ■ Colorado: the state uses a bottom-up approach, providing resources to help communities through the SWP planning process.	■ It is a voluntary process. ■ Sensitive areas can be protected through the *Water for Life* strategy, water management, *Wetland Policy* implementation, land acquisition by Ducks Unlimited, Nature Conservancy, and Alberta Land Trust, among others.	■ Provide more funding and resources to support and expand land acquisition efforts. ■ The South Saskatchewan Water Management Plan includes measures for protecting drinking water sources during drought; this can be a model for other basins if required. ■ Improve and expand infrastructure design and maintenance standards in source water areas (e.g., stormwater treatment). ■ Ensure that SWP planning considers broader issues (e.g., flood and drought mitigation, respective municipal priorities, and regional land-use planning). ■ Develop and implement ongoing education and engagement programs about the importance of drinking water sources and why we need to protect them. ■ Provide funding incentives to encourage groups to participate and complete SWP planning. ■ Develop and enforce observational monitoring of the source water areas to minimize and prevent harmful activities on land and water.



Step	What are Other Jurisdictions Doing?	What is Alberta Doing in Comparison to This?	What Could be Applied to the Alberta Context?
	■ British Columbia: the province uses infrastructure design and maintenance standards in drinking water areas (e.g., stormwater treatment and riparian setbacks) to improve water quality. ■ Overall: not a lot of support for small and rural communities to implement SWP plans.		
Collaboration – all steps	■ British Columbia: – Input from respective communities is gathered after the assessment is done. – Collaboration is not very common in the SWP planning process. – Process is led by the Ministry of Health. – Non-government organizations and other interested groups are excluded from assessment process.	■ The *Water for Life* strategy supports its partnerships (i.e., GoA, AWC, WPACs, and WSGs) and their roles in SWP planning to an extent. ■ WPAC boards include diverse representation from municipalities, industry, and, in some cases, Indigenous communities. ■ Some guidance materials exist. ■ There is no mandated participation. ■ The DWSP process is mandated and overlaps with the SWP planning process to a degree.	■ Create and share a list of key groups involved in SWP, or intending to become involved, so they can pool grant money and other resources.

Step	What are Other Jurisdictions Doing?	What is Alberta Doing in Comparison to This?	What Could be Applied to the Alberta Context?
	■ Ontario: legislates source protection committees. ■ Colorado: provides stakeholder lists to municipalities and grants that can be pooled so collaboration among municipalities is common and encouraged. ■ Australia: funds the involvement of Indigenous people as an incentive for them to participate. ■ Except for Ontario, requirements for whom to collaborate with and how are unclear. ■ Collaboration with data holders is not included for any of the jurisdictions.		

5.0 Identified Successes, Gaps, Barriers, Redundancies, and Lessons Learned

To complete the fifth key task of the project, the team identified SWP successes, gaps, barriers, redundancies, and lessons learned through project team analysis and discussions based on the results obtained from tasks two to four in the terms of reference.

The findings presented here were collected from the surveys, targeted questionnaire, literature review, and group discussions; they do not represent all the successes, gaps, barriers, redundancies, lessons learned, and common practices in Alberta. Some of these findings may be viewed as subjective and not science-based. The team complied the findings from the surveys, the targeted questionnaire, and the literature review and sorted the findings by five key themes related to SWP:

- data collection, information, and monitoring
- development, regulatory, and enforcement
- collaboration and engagement
- resources and training
- governance

These findings were then further sorted by:

- **Successes** — an approach that is accomplishing an aim or purpose
- **Gaps** — an incomplete, deficient area
- **Barriers** — something that is preventing action
- **Redundancies** — repetition or duplication of efforts and where opportunities for integration and collaboration are present
- **Lessons learned** — knowledge or understanding that was gained from experience
- **Common practices** — proven method or process that results in success

Some of these findings are summarized below.

5.1 Public and Private Organizations (Including Drinking Water Providers)

Data Collection, Information, and Monitoring

Successes

- State of the watershed reports developed by WPACs and WSGs provide important baseline information for evaluating land uses and potential contamination and risks to drinking water sources.
- GoA maintains an inventory of water licences and registrations in the province that includes the total volume of surface and groundwater allocated in each watershed.
- GoA offers base feature datasets as well as several other datasets for free.
- Provincial GIS files can be downloaded from www.AltaLIS.com.
  - The entire GoA spatial data catalogue can be searched and viewed on GeoDiscover Alberta at www.GeoDiscover.Alberta.ca.
  - Groundwater vulnerability maps have been published to assess the vulnerability of aquifers to surface water contamination and are also available on GeoDiscover Alberta.

Gaps

- Day-to-day source water quality and quantity data and other real-time information are lacking.
- Efforts are mostly focused on watershed and lake watershed management planning, stewardship projects, and education programs and less on SWP planning, research, and monitoring.
- There is a need to identify key drinking water risks (e.g., specific threats or contaminants, such as sedimentation, organics, and hydrocarbons) that drinking water providers should be prepared to address and potential common practices for assessing and managing these risks.

Barriers

- Various SWP parameters are being used, and there is no consistency in how they are being used.
- Many communities lack the capacity, resources, or expertise to monitor and assess risks to drinking water sources.
- It is challenging to access datasets through web-based interfaces with insufficient protocols, official agreements, or documentation.

Redundancies

- Various organizations have multiple sources of climate change data.

Lessons Learned

- By implementing a monitoring program with partners, a larger and more representative sample of drinking water quality and quantity in a source water area can be collected.
- It is important to translate data and technical information into meaningful materials that decision makers can use to develop policy.

Common Practices

- Community-based water monitoring has been helpful with collecting data and information in some communities.
- Water quantity is becoming a focus of SWP rather than only water quality.

Development, Regulatory, and Enforcement

Successes

- The Land-use Framework and its associated regional land-use plans can also protect drinking water sources.
- Municipal development plans can also protect drinking water sources.
- Municipal bylaws are influential tools that can be applied when needed to safeguard drinking water sources.

Gaps

- Regional land-use plans can be a challenge to enforce—some plans have not been developed for regions in Alberta.
- The voluntary nature of IWMPs presents a hurdle for implementing actions and, in turn, protecting drinking water sources.

Barriers

- It is difficult to manage enforcement measures on non-compliant recreational, residential, and industrial activities that happen in proximity to the drinking water source.
- It is challenging to achieve the desired outcomes of collaborative management plans and align them with related regulatory initiatives.
- Regulations often change frequently, and sometimes affected groups are not consulted.

Redundancies

- Municipalities need to collaborate more among themselves to protect sources of drinking water as they create municipal and inter-municipal development plans.

Lessons Learned

- Managing the headwaters and uplands of drinking water sources is an important focus.
- Water quality should be treated as a public health issue, and more money invested to improve water quality.

Common Practices

- Investing in capital projects may ensure the source is proactively protected (e.g., switching from a diesel to a gas emergency generator).
- Implement regulations that require setbacks from water bodies for various activities or structures that could adversely affect water quality.

Collaboration and Engagement

Successes

- The Alberta Federation of Rural Water Co-operatives Ltd. has formed and supported water co-operatives to pool resources and share ownership, costs, and benefits of a self-owned system for providing safe, reliable, sustainable, and affordable water to rural communities.
- WPACs and WSGs are leading most SWP initiatives and bringing partners together to work on watershed-level challenges.

Gaps

- Collaboration among drinking water providers, water co-operatives, WPACs, and other organizations is inadequate.
- Drinking water treatment plant operators and public works staff of municipalities as well as water co-operatives and regional water commission staff are not as engaged in SWP work as other groups.
- Collaboration with Indigenous communities is occurring but at a minimal level.

Barriers

- Jurisdictional challenges prevail, particularly among municipalities, but less at the transboundary, provincial and territorial level, and within individual organizations.
- Communication with key decision makers is a struggle because of competing priorities.
- The timeframe for SWP is long term, and sometimes budgets and priorities are short term.

Lessons Learned

- SWP cannot be done in isolation and requires engagement and relationships with a wide range of stakeholders.

Common Practices

- Workshops on best practices can be facilitated for restoring damaged shoreline using natural processes and native plant material.
- Communication can be more effective if approaches are clear and concise when working with other agencies.
- It is vital to collaborate with key organizations in the source water area, such as WPACs, WSGs, municipalities, NGOs, research institutions, and academia.

Resources and Training

Successes

- DWSP guide and supporting materials are available from the GoA for drinking water providers.
- Alberta Municipal Water/Wastewater Partnership provides cost-sharing funding to smaller municipalities for constructing water supply and treatment facilities.
- Alberta Water and Wastewater Operators Association's tools and resources are available.

Gaps

- WPACs and WSGs need stable and increased funding to keep doing SWP work.

Barriers

- Funding and resources for upgrading infrastructure, buying new equipment, or training staff are inadequate.
- WPACs and WSGs do not have enough funding to support SWP efforts.
- Water supply and distribution infrastructure is aging making it a challenge to maintain water quality and quantity of the source water,

Lessons Learned

- Leveraging funding with other organizations can maximize results.
- Make sure there is sustainable funding for water quality programs.
- Invest in stormwater treatment to improve drinking water quality in the long term.

Governance

Successes

- There is a strong focus on raw water protection (i.e., well security and water quality).

Gaps

- Drinking water protection requirements are absent in existing provincial legislation.

Barriers

- Accountabilities and response time from leaders to on-the-ground groups are insufficient.
- Clarity is needed on the roles of municipalities, WPACs, GoA, and others in developing, implementing, and evaluating SWP plans and programs.

Redundancies

- Both DWSPs and SWP plans strive to directly protect drinking water sources, and they overlap in some areas.
- Lake Watershed Management Plans, IWMPs, and regional plans strive to protect drinking water supplies indirectly, and they overlap in some areas.

Lessons Learned

- The use of environmental economic instruments (e.g., a price on pollution discharges, water withdrawals, and land-use impacts based on the full economic and environmental value of water and land) can promote drinking water protection.
- SWP is not a simple exercise or a checkbox you can complete; it is an ongoing and ever-evolving process.
- The lack of integrated land-use planning continues to be a major barrier for those attempting to implement SWP plans for their operation, independent of the scale (major river to small lake).

5.2 Individuals

Data Collection, Information, and Monitoring

Successes

- Most of the individuals who participated in the survey get their drinking water tested every two-to-five years.

Gaps

- There is insufficient information on well shocking.
- It is difficult to find information about drinking water quality and quantity.
- The test results are not always accessible or easy to interpret.

Barriers

- There is not enough time to take care of the drinking water source because some people are busy with other priorities.
- People don't know who to ask for help when taking care of the source.

Lessons Learned

- It would be valuable to provide knowledge on how to establish static water depth.
- It is important to provide current information on how contaminants are getting into water sources and where this is happening.

Common Practices

- A trained volunteer living in the community can provide kits and collect water samples during a specific week or month; this would be better than residents of each house having to travel.
- Equipment should be made more readily available for undertaking chlorine shock of well by residents who are interested.
- Well maintenance should be undertaken at periodic intervals and not when the well fails.

Development, Regulatory, and Enforcement

Gaps

- Some private systems are not required to adhere to AEP regulations (i.e., farms, Indigenous communities, communal systems, and private residences) and rely instead on Alberta Health and regional health authorities.
- Mandatory screening of individuals' water should be done to determine pollution risks.
- Policy and legislation do not allow for grey water usage.

Barriers

- Not all water wells are registered; old wells are not properly closed.
- Agricultural practices including intensive livestock operations and the use of herbicides and fertilizer threaten groundwater supply.

Lessons Learned

- Water wells must be properly completed by an expert.
- Have a backup dugout so that you can clean the other one on an annual rotation.
- Disinfect your cistern every two years.

Common Practices

- Dugouts and riparian areas must be fenced so that no wildlife can enter and cause any contamination.
- Setbacks for septic systems should be in place and part of the planning process.
- Conservation easements can be explored and implemented if suitable.

Collaboration and Engagement

Successes

- There is a fairly good level of participation by individuals in the GoA's Working Well Program.
- The ALMS' LakeWatch Program provides water quality and quantity data and updates for several lakes in the province.
- The Land Stewardship Centre's Septic Sense workshops help homeowners take better care of their systems by implementing best management practices.

Gaps

- There are no updates from the drinking water provider with notices to remind people of the need to test water at key milestones.
- There are not enough workshops and seminars about SWP being hosted by local municipalities to date.
- The general public do not have sufficient understanding of where drinking water comes from (e.g., campaigns, education, and signage are needed).

Lessons Learned

- Educate individuals about the surrounding watershed and its importance.
- Improve understanding of aquifers and their flow paths.
- Be aware of the risks to your drinking water and take the initiative to maintain its quality and quantity.

Common Practices

- It is important to make the connection between animal husbandry and SWP organizations.
- Create a list and know who to go to for help in time of an emergency.
- Give advice and support when something outside an individual's control damages the water source.

Resources and Training

Successes

- The AEP's Working Well Program educates well owners about how to responsibly care for their wells.
- Alberta Agriculture and Forestry's Quality Farm Dugouts Program teaches landowners about best management practices when maintaining a dugout on their property.
- The Alberta Riparian Habitat Management Society (Cows and Fish) works with farmers and other types of landowners to prevent livestock from entering water bodies and degrading its quality.

Gaps

- Sometimes there is no suitable equipment available for well drilling.
- There are limited options and contractors available for water well drilling.

Common Practices

- Hosting annual water test drives can help individuals be aware of the need for water testing.
- By making funding available to some landowners, they can decommission abandoned wells.
- Reducing the rates for water testing may encourage more testing by private well owners.

Governance

Gaps

- There are no laws to protect groundwater—particularly when it comes to the decommissioning of water wells.
- There is confusion about municipal government responsibilities and managing land use to protect source water.

Barriers

- Depending on the government's priorities, protecting sources of drinking water can be either a high priority or a low priority.

5.3 Overall

Data Collection, Information, and Monitoring

Gaps

- There is insufficient research, data, information, and understanding about surface and groundwater interactions.
- There are not enough Alberta-specific tools to help with SWP (e.g., risk assessment and mapping tools, and drinking water maps), particularly for groundwater.
- There is a lack of real-time data and monitoring of drinking water sources in the watershed.

Barriers

- Source water quality impacts (e.g., contamination) are emphasized more than source water quantity (e.g., low water levels in aquifers).
- There is more focus on managing surface water sources than on managing groundwater sources.

Lessons Learned

- Track the performance of SWP approaches to learn which areas need improvement.
- Make better use of social science and environmental psychology work.
- Implement economic instruments to better support water management.

Development, Regulatory, and Enforcement

Successes

- Work on land-use planning processes has been very collaborative and has had a big impact on the outcome of the process.
- Work on forestry practices has been less successful.

Barriers

- There is a limited ability to mitigate or restrict potentially harmful upstream activities.
- It is challenging to limit the transportation of dangerous goods through small and rural communities.

Lessons Learned

- Improve stormwater management in urban areas.

Collaboration and Engagement

Successes

- More collaboration is occurring at the regional and municipal levels than at the provincial or federal levels.

Gaps

- The general public do not sufficiently understand the importance of protecting drinking water sources and, in turn, the watershed.
- Drinking water treatment plant operators and public works staff of municipalities as well as water co-operatives and regional water commission staff are not as engaged in SWP work as other groups.

Barriers

- It is a challenge for some members of the public to become more involved in protecting drinking water sources.
- There is a lack of concern by some municipalities about SWP.

Lessons Learned

- Networking among involved groups (e.g., municipalities, regional water commissions, water co-operatives, and WPACs) drives collaboration.
- Have more workshops for target audiences to learn about best practices in taking care of their drinking water (e.g., Working Well).
- Educate and involve the public and municipal decision makers in SWP efforts (e.g., demonstration sites and online forums).

Resources and Training

Successes

- Training programs and certifications are available (e.g., AWWOA, AEP, and NAIT).
- There has been a lot of focus on providing SWP information and training and informing people about the need to be involved with legislation, policies, plans, processes, guidance, and the implementation and promotion of best management practices.

Gaps

- Planners and other municipal players need access to educational resources to help them develop presentations for the public.

Governance

Barriers

- Efforts among sub-regional, regional, and provincial organizations are uncoordinated.
- It is difficult to see exactly how decision-making can influence drinking water protection.
- There are challenges in integrating land and water approaches.

6.0 A Guidance Document

To complete the sixth key task of the project, the team developed a guidance document[36] that highlights best practices[37] from tasks two to five (this document would offer a vision for SWP in Alberta, inform a common approach, and identify tools for implementation to enable decision makers to manage source waters).

The project team developed a separate *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning* as a complementary document to this companion report.[38] The guide provides advice on how to protect drinking water sources through developing a Source Water Protection Plan. It is intended for drinking water providers (i.e., public, private, and individual) and key groups that they collaborate with (e.g., WPACs and WSGs). Its structure was adapted from the SWP Operational Guide to the AWWA's Standard G300 and was based on a review of several documents and expertise from Alberta and other jurisdictions.

The guide includes six steps for creating a SWP plan. Each step offers key factors for success for drinking water providers to consider when undertaking this work, with related case studies, tools, and examples. A list of resources, methods used to identify wellhead protection areas, identified risks, common practices, risk management approaches, and legislation and policies related to SWP in Alberta are detailed in the supporting appendices.

For more information, please refer to the *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning*.

36 For simplicity purposes, the project team decided to change the wording "guidance document" to "guide."

37 Based on their research, the team was unable to find best practices related to drinking water protection that were evidence-based or scientifically defensible. Because of this challenge, they decided that the term "common practices" would better reflect the findings.

38 The *Protecting Sources of Drinking Water in Alberta: Guide to Source Water Protection Planning* can be found here: https://www.awchome.ca/projects/protecting-sources-drinking-water-alberta-2/.

Conclusion

SWP requires a well-coordinated and collaborative approach among partners in a source water area. This approach will ensure effective development, implementation, and evaluation of plans to mitigate potential risks to drinking water quality and quantity. SWP should be viewed as an ongoing and long-term process in which plans are evaluated regularly to ensure that the appropriate groups are at the table, emerging challenges are being addressed, and new tools, technology, and information are being shared and applied.

Although some communities have developed DWSPs, SWP plans take a higher-level watershed focus on protecting drinking water sources. A designated lead can help facilitate the SWP planning process while, as noted in this report, financial assistance, technical and personnel resources, and centralized tools could greatly encourage SWP planning. Integrating SWP plans with other types of land and water initiatives remains a challenge in Alberta. While planning, collaboration, and ongoing evaluation are common to most SWP plans, each source water area is unique and requires a SWP planning approach that is adapted to local risks, conditions, challenges, and opportunities.

Appendices

Appendix A Terms of Reference

Protecting Sources of Drinking Water in Alberta

Approved by the Alberta Water Council (AWC) on March 29, 2018

Context

Albertans' quality of life depends on a healthy, secure, and sustainable water supply for communities, the environment, and the economy. Population growth, development, and climate variability continue to stress water supplies and the health and well-being of Albertans, the economy, and aquatic ecosystems. The AWC launched a working group in October 2017 to scope a project on protecting sources of drinking water, based on a Statement of Opportunity brought forward by the Government of Alberta (GoA).

Source water is untreated, raw water from surface or groundwater sources used for drinking water or other uses. Source Water Protection (SWP)is a risk management process designed to maintain or improve the conditions of water through proactive, collaborative identification, validation, assessment, and management of risk.

In Alberta, SWP is occurring across various geographical areas, utilizing several practices, and spearheaded by diverse groups such as governments, Indigenous communities, watershed organizations, and others. For example, municipalities in Alberta are required to develop drinking water safety plans to assess risks to the source, treatment, network, and consumer components of waterworks systems. Several approaches are implemented to identify, manage, or minimize the potential introduction of contaminants in drinking water sources. There is a need for a common approach and integration of planning and risk management processes to guide SWP for drinking water purposes, particularly in rural and small communities lacking the capacity to do so.

A key goal of *Water for Life* is to ensure safe, secure drinking water supplies for Albertans. This project would advance outcomes of *Water for Life*, *Our Water, Our Future; A Plan for Action*, applicable regional plans, and other pertinent initiatives. While SWP is an extensive topic with multiple areas to examine, this project will focus on protecting drinking water sources with the premise that future phases of work may result following this work.

Strategic Intent (Goal)

The purpose of this work is to document existing SWP approaches and provide guidance for protecting public, private, and individual drinking water sources in Alberta. It will focus on the quality of surface and groundwater supplies (while recognizing that quality and quantity are related).

Objectives

1. Synthesize SWP practices, processes, and risks to drinking water sources in Alberta
2. Document complementary source water related initiatives (i.e., legislation, plans, policies, programs in Alberta and opportunities for integration and collaboration)
3. Examine SWP approaches and risk management models in selected jurisdictions
4. Identify successes, gaps, barriers, redundancies, and lessons learned
5. Develop a guidance document highlighting best practices uncovered from objectives 1 to 4

Key Tasks

1. Develop a work plan that includes key tasks, expected deliverables, and timelines
2. Synthesize SWP practices, processes, and risks to drinking water sources in Alberta:
   - Inventory drinking water treatment plants and their water sources in Alberta
   - Conduct a survey/interviews among water treatment plant operators, GoA and Provincial Authorities, municipalities, Indigenous communities, WPAC, Alberta Health Services, and other upstream and downstream users on identified risks and risk management approaches to drinking water sources and SWP practices
3. Document complementary water initiatives (i.e., legislation, plans, policies, programs, education) in Alberta:
   a. Create a list of existing source water-related policies, regulations, initiatives, and opportunities for integration and collaboration related to SWP through a literature search
4. Examine SWP approaches and risk management models in selected jurisdictions (e.g., North America, Australia)
   a. Engage a consultant to scan and compile SWP practices in jurisdictions that face similar risks to Alberta's drinking water supply identified in task 2
5. Identify successes, gaps, barriers, redundancies, and lessons learned through project team analysis and discussion based on the results from tasks 2 to 4.

6. Develop a guidance document that highlights best practices from tasks 2 to 5 (this document would offer a vision for SWP in Alberta, inform a common approach, and identify tools for implementation to enable decision makers manage source waters).
7. Provide regular updates and a guidance document to the AWC.

Timelines and Deliverables

The project team will provide the following deliverables to the AWC:

- Present initial findings on SWP practices, processes and risks in Alberta .....Nov. 2018
- Share findings from the jurisdictional review.....March 2019
- Share draft guidance document with findings to the AWC .....June 2019
- Final guidance document with findings to the AWC..... Oct. 2019

Membership

Open to AWC Members and other relevant groups identified by the project team. The project team will operate in a manner consistent with the rules, policies and procedures adopted by the AWC, including the use of consensus to make decisions in a multi-stakeholder process.

Budget

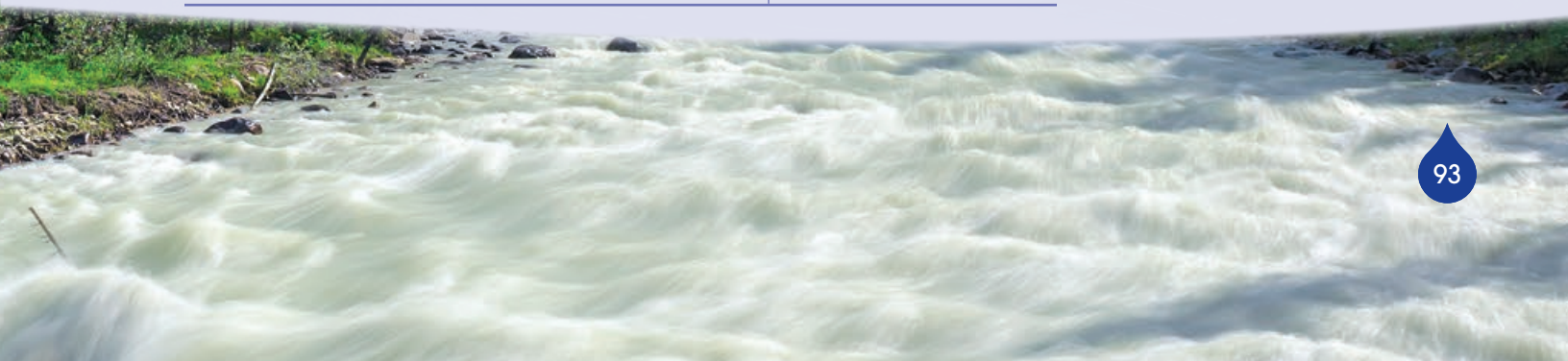
The working group estimates a budget of $120,000 as follows:

Core Funding Costs (covered by the AWC)

Type	Amount
Stakeholder Support	$50,000
Hosting	$5,000
Communications	$15,000

Project Funding Costs (provided by stakeholders)

Type	Amount
Jurisdictional review by consultant *AWC has $25,000 remaining from a previous project that may be available to contribute to this work, meaning only $25,000 would need to be raised from stakeholders.	$50,000



Appendix B Acknowledgments

The AWC acknowledges the contributions of the following working group, project team members, and their organizations who volunteered time and expertise to this work.

Members

Barry White	Alberta Agriculture and Forestry
Dan Moore	Alberta Forest Products Association
Danielle Koleyak	City of Edmonton
Dean Morin*	Alberta Municipal Affairs
Debra Long	Alberta Environment and Parks
Donald Reid	Alberta Environment and Parks
Fiona Briody*	Crop Sector Working Group
George Roman	Bow River Basin Council
James Guthrie*	Alberta Chamber of Resources
Margo Jarvis Redelback	Alberta Irrigation Projects Association
Mike Christensen (co-chair)	Alberta Lake Management Society
Morna Hussey	Alberta Environment and Parks
Paul McLauchlin	Rural Municipalities of Alberta
Phil Boehme (co-chair)	Alberta Environment and Parks
Rosey Radmanovich	(First Nations) Technical Services Advisory Group
Roxane Bretzlaff*	Beaver River Watershed Alliance
Sarah Skinner	Battle River Watershed Alliance
Soren Odegard*	Rural Municipalities of Alberta
Steph Neufeld	EPCOR
Tanya Thorn	Alberta Urban Municipalities Association
Trevor Rhodes	City of Calgary

Project managers: Anuja Ramgoolam, Marie-Claire St-Jacques, Lauren Hall

*Indicates participants of the working group only.

The AWC thanks the following individuals for responding to the targeted questionnaire:

Alex Monkman	City of Red Deer
Derrel Johnson	Town of Grimshaw
Heather Dolhanty	Regional Municipality of Wood Buffalo
Ivan Lesmeister	Town of Hardisty
Jamie Giberson	Aspen Regional Water Services Commission
Khalil Shaikh	Lac La Biche County
Kole Steinley	Newell Regional Water Services Commission
Ryan Moray	Town of Banff
Samuel Beliveau	Town of Milk River
Shane Vollett	Town of Sundre
Staff	Town of Sedgewick

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Appendices C to G are published online

https://www.awchome.ca/projects/protecting-sources-drinking-water-alberta-2/

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