

Protecting Sources of Drinking Water in Alberta

Appendices C, D, E, and F

ALBERTA WATER COUNCIL
JUNE 2019



About the Alberta Water Council

The Alberta Water Council (AWC) is a multi-stakeholder partnership with members from governments, industry, and nongovernment 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 *Water for Life* and continues to administer water and watershed management activities throughout the province.

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Acronyms

AAF	Alberta Agriculture and Forestry
AEP	Alberta Environment and Parks
AUMA	Alberta Urban Municipalities Association
AWC	Alberta Water Council
AWWA	American Water Works Standard
AWWOA	Alberta Water and Wastewater Operators Association
B.C.	British Columbia
DWSPs	Drinking Water Safety Plans
GoA	Government of Alberta
GoC	Government of Canada
GWUDI	Groundwater Under the Direct Influence of Surface Water
IWMPs	Integrated Watershed Management Plans
NGOs	Non-government Organizations
RMA	Rural Municipalities of Alberta
SWP	Source Water Protection
SWPPs	Source Water Protection Plans
U.S.A.	United States of America
WPACs	Watershed Planning and Advisory Councils
WSGs	Watershed Stewardship Group

**Appendix C – List of Regional Drinking Water Systems in
Alberta**

#	Name	Members	Location
1	Aqua 7 Regional Water Commission	Kneehill County, Town of Irricana, Village of Beiseker, Village of Linden, Rocky View County, Village of Acme, Village of Carbon	Acme
2	Aspen Regional Water Services Commission	Athabasca County, Village of Boyle, Town of Athabasca	Athabasca
3	Barrhead Regional Water Commission	County of Barrhead No. 11, Town of Barrhead	Barrhead
4	Bonnyville Regional Water Services Commission	Municipal District of Bonnyville No. 87	Bonnyville
5	google	City of Fort Saskatchewan, Sturgeon County, Town of Gibbons, Strathcona County, Town of Bon Accord, Town of Redwater	Sherwood Park
6	Capital Region Parkland Water Services Commission	City of Spruce Grove, Town of Stony Plain, Parkland County	Spruce Grove
7	Capital Region southwest Water Service Commission	City of Leduc, Lamont County, Town of Beaumont, Town of Millet, Camrose County, Leduc County, Town of Calmar, Village of Hay Lakes	Leduc
8	Cold Lake Regional Utility Services Commission	City of Cold Lake, Cold Lake Indian Reserve #149, Municipal District of Bonnyville No. 87	Cold Lake
9	Darwell Lagoon Commission	Lac Ste. Anne County, Summer Village of South View, Summer Village of Silver Sands	Sangudo
10	Elk Point. St. Paul Regional Water Commission	County of St. Paul No. 19, Town of Elk Point	Elk Point
11	Henry Kroeger Regional Water Services Commission	Municipal District of Acadia No. 34, Town of Hanna, Village of Cereal, Village of Youngstown, Starland County, Town of Oyen, Village of Delia, Special Areas Board	Hanna
12	Highway 12/21 Regional Water Services Commission	Camrose County, Town of Bashaw, Village of Clive, Village of Ferintosh, Lacombe County, Village of Alix, Village of Edberg	Lacombe
13	Highway 14 Regional Water Services Commission	Beaver County, Town of Viking, Village of Ryley, Town of Tofield, Village of Holden	Ryley
14	Highway 28/63 Regional Water Services Commission	Smoky Lake County, Town of Smoky Lake, Village of Waskatenau, Thorhild County, Village of Vilna	Smoky Lake
15	Highway 3 Regional Water Services Commission	County of Forty Mile No. 8, Town of Bow Island, Municipal District of Taber	Taber
16	John S. Batiuk Water Commission	Strathcona County, Town of Bruderheim, Town of Mundare, Village of Chipman, Lamont County, Town of Lamont, Town of Vegreville	Chipman
17	Lethbridge Regional Water Services Commission	Lethbridge County, Town of Coaldale	Lethbridge
18	Magrath and District Regional Water Services Commission	Cardston County, Town of Magrath	Magrath

19	Mountain View Regional Water Services Commission	Town of Bowden, Town of Crossfield, Town of Innisfail, Town of Carstairs, Town of Didsbury, Town of Olds	Red Deer County
20	North Red Deer River Water Services Commission	City of Lacombe, Ponoka County, Town of Ponoka, Lacombe County, Town of Blackfalds	Lacombe
21	Ridge Water Services Commission	County of Warner no. 5, Village of Stirling, Town of Raymond, Village of Warner	Raymond
22	Shirley McClellan Regional Water Services Commission	County of Paintearth no. 18, Town of Castor, Village of Bawlf, Village of Consort, Village of Halkirk, Village of Veteran, Summer of Village of White Sands, County of Stettler No. 6, Town of Coronation, Village of Big Valley, Village of Donalda, Village of Rosalind, Summer Village of Rochon Sands, Special Areas Board	Stettler
23	Smoky River Regional Water Management Commission	Municipal District of Smoky River No. 130, Town of McLennan, Village of Griouxville, Town of Falher, Village of Donnelly	Falher
24	Sylvan Lake Regional Water Commission	Lacombe County, Town of Sylvan Lake, Summer Village of Half Moon Bay, Summer Village of Norglenwold, Red Deer County, Summer Village of Birchcliff, Summer Village of Jarvis Bay, Summer Village of Sunbreaker Cove	Sylvan Lake
25	Twin Valley Regional Water Services Commission	Vulcan County, Village Carmangay, Town of Vulcan, Village of Champion	Vulcan
26	Vauxhall and District Regional Water Services Commission	Municipal District of Taber, Town of Vauxhall	Taber
27	West Inter Lake District Regional Water Services Commission	Lac Ste. Anne County, Town of Onoway, Village of Wabamun, Summer Village of Lakeview, Summer Village of Ross Haven, Summer Village of Seba Beach, Summer Village of Sunset Point, Summer Village of West Cove, Parkland County, Alberta Beach, Summer Village of Castle Island, Summer Village of Nakamun Park, Summer Village of Sunrise Beach, Summer Village of Val Quentin, Summer Village of Yellowstone	Alberta Beach
28	Westlock Regional Water Services Commission	Westlock County, Village of Clyde, Town of Westlock	Clyde

Appendix D – List of Source Water Protection Practices and Processes

Disclaimer: This table lists SWP practices and processes collected by the team's surveys, targeted questionnaire, and literature review, and may not represent a complete list of SWP work in Alberta.

Approach	Type	Who	Scale	Source	Main Goals/Purpose	Targeted Audience	Details	Link
<i>2017 Source Water Protection Plan</i>	Plan	Water Utility - EPCOR	Regional/Watershed	Multiple	1. Establish and maintain source water protection programs that account for unique local conditions, incorporate the interests of local stakeholders and reflect sustainable long-term commitments to the process by all parties.	1. Waterworks operators	This plan was prepared for Edmonton's Rosedale and E.L. Smith water treatment plants (WTPs) which are operated by EPCOR Water Services Inc. (EPCOR), as part of EPCOR's due diligence to protect the communities it serves.	https://www.epcor.com/products-services/water/Documents/source-water-protection-plan.pdf
<i>A Guidance Framework for the Production of Drinking Water Safety Plans</i>	Guidance	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Assist water supply system operators navigate Alberta's Drinking Water Safety Plan process.	1. Waterworks Operators	The purpose of this framework is to assist operators by providing information about the concept of the Drinking Water Safety Plan, why it is necessary and how it will help maintain and operate water supply systems in a way that minimises public health risk.	http://environment.alberta.ca/apps/regulatteddwq/DWSP.aspx
<i>A Source to Tap, Multi-Barrier Approach - Drinking Water Program</i>	Program	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Deliver information about Alberta's Drinking Water Program. 2. Provide information about the multi-barrier 'source to tap' approach. 3. Ensure and maintain the sustainability of drinking water systems.	1. Waterworks operators 2. Bulk Water Hauling Operators	This document details the structure of Alberta's drinking water system including a description of the multi-barrier approach, related legislation and regulations that apply, and involved players who participate in the drinking water system.	http://aep.alberta.ca/water/programs-and-services/drinking-water/documents/DrinkingWaterProgram-May2009.pdf
<i>A Toolkit for Protecting Source Water Quality in the Red Deer River</i>	Tool	Association - Red Deer River Municipal Users Group	Regional/Watershed	Multiple	1. Broaden and improve an understanding of the importance of source water quality 2. Clarify the values of a	1. Municipalities 2. Watershed residents	The toolkit addresses source water protection as a matter of vital concern to the future well-being and sustainability of municipalities, and other water users. The toolkit report addresses 21 threats,	http://rdmug.ca/wp-content/uploads/2014/11/Final-3rd-printing-Toolkit-Report.pdf

<i>Watershed</i>					watershed (regional) approach 3. Identify threats to water quality of sources within river 4. Outline municipal roles in source water and source water quality protection 5. Introduce tools municipalities may use to protect sources water quality		both continuous and periodic, to source water and source water quality. To address threats, it gives 39 tools. The intent of this report is to stimulate municipalities to act and protect source water and its quality.	
<i>Action Protocol for Exceedance of Chemical Health Parameters in Drinking Water</i>	Protocol	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Outline the process followed to develop the Guidelines for Canadian Drinking Water Quality 2. Outline how guidelines will be implemented by Alberta Environment 3. Outline how guidelines will be monitored and reported 4. Outline the protocol to be followed if a non-bacteriological drinking water test exceeds a health limit	1. Alberta Environment and Parks 2. Alberta Health 3. Alberta Health Services 4. Waterworks operators	It is intended that this document will increase the awareness and confidence Albertans have in the drinking water provided to them by regulated waterworks systems.	http://aep.alberta.ca/water/programs-and-services/drinking-water/protection/documents/ActionProtocolExceedanceWater-2009.pdf
<i>Battle River Watershed Alliance SWP Policy Advice and Implementation Guidelines</i>	Policy Advice	Watershed Planning and Advisory Council - Battle River Watershed Alliance	Regional/Watershed	River	1. Development of ground and surface water source water protection plans for the region 2. Monitoring and evaluation to ensure the effectiveness of these source water protection plans 3. Research to support source water protection planning efforts	1. Landowners 2. Watershed residents	Provides an overarching policy direction for source water protection, while the implementation guidelines document describes options for several management strategies to support the implementation of this policy direction.	http://www.battleriverwatershed.ca/sites/default/files/Final%20SWP%20Policy%20Advice%20Report.pdf
<i>Bow is Below: Protecting Calgary's Water</i>	Tool	Municipality - City of Calgary	Regional/Watershed	River	1. Create awareness to the importance of protecting the Bow River 2. Provide techniques and	1. The public	This online tool provides information about potential impacts of various community activities on the Bow River. It also includes ways to prevent the	http://www.calgary.ca/UEP/Water/Pages/Water-and-wastewater-systems/The-bow-is-below/Bow-is-Below.aspx#

					information on how someone can help protect rivers		spread of contaminants to the river with associated bylaws and programs.	
<i>City of Calgary Source Water Protection Plan</i>	Plan	Municipality - City of Calgary	Regional/Watershed	River	1. Provide clean, high quality water to the region through proactive stewardship, and management	1. Waterworks operators 2. Municipalities	This plan was developed over a three-year period and is based on provincial direction and guidance, water quality monitoring and data, technical risk assessments, internal and external engagement, and best practice guidelines and standards.	http://www.calgary.ca/UEP/Water/Documents/Water-Documents/Source-Water-Protection-Plan.pdf
<i>City of Camrose Source Water Protection Plan</i>	Plan	Municipality - Town of Camrose	Regional/Watershed	River, Lake	1. Support the protection and improvement of surface water quality in the Battle River and Driedmeat Lake 2. Identify risk to source waters within the planning area and outline management activities to minimize or eliminate those risks.	1. Waterworks operators 2. Municipalities	The Camrose Source Water Protection Plan is a united effort of the City of Camrose, Camrose County, and the people who live and work in the area. Implementation of measures identified in the plan will help sustain the Battle River as a water source for present and future generations.	https://camrosecounty.civicweb.net/filepro/document/69015/Draft%20Camrose%20Source%20Water%20Protection%20Plan%20(with%20appendices)%20March%202016.pdf
<i>Closer to Home Smaller Centres Water and Wastewater Capacity Renewal Initiatives</i>	Project	Association- Alberta Water and Wastewater Operators Association	Provincial	Multiple	1. Designed to strengthen the capacity of rural Alberta communities and assist local proponents in smaller Alberta centres improve a community's ability to provide safe drinking water and manage and dispose of wastewater responsibly according to regulation.	1. Waterworks operators 2. Municipalities	268 communities in Alberta were engaged by activities that addressed local need. 195 certified operators and officials from 131 regulated waterworks were offered an opportunity to complete a DWSP closer to home than 14 area charts. Another 74 municipalities benefited from 483 contact hours of outreach, education through monthly Waterwise Alberta information session.	n/a
<i>Communication and Action Protocol for Failed Bacteriological Results in Drinking Water</i>	Protocol	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Ensures that exceedances of bacteria in drinking water is reported and appropriate action taken.	1. Waterworks operators 2. Municipalities	This protocol is intended to ensure that test results that exceed the bacteriological criteria as described in the latest editions of the Guidelines for Canadian Drinking Water Quality, or other potential failures, are communicated to the appropriate parties	http://aep.alberta.ca/water/programs-and-services/drinking-water/protection/default.aspx

<i>for Waterworks Systems</i>							so that follow-up action can be taken immediately.	
<i>Drinking Water Information Letters</i>	Tool	Government - Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Provides advice on a variety of drinking water topics 2. Set out requirements for validating microbiological methods and the analysis of drinking water samples 3. Provide interim guidance on analytical requirements 4. Set out AEP's road map for introducing DWSP to waterworks systems 5. Provide advice regarding the granting from 40log virus reduction under the Standards and Guidelines for municipal waterworks 	<ol style="list-style-type: none"> 1. Waterworks operators 2. Municipalities 	Drinking Water Information letters strive to provide advice, guidance, and set out requirements for various activities such as achieving 4-log virus reduction, adoption of microbiological methods, analysis of drinking water for metals, drinking water safety plans, cyanobacterial toxins in drinking water, and granting exemption from 4-log virus reduction.	http://aep.alberta.ca/water/programs-and-services/drinking-water/legislation/drinking-water-information-letters.aspx
<i>Drinking Water Safety Plan Data Assessment</i>	Research	Government - Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Provide an analysis and evaluation of DWSP assessment data 2. Identify top risks in the DWSPs completed to date 	<ol style="list-style-type: none"> 1. Waterworks operators 2. Municipalities 	The report provides an analysis and evaluation of DWSP risk assessment data, voluntarily submitted from communities throughout Alberta. The goals of this project were to identify the top key risks in the DWSPs completed to date, potential means of controlling the top key risk and assessment improvements as part of the ongoing support provided to operators undertaking DWSP assessments.	http://aep.alberta.ca/water/programs-and-services/drinking-water/knowledge/documents/DrinkingWaterSafetyPlanAssessment-Mar2015.pdf
<i>Drinking Water Safety Plan Training Course</i>	Program	Government - Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Build understanding about the DWSP planning process and help target groups identify and categorize risks 	<ol style="list-style-type: none"> 1. Waterworks operators 2. Municipalities 	A DWSP represents a system-wide approach to ensuring that the quality of water delivered to consumers is of good and consistent quality. This course helps provide a proactive method for identifying and dealing with risks.	https://environment.extranet.gov.ab.ca/info/8691.pdf

<i>Drinking Water Safety Plan- Generic Risk Control Measures</i>	Research	Government - Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Enable waterworks operators to maximize the safety of their drinking-water systems 2. Set out risk control measures 3. Serve as general guidance for developing site-specific control measures 	<ol style="list-style-type: none"> 1. Waterworks operators 2. Municipalities 	Following a 2015 project which identified the top 21 risks found in drinking water safety plans in Alberta, generic risk control measures were developed to enable operators to maximize the safety of their drinking-water systems. This document sets out these risk control measures and is meant to serve as general guidance for drinking-water system operators to develop their own site-specific risk control measures to address local needs and issues.	http://aep.alberta.ca/water/programs-and-services/drinking-water/knowledge/documents/DrinkingWaterSafety-RiskControl-Mar2016.pdf
<i>Environmental Public Health - Drinking Water</i>	Process	Provincial Authority - Alberta Health Services	Provincial	Multiple	<ol style="list-style-type: none"> 1. Inspects public water supplies 2. Reviews water sample results 3. Issues water advisories if needed 	<ol style="list-style-type: none"> 1. Waterworks operators 2. Municipalities 3. Researchers 	Inspects public water supplies, reviews water sample results, and issues water advisories if needed. You can get water testing supplies (sample bottles) and shipping information from your local Community Health Centre. Testing for municipalities and private home owners is done through the Provincial Laboratory of Public Health and Alberta Centre for Toxicology.	https://www.albertahealthservices.ca/info/service.aspx?id=1052212
<i>Extend Water Distribution, Wastewater collection, and Storm Drainage Systems: information requirements</i>	Tool	Government - Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Mandates that approval or registration holders provide certain information to AEP prior to construction activities in relation to watermains, sanitary sewers and storm sewers 	<ol style="list-style-type: none"> 1. Municipalities 2. Industry 3. Developers 	Approval or Registration Holders, or their authorized agents (such as developers or consultants) must provide certain information to Alberta Environment, prior to construction, as part of the written notice required when extending or replacing watermains, sanitary sewers and/or storm sewers.	https://open.alberta.ca/dataset/802a1a2c-bd8d-4117-b9ad-54e4d7380c60/resource/c7d24863-95fd-4652-91c4-3fe6743238fc/download/extendsystemsinforequirements-oct2003.pdf
<i>First Nations On-Reserve Source Water Protection Plan Guide and Template</i>	Guidance	Government - Federal/Government of Canada	Federal	Multiple	<ol style="list-style-type: none"> 1. Assist Indigenous communities to address the contamination of water sources through a process to manage drinking water sources 	<ol style="list-style-type: none"> 1. Indigenous communities 	The On-Reserve Source Water Protection Guide and Template (the Guide) aims at assisting First Nations in addressing this issue. The approach proposed by this Guide will steer First	https://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ-ENR/STAGING/texte-text/source_1398366907537_e

					and take action		Nations through a process that will help them manage their drinking water sources and to locally take concrete actions to support human health and ensure a healthy environment for now and for future generations.	ng.pdf
<i>Frog Lake First Nation Source Water Protection Plan</i>	Plan	Indigenous Community - Frog Lake First Nation	Indigenous	Lakes	<ol style="list-style-type: none"> 1. Form part of a wider community infrastructure plan 2. Provide an inventory of risks to source water 3. Focus resources based on priority 	<ol style="list-style-type: none"> 1. Watershed residents 2. Waterworks operators 	Two Nations of 121 and 122 where approximately 3300 registered members and 220 living on reserve. Their predominant revenue is oil and gas. Frog Lake is the main source of drinking water and water is primarily delivered to houses via water trucks in household cisterns. Due to increased oil and gas activity, growing community, and dropping lake levels, a SWP was seen as critical to this Nation.	http://www.saskriverbasin.ca/images/files/Frog%20Lake%20Source%20Water%20Protection%20Presentation.pdf
<i>From Source to Tap: The Multi-Barrier Approach to Safe Drinking Water</i>	Guidance	Association - Canadian Council of Ministers of the Environment	Federal-Provincial-Territorial	Multiple	<ol style="list-style-type: none"> 1. Provide guidance on applying the multi-barrier approach 2. Provide tools for communicating activities among decision-makers and consumers 	<ol style="list-style-type: none"> 1. Waterworks operators 2. Municipalities 3. Well owners 4. The public 	This document intends to provide guidance to drinking water system owners and operators on how to apply the concept of the multi-barrier approach to Canadian drinking water supplies from source to tap. It also gives them language and tools for communicating their activities to decision-makers and consumers.	https://www.ccme.ca/files/Resources/water/source_tap/mba_guidance_doc_e.pdf
<i>Guidance on Controlling Corrosion in Drinking Water Distribution Systems</i>	Guidance	Government - Federal/Government of Canada	Federal	Multiple	<ol style="list-style-type: none"> 1. Provide guidance for controlling corrosion in distribution systems 2. Provide scientific and technical information to support this guidance 3. Provide the tools and information required to develop specific corrosion control programs and activities 	<ol style="list-style-type: none"> 1. Waterworks operators 2. Municipalities 	The intent of this document is to provide responsible authorities, such as municipalities and water suppliers, with guidance on assessing corrosion and implementing corrosion control for distribution systems in residential settings. It also provides sampling protocols and corrective measures for non-residential buildings, including schools, day care facilities and office	https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidance-controlling-corrosion-drinking-water-distribution-systems.html

							buildings, for those authorities, such as school boards, building owners or employers, that are responsible for the health and safety of the occupants of such buildings.	
<i>Guide to Source Water Protection Planning in the South Saskatchewan Region</i>	Guidance	Government - Provincial/Government of Alberta	Regional	Multiple	1. This guide supports the need for an integrated approach to protecting water sources in the South Saskatchewan Region of Alberta. The focus is on the integration of watershed management planning and risk assessment processes, such as the development of municipal drinking water safety plans.	1. Municipalities 2. Waterworks operators 3. Indigenous People 4. Watershed Planning and Advisory Councils 5. Watershed Stewardship Groups	This guide is used in conjunction with the Guide to Watershed Management Planning in Alberta. The 5-step process outlined here builds on the multi-barrier approach used to develop municipal drinking water safety plans in Alberta.	http://www.rdrwa.ca/sites/rdrwa.ca/files/pdf/Guide%20to%20Source%20Water%20Protection%20Planning%20in%20SSR%20DRAFT%20v3.pdf
<i>Guidelines for Canadian Drinking Water Quality</i>	Guidance	Government - Federal/Government of Canada	Federal	Multiple	1. Set out maximum acceptable concentrations of certain substances in drinking water 2. Protect the health of more vulnerable members of society such as children and the elderly	1. Waterworks operators 2. Municipalities	The guidelines set out the basic parameters that every water system should strive to achieve in order to provide the cleanest, safest and most reliable drinking water possible. Understanding and meeting the guidelines is an important component of a Multi-Barrier Approach to Safe Drinking Water. The Guidelines for Canadian Drinking Water Quality deal with microbiological, chemical and radiological contaminants. They also address concerns with physical characteristics of water, such as taste and odour.	https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html
<i>Integration of Drinking Water Source Protection into the Watershed Protection/Management</i>	Guidance	Not-for-Profit Organization - Alberta Water and Wastewater Operators	Provincial	Multiple	1. Support municipal leaders and water and wastewater utility managers and strengthen capacity and expertise	1. Waterworks operators 2. Municipalities	AWWOA created several water and wastewater print and AV resource materials to provide information and expertise on safe drinking water and how to manage wastewater systems responsibly in Alberta.	https://awwoa.ca/resources/water-and-wastewater-resource-materials

<i>gement Process</i>		Association						
<i>Piikani Nation Source Water Protection Plan</i>	Plan	Indigenous Community - Siksika Nation	Regional/Watershed	Lake	1. Develop a source water protection plan for the nation	1. Indigenous communities	Piikani Nation is undertaking source water protection planning with the assistance of the First Nations Technical Advisory Committee using the First Nations On-Reserve Source Water Protection Plan template.	n/a
<i>Plan of Action for Drinking Water in First Nations Communities</i>	Plan	Government - Federal/Government of Canada	Federal	Multiple	1. Issue a clear protocol on water standards 2. Ensure mandatory training and oversight of water systems by certified operators 3. Address the drinking water concerns of all high risk systems-starting with 21 priority communities 4. Create an expert panel that will provide options for a regulatory regime for drinking water on reserve 5. Commit to future reporting on progress	1. Waterworks operators 2. Indigenous Communities	This action plan examined the multi-barrier approach of the First Nations Water Strategy, and placed added emphasis and action on expanding upon the key points that would have the most impact on reducing the risk ranking of water systems in First Nations communities. In addition, these activities would also address the recommendations made by the Commissioner of the Environment and Sustainable Development.	http://www.aadnc-aandc.gc.ca/eng/1100100034958/1100100034966
<i>Potable Water Regulation</i>	Regulation	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Provides guidance on regulating municipal drinking water systems	1. Waterworks operators 2. Municipalities	The Potable Water Regulation is administered by Alberta Environment and Parks. This regulation guides activities in municipal drinking water systems.	http://www.qp.alberta.ca/1266.cfm?page=2003_277.cfm&leg_type=Regs&isbncIn=0779723023
<i>Protocol for Safe Drinking Water in First Nations Communities</i>	Protocol	Government - Federal/Government of Canada	Federal	Multiple	1. Upgrade and build water and wastewater facilities to meet standards 2. Have an effective water quality monitoring program 3. Ensure and effective and sustainable operation and	1. Waterworks operators 2. Indigenous Communities	The Protocol for Safe Drinking Water in First Nations Communities contains standards for design, construction, operation, maintenance, and monitoring of drinking water systems in First Nations communities and is intended for use by First Nations staff	http://www.aadnc-aandc.gc.ca/eng/1100100034913/1100100034920

					maintenance program		responsible for water systems.	
<i>Regulated Drinking Water in Alberta</i>	Tool	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Provides annual reports received from drinking water facility owners and operators' facilities 2. Provide monthly reporting data summarizing the results of drinking water quality testing received from waterworks facilities	1. Waterworks operators 2. Municipalities 3. Watershed Planning and Advisory Councils 4. Watershed Stewardship Groups	Alberta Environment receives annual reports from drinking water facility owners and operators' facilities. In addition, facilities collect monthly reporting data summarizing the results of their drinking water quality testing.	http://environment.alberta.ca/apps/regulateddwq/
<i>Rural Water Quality Information Tool</i>	Tool	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Assesses one water source at a time from the water analysis data you provide 2. Assesses water used for the following purposes: human drinking, livestock water, irrigation or mix water for chemical spraying application 3. Asks key diagnostic questions based on the selected use	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities 5. The public 6. Industry 7. Livestock producers 8. Crop producers 9. Landowners 10. Well owners	This on-line tool assesses the quality and suitability of raw water sources for privately owned and operated water supplies. Information is provided on sampling, testing, and treatment.	http://www.agric.gov.ab.ca/app84/rwqit
<i>Saddle Lake Cree Nation Source Water Protection Plan</i>	Plan	Indigenous Community - Saddle Lake Cree Nation	Indigenous	Lake	1. Develop a source water protection plan for the nation	1. Indigenous communities	The working committee guided the development of the plan. The committee was made up of people from the community with knowledge of the water and land. A list of threats was identified by the working committee.	http://www.saddlelakecreenation.ca/assets/sl-source-water-protection-planning.pdf
<i>Siksika Nation Source Water Protection Plan</i>	Plan	Indigenous Community - Siksika Nation	Regional/Watershed	Lake	1. Develop a source water protection plan for the nation	1. Indigenous communities	The Siksika Nation is undertaking source water protection planning with the assistance of the First Nations Technical Advisory Committee using the First Nations On-Reserve Source Water Protection Plan template.	n/a

<i>Small Drinking Water Systems: Who Does What in Alberta</i>	Guidance	Association - National Collaborating Center for Environmental Health	Provincial	Multiple	1. Provide an overview of who does what in Alberta with regards to small drinking water systems	1. Waterworks operators 2. Municipalities	This document explains the roles and responsibilities of key players in the small drinking water systems in Alberta and what they do regarding source water protection, water treatment and distribution, drinking water quality and monitoring, waste management, surveillance, and the role of communities.	http://www.ncceh.ca/sites/default/files/SDWS_Who_What_Alberta.pdf
<i>Source Water Protection Implementation Guidelines</i>	Guidance	Battle River Watershed Alliance	Regional/Watershed	Multiple	1. Provides concrete actions for implementing source water protection planning in the Battle River watershed 2. Protect the quality and quantity of source waters in the Battle River and Sounding Creek watersheds	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners	This document outlines the Battle River Watershed Alliance's recommendations for actions that should be taken to implement source water protection planning in the Battle River and Sounding Creek watersheds in Alberta. This advice was developed with broad input from watershed residents, stakeholders and decisionmakers, and is supported by information compiled in the BRWA's Understanding the Policy Context for Source Water Protection in the Battle River and Sounding Creek Watersheds report.	http://www.battleriverwatershed.ca/publications/293/view
<i>Source Water Protection Plan: Protecting our Source Watershed Through Proactive Collaboration</i>	Plan	Municipality - City of Calgary	Regional/Watershed	River	1. Protect the source watershed with improved land use planning 2. Promote innovation in stormwater management to protect source water quality 3. Leverage key partnerships for risk mitigation	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	Their plan's vision, goals, and actions to protect source water quality are its foundation. These flow from documented best practices in other jurisdictions, as well as provincial direction and key policy drivers, including public health, environmental stewardship and cost-effective service delivery. The Plan provides a common direction and priorities, while synthesizing and building on existing data and initiatives. Although the Plan is focused on The City's source water, it	http://www.calgary.ca/_layout/cocis/DirectDownload.aspx?target=http%3a%2f%2fwww.calgary.ca%2fUEP%2fWater%2fDocuments%2fWater-Documents%2fSource-Water-Protection-Plan.pdf&noredirect=1&sf=1

							can also be used as a foundation for more regional source water protection initiatives as well.	
<i>Source Water Protection Plan: Victor Lake and Grande Cache Lake</i>	Plan	Municipality - Town of Grand Cache and Associated Engineering	Sub-regional	Lake	1. Determine steps for reducing risks of contamination to the Victor Lake source 2. Set priorities for future implementation	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Watershed Planning and Advisory Councils 7. Livestock producers 8. Landowners	Following the creation of a Drinking Water Safety Plan in 2013, the town decided to proceed with a source water protection plan for the Victor Lake source. The goal of this plan is to supplement the Drinking Water Safety Plan by determining steps that should be taken to reduce the key risks to the source and set priorities for implementation.	https://grandecache.civicweb.net/document/3344
<i>Source Water Protection Research Report</i>	Research	Watershed Planning and Advisory Council - Battle River Watershed Alliance	Regional/Watershed	Multiple	1. Outlines the various planning processes, policies, and practices that govern source water protection planning at the regional, provincial, national, and international level	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners	The purpose of this report is to outline the current knowledge base for source water protection, the policy context in which it takes place in Alberta and Canada, and current and emerging source water protection management options. This research will then inform the development of source water protection policy advice and implementation guidelines for the Battle River and Sounding Creek watersheds in Alberta.	http://www.battleriverwatershed.ca/publications/291/view
<i>Source Water Protection Site</i>	Guidance	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Outlines how source water protection is achieved in Alberta through existing acts and legislation	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators	This webpage provides an overview of how source water protection is administered through existing acts and legislation in Alberta.	http://aep.alberta.ca/water/programs-and-services/drinking-water/protection/source-water-protection.aspx

						10. Municipalities		
<i>Source Water Quality Primer</i>	Guidance	Association - Red Deer River Municipal Users Group	Regional/Watershed	River	1. Promote the use of beneficial practices as an integral part of integrated land and water resources 2. Promote water quality within the watershed that will meet or exceed provincial requirements under government regulations	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	The Water Primer Report emphasize the importance of source water quality to all municipalities within the Red Deer River watershed and those served with water from the Red Deer River, provide a range of background information on water availability in the Red Deer River watershed within the context of water availability in Alberta and the South Saskatchewan River basin, including the Red Deer River.	http://rdrmug.ca/wp-content/uploads/2016/03/Source-Water-Quality-Primer-1.pdf
<i>Taking Care of Your Drinking Water and Wastewater: A Guide for Members of Municipal Councils</i>	Guidance	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Provide guidance to members of municipal council about their responsibilities when managing drinking water and wastewater	1. Municipal council members	This document provides detailed information about what municipal council members should know about drinking water and wastewater management--topics covered include responsibilities, actions that they can take to be better informed, checking their knowledge, what they should be asking, main topics in water and wastewater, and summary of actions.	http://www.westendregionalsewageservicescommission.ca/uploads/5/8/1/2/5812407/3_wastewater_guide.pdf
<i>Understanding the Policy Context for Source Water Protection in the Battle River and Sounding Creek Watersheds</i>	Policy Advice	Watershed Planning and Advisory Council - Battle River Watershed Alliance	Regional/Watershed	Multiple	1. Outlines the Battle River Watershed Alliance's recommendations for source water protection planning in their watershed	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners	The objective of this policy advice is to ensure protection of the quality and quantity of ground and surface water sources within the Battle River and Sounding Creek watersheds in Alberta.	http://www.battleriverwatershed.ca/publications/292/view
<i>Wabasca Area Source Water Protection Plan</i>	Plan	Indigenous Community - Big Stone Cree	Regional/Watershed	River	1. Develop a source water protection plan for the municipality and the First	1. Indigenous communities 2. Municipalities	This unique partnership is undertaking source water protection planning with the assistance of the First Nations	http://www.mdopportunity.ab.ca/sites/default/files/u808/20170404%20Wabasca%20Area

		Nation and the Municipal District of Opportunity			Nation community	3. Waterworks operators	Technical Advisory Committee using the First Nations On-Reserve Source Water Protection Plan template.	%20SWPP.pdf
<i>Waterworks System Consisting Solely of a Water Distribution System</i>	Process	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Provides guidance on best practices for water distribution systems	1. Waterworks operators 2. Municipalities	This code provides best practices on general on provisions, administration, design, and construction, operational requirements, limits and monitoring requirements, reclamation requirements, reporting requirements, record keeping requirements and codes of practice for administration.	http://aep.alberta.ca/water/for ms-applications/documents/Water DistributionSystemForm-Feb08-2018.pdf
<i>Waterworks Systems Using High Quality Groundwater</i>	Process	Government - Provincial/Government of Alberta	Provincial	Multiple	1. Provides guidance on best practices for waterworks systems using high quality groundwater	1. Waterworks operators 2. Municipalities	This code provides best practices on general on provisions, administration, design, and construction, operational requirements, limits and monitoring requirements, reclamation requirements, wastewater management, reporting requirements, record keeping requirements, and code of practice administration.	http://aep.alberta.ca/water/for ms-applications/documents/HighQualityGroundwaterForm-Feb08-2018.pdf
<i>Working Well Program</i>	Program	Government - Provincial/Government of Alberta	Provincial	Groundwater	1. Provide private well owners with the information and tools they need to properly care for their wells	1. Well owners	Working Well offers province-wide, hands-on workshops for well owners to learn the basics of groundwater, well construction, common well problems, contamination risks, importance of well reclamation and best management practices. Over past 10 years, the Working Well program has delivered 254 workshops to more than 6,900 people in 172 different communities across Alberta.	http://aep.alberta.ca/water/education-guidelines/working-well/default.aspx

Appendix E – List of Complementary Water Initiatives

Disclaimer: This table lists complementary water initiatives (i.e., source water-related policies, regulations, initiatives) collected by the team’s surveys, targeted questionnaire, and literature review and doesn’t represent a complete list of all SWP water-related work being undertaken in Alberta.

Legislation and Regulation							
Approach	Who	Scale	Drinking Water Source(s)	Main Goals/Purpose	Targeted Audience(s)	Details	Link
<i>Agricultural Operations Practices Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Sets manure management standards 2. Meet opportunities presented by local and world markets in an environmentally, sustainable manner 	<ol style="list-style-type: none"> 1. Livestock producers 2. Crop producers 3. Industry 4. Municipalities 	Regulates confined feeding operations and agricultural operations. Part 1 of the Act provides what’s commonly referred to as “right to farm” legislation by defining how nuisance issues such as odour, dust, noise and smoke resulting from agricultural activities are addressed. Part 2 of the Act sets the permitting process for the construction or expansion of confined feeding operations.	http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/epw12498
<i>Alberta Land Stewardship Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Provide direction and leadership in identifying economic, environmental and social objectives 2. Provides a means to plan 3. Provides for coordination of decisions by decision-makers on land, species, human settlement, natural resources and the environment 	<ol style="list-style-type: none"> 1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 	Legal basis for regional land-use planning. Guides planning for future needs of Albertans, manage growth while respecting existing property rights. The Act establishes the legal basis for developing regional plans under the Land-use Framework, while the Regulation provides rules for Albertans concerning the implementation of regional plans under the Land-use Framework.	https://landuse.alberta.ca/Governance/ALSA/Pages/default.aspx

<i>Alberta Water Act (and regs) and Approved Water Management Plans</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Focuses on the planning, use, and enforcement needed to manage and protect Alberta's water. The Act emphasizes the wise use and allocation of our water—including the protection of Alberta's rivers, streams, lakes and wetlands.	1. Municipalities 2. Industry 3. Irrigation Districts	The <i>Water Act</i> is Alberta legislation that allocates and manages Crown owned water. The purpose of the <i>Water Act</i> is to support and promote the conservation and management of water, including the wise allocation and use of water while recognizing those matters set out in Section 2 of the <i>Water Act</i> .	http://www.qp.alberta.ca/1266.cfm?page=w03.cfm&leg_type=Acts&isbncln=9780779733651
<i>Emergency Management Act</i>	Provincial Authority-Alberta Emergency Management Agency	Provincial	Multiple	1. Provides a legislative framework for local and provincial management of emergencies and disasters. 2. Provides authority for granting additional powers during a state of emergency	1. Governments	Addresses the province's emergency preparedness and response authority at both the municipal and provincial levels.	http://www.qp.alberta.ca/documents/Acts/E06P8.pdf
<i>Energy Resources Conservation Act</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Prevent the waste of and conservation of energy resources 2. Control pollutions and ensure environmental conservation 3. Ensure safe practices when exploring, processing, and developing and transporting energy resources	1. Governments 2. Industry 3. Developers	This Act provides for the appraisal of reserves and productive capacity of energy resources, provides for the appraisal of requirements for energy and of markets outside Alberta, conserve and prevent the waste of energy, control pollutions and ensure conservation of energy, secure safe and efficient practices in exploring, processing, developing, and transporting energy, provide timely information dissemination, and provide information, advice, and	https://www.acee-ceaa.gc.ca/050/documents_staticpost/cearref_37519/45281/t04.pdf

						recommendations regarding energy resources and energy to relevant agencies.	
<i>Environmental Protection and Enhancement Act (regs and cops)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Strives to protect air, land, and water resources	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	Provides a framework to evaluate the impacts of proposed developments or activities on water quantity and quality. The <i>Environmental Protection and Enhancement Act</i> supports and promotes the protection, enhancement, and wise use of the environment to ensure sustainable use and preservation of the environment for future generations of Albertans while recognizing the need to promote Alberta's economy.	http://www.qp.alberta.ca/1266.cfm?page=E12.cfm&leg_type=Acts&isbncln=9780779735495
<i>Federal Navigation Protection Act</i>	Government-Federal/Government of Canada	Federal	Multiple	1. Restore lost protections so that recreational boaters can continue to travel Canada's vast network of rivers, lakes and canals for years to come 2. Deliver greater transparency about proposed projects that could affect navigation; 3. Allow good projects to move forward	1. Governments 2. Industry 3. Developers	Protects the public's right of navigation in Canadian waters, by prohibiting the building, placing, maintaining or removing of any work whatsoever in, on, over, under, through or across select navigable waters, without authorization from the Minister of Fisheries and Ocean Canada. As of 2014, the Act applies to select navigable waters.	http://laws-lois.justice.gc.ca/eng/acts/N-22/FullText.html
<i>Fisheries (Alberta) Act</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Sets fish harvest limits and regulations in all waterbodies including lakes.	1. Industry 2. Governments 3. Fishermen	This Act controls licences for fishing, the transportation of fish, fish stocking and the handling, marketing, processing, storage, preservation, sale and disposition of fish. It also prohibits the possession, importation and sale of	http://www.qp.alberta.ca/documents/Acts/F16.pdf http://aep.alberta.ca/land/programs-and-services/reclamation-and-remediation/legislation-and-general-information/forms-

						prescribed invasive organisms without approval, and provides unique protections for fish that allow action to be taken to prevent the spread of ecological threats to fish, including fish parasites, diseases and genetic contamination of fish.	applications/epea-approval-process.aspx
<i>Fisheries Act - Fisheries and Oceans Canada</i>	Government-Provincial/Government of Alberta	Federal	Multiple	1. Conservation and protection of fish habitat essential to sustaining freshwater and marine fish species.	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	Prohibits activities that result in serious harm to fish (e.g. death of fish and alteration and destruction of fish habitat) for fish deemed to support commercial, recreational or Aboriginal fisheries, under Section 35.	http://laws-lois.justice.gc.ca/eng/acts/F-14/FullText.html
<i>Forests Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides and defines the powers of the Lieutenant Governor and Minister with respect to establishing regulations related to forestry in Alberta 2. Provides for establishing forest management units 3. Outline timber damage assessment requirements for industrial disturbances	1. Industry 2. Municipalities 3. Developers	This Act establishes an annual allowable cut in coniferous and deciduous forests. It prohibits persons from damaging the forest in any way and allows the Minister to construct and maintain forest recreation areas. Alberta supports the principles of sustainable forest management and responsible stewardship. Forest management planning is essential to sustainable forest management in Alberta.	https://www1.agric.gov.ab.ca/\$deparment/deptdocs.nsf/all/acts15898
<i>Historical Resources Act - Culture and</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides for the use, designation, and protection of	1. Municipalities	Concerns any work of humans that is primarily of value for its prehistoric, historic, cultural or	http://www.qp.alberta.ca/documents/Acts/h09.pdf

<i>Community Spirit</i>				moveable and immovable historic resources, and the Alberta Historical Resources Foundation.		scientific significance, and is (or was) buried or partially buried in land or submerged beneath the surface of any watercourse or permanent body of water.	
<i>Irrigation Districts Act</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Establish the structure, governance, powers and duties for the formation and operations of irrigation districts. 2. To construct, operate, and maintain irrigation works in each district for the conveyance and delivery of water; divert and use of water in accordance with the terms and conditions of license under the <i>Water Act</i> ; and, to maintain and promote the economic viability of the district.	1. Irrigation Districts	The purpose of this Act to provide for the formation, dissolution and governance of Alberta's thirteen irrigation districts in order that the management and delivery of water in the districts occur in an efficient manner that provides for the needs of the users. The powers and duties of Irrigation Council, the irrigation districts, the irrigation district board of directors and the Irrigation Secretariat are specified in the Act.	http://www.qp.alberta.ca/documents/Acts/I11.pdf
<i>Land Titles Act</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides a mechanism for registration of land related documents and establishes priority among them.	1. Governments	Provides for boundary changes when the "natural boundary" changes through erosion or accretion when the title to lands is a "natural boundary". Public lands are excluded from titles.	http://www.qp.alberta.ca/documents/Acts/L04.pdf
<i>Migratory Birds Convention Act</i>	Government-Federal/Government of Canada	Federal	Multiple	1. Regulate migratory bird management	1. Governments 2. Industry 3. Developers	Regulates activities that could harm migratory birds or their nests and prohibits release of certain materials that might be harmful in water frequented by migratory birds.	http://laws-lois.justice.gc.ca/eng/acts/m-7.01/

<i>Municipal Land-Use Bylaws</i>	Government - Municipalities	Municipality	Multiple	1. Govern SWP	<ol style="list-style-type: none"> 1. Governments 2. Industry 3. Developers 4. Livestock producers 5. Crop producers 6. Landowners 7. Developers 8. Watershed residents 	<p>Legally binding instruments that can be used to regulate activities that lead to the introduction of contaminants in drinking water sources. Some examples include:</p> <ol style="list-style-type: none"> 1. Management of wastewater and storm drainage 2. Conservation and management of essential natural landscape features – river valleys, riparian lands, wetlands, springs and seeps 3. Land use planning and development-land use bylaw provisions and municipal overlays and provisions for setbacks from surface water bodies, springs and seeps, and other groundwater sources 4. Collaborations and partnerships for source water protection 	<p>http://aep.alberta.ca/water/programs-and-services/municipal-wastewater-and-storm-water-management-program/default.aspx</p> <p>https://open.alberta.ca/dataset/1c70eb43-a211-4e9c-82c3-9ffd07f64932/resource/6e524f7c-0c19-4253-a0f6-62a0e2166b04/download/2012-steppingbackfromwater-guide-2012.pdf</p> <p>https://stalbert.ca/city/environment/natural/natural-areas/natural-area-assessment-and-management-plan/</p> <p>https://www.lethbridge.ca/Doing-Business/PlanningDevelopment/Documents/River%20Valley%20ARP.pdf</p> <p>https://www.cochrane.ca/ArchiveCenter/ViewFile/Item/223</p> <p>https://www.medicinehat.ca/home/sowdocument?id=2715</p>
<i>Municipal Government Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Enable municipalities to function, administer, plan, and direct development within their jurisdictions.	1. Municipalities	Provides municipalities with authority to regulate water on municipal lands, management of private land to control non-point sources, and authority to ensure that land use practices are compatible with protection of aquatic environments.	http://www.qp.alberta.ca/1266.cfm?page=m26.cfm&leg_type=Acts&isbncln=9780779756155&display=html
<i>Natural Resources Conservation</i>	Government-Federal/Governm	Federal	Multiple	1. Established this board as a quasi-	<ol style="list-style-type: none"> 1. Governments 2. Industry 	Regulates the review process for proposed projects affecting	http://laws-lois.justice.gc.ca/eng/acts/A-

<i>Board Act</i>	ent of Canada			judicial tribunal and sets out the mandate to conduct public reviews and issue decisions with respect to the public interest of all non-fossil fuel projects that require an environmental impact assessment. 2. Provides that the Board administer a regulatory system imposed on it by another enactment.	3. Developers	natural resources.	10.6/FullText.html
<i>Provincial Parks Act and Wilderness Areas, Ecological Reserve and Natural Areas Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provide guidance around specific activities and restrictions in provincial parks, wildland provincial parks and provincial recreation areas.	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners	Both Acts can be used to minimize harmful effects of land use activities on water quality and aquatic resources in (and adjacent to) parks and other protected areas.	http://www.qp.alberta.ca/1266.cfm?page=P35.cfm&leg_type=Acts&isbn=9780779753840&display=html%29
<i>Public Health Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Address matters relating to public health issues. 2. Address the duties of the Chief Medical Officer of Health, deputy and medical officers of health 3. Outlines the responsibilities of regional health authorities; deals with	1. Governments	Looks at public health in relation to water quality issues for drinking water and recreational uses. This Act addresses matters relating to public health issues. The Act addresses the duties of the Chief Medical Officer of Health, deputy and medical officers of health; outlines the responsibilities of regional health authorities; deals with the treatment of communicable diseases; addresses epidemics; and deals with public health emergencies.	http://www.qp.alberta.ca/documents/Acts/P37.pdf

				the treatment of communicable diseases; addresses epidemics; and deals with public health emergencies.			
<i>Public Lands Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provide for provincial ownership of the beds and shores of permanent water bodies, and prohibition of certain activities that may cause injury to Crown lands.	1. Governments 2. Industry 3. Developers	Regulates and enforces activities that affect Crown-owned beds and shores of water bodies and some Crown-owned uplands that may affect nearby water bodies.	http://www.qp.alberta.ca/documents/Acts/P40.pdf
<i>Pulp and Paper Effluent Regulations</i>	Government-Federal/Government of Canada	Federal	Multiple	1. Regulate the discharge and quantities of certain types of substances from pulp and paper mills.	1. Governments 2. Industry 3. Developers	Regulations Prescribing Certain Deleterious Substances Related to the Effluent from Pulp and Paper Mills and Authorizing the Deposit of Limited Quantities of those Deleterious Substances in Certain Circumstances.	http://laws-lois.justice.gc.ca/eng/regulations/SOR-92-269/
<i>Regional Health Authorities Act</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Authorizes the Minister to establish one or more health regions, name the region, and describe the boundaries. 2. Outlines the responsibilities of regional health authorities. 3. Provides for the Minister's ability to dismiss members of a regional health	1. Governments	Mandated to promote and protect the health of the population in the region and respond to concerns that may adversely affect surface and groundwater.	

				authority and appoint an official administrator, to appoint a new board and to provide grants.			
<i>Safety Codes Act (and regs)</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Establish a unifying framework for the administration of ten safety disciplines which each have their own safety codes and standards.	1. Governments	Regulates and enforces septic system management practices, including installation of septic field and other subsurface disposal systems.	http://www.qp.alberta.ca/documents/acts/s01.pdf
<i>Species at Risk Act</i>	Government-Provincial/Government of Alberta	Federal	Multiple	1. Protects endangered or threatened species and manages species of special concern.	1. Governments 2. Industry 3. Developers 4. Watershed Planning and Advisory Councils 5. Watershed Stewardship Groups	Prohibits destruction of critical habitat for species at risk. Provides stewardship opportunities to protect critical habitat. Prohibits killing, harming or harassing endangered species as defined.	http://laws-lois.justice.gc.ca/eng/acts/s-15.3/
<i>Transportation of Dangerous Goods Act</i>	Government-Federal/Government of Canada	Federal	Multiple	1. Promote public safety when dangerous goods are being handled, or transported by road, rail, air, or water.	1. Governments 2. Industry 3. Developers	The purpose of the Transportation of Dangerous Goods (TDG) Act and Regulations is to promote public safety when dangerous goods are being handled, offered for transport or transported by road, rail, air, or water (marine). TDG also establishes safety requirements.	https://www.ccohs.ca/oshanswers/legisl/tdg/tdg_overview.html
<i>Weed Control Act</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Enable the Minister to declare noxious or prohibited noxious weeds that present significant economic, social, or ecological risks 2. Duties of individuals, local	1. Governments 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups	Municipalities are delegated authority to pass local bylaws to control restricted, noxious and nuisance weeds on municipal lands and on certain public lands, such as highway corridors.	https://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts6156

				<p>authorities, municipalities, and the Crown related to prevention, control, and destruction of weeds are outlined.</p> <p>3. Outlines the appointment and powers of inspectors who enforce the Act and the operational requirements of seed cleaning facilities.</p>			
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Policy and Guidance							
Approach	Who	Scale	Drinking Water Source(s)	Main Goals/Purpose	Targeted Audience(s)	Details	Link
<i>Agriculture Best Practices in the Pigeon Lake Watershed</i>	Municipality - Leduc County	Regional/Watershed	Multiple	<ol style="list-style-type: none"> 1. Outline best practices for grazing and winter-feeding management 2. Provide best practices for annual crops 3. Provide information about sustainable agriculture practices 	<ol style="list-style-type: none"> 1. Crop Producers 2. Livestock Producers 	<p>Due to the dark gray chernozemic soils in the Pigeon Lake area, most agriculture land is perennial forage for hay and pasture. Perennial forages are seldom cultivated and consequently less likely than annual crops to contribute to erosion and nutrient run off issues within the watershed. Actions such alternative watering systems, winter watering systems, direct seeding and zero tillage, variable rate technology, and the Growing Forward Stewardship Program aims to minimize cattle producers' environmental impact on the area.</p>	file:///C:/Users/a.ramgoolam/Downloads/Agriculture%20BP's%20in%20the%20PL%20Watershed%202013%20-%20FINAL.pdf

<i>Alberta Soil and Groundwater Remediation Guidelines</i>	Government-Provincial/Government of Alberta	Provincial	Groundwater	1. Provide a flexible approach with regards to contaminated site remediation while maintaining a high standard of environmental and human health protection	1. Industry 2. Municipalities	Tier 1 guidelines are generic and for use at a range of sites within a given land use. Tier 2 guidelines describe how to develop site-specific guidelines by modifying the Tier 1 guidelines by using site-specific information.	http://aep.alberta.ca/land/programs-and-services/reclamation-and-remediation/contaminant-management/remediation/part-one-soil-and-groundwater-remediation-guidelines/default.aspx
<i>Beneficial Management Practices- Environmental Manual for Crop Producers in Alberta- Water Quality</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Promote best management practices among crop producers in Alberta on water protecting water quality	1. Livestock producers 2. Crop producers 3. Municipalities 4. The public	Crop production can affect water quality if water carries contaminants from fields to surface water or groundwater. Precipitation that falls on the field either as snow or rain can take several paths. This manual provides best management practices for crop producers on how to maintain water quality near to their operations.	http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/agdex9317
<i>Best Management Practices for Stormwater Management Facilities</i>	Municipality - Strathcona County	Regional/Watershed	Multiple	1. Commit to environmental leadership by conservation and protection of the watershed 2. Ensure stormwater management is designed, engineered, constructed, and managed in a safe, efficient, cost effective, environmentally responsible manner 3. Recognize the importance of	1. Municipalities 2. Watershed Stewardship Groups 3. Watershed Planning and Advisory Councils	Stormwater management has evolved over the past several years and it is now recognized that comprehensive planning is necessary to protect human and animal life, property, and the natural receiving waters. Planning must be coordinated with several agencies, ranging from government regulators to developers to private property owners to users. There are several different designs that may be used to collect, store, improve water quality and moderate stormwater runoff. Each design will be used based on the site-specific requirements and receiving waters.	https://www.strathcona.ca/files/files/att-best_management_practices_guidebook_final_june_2016.pdf

				ensuring principles of sustainable development at embodied			
<i>Clean Runoff Action Guide</i>	Non-profit-Alberta Low Impact Development and Pigeon Lake Watershed Association	Regional/Watershed	Lake	1. Promote practices to direct, slow, and clean water runoff before it enters the lake	1. Landowners	The Clean Runoff Action Guide is a draft document in being developed in cooperation with the Pigeon Lake Watershed Association. The Rain Garden section is provided here as an example of the type of information the guide contains. This plain language, heavily illustrated guide is intended to provide an overview of practices that can be implemented both on private property and in public spaces.	http://www.alidp.org/initiatives/citizen-education-and-demonstration/clean-runoff-action-guide
<i>Drilling Water Wells in Alberta</i>	Government-Provincial/Government of Alberta	Provincial	Groundwater	1. Regulate the development of drinking water wells in Alberta	1. Drilling contractors 2. Well owners	Water well drilling activity is regulated in Alberta under the Water Act and the Water (Ministerial) Regulation. To work in Alberta, drilling contractors must have a current approval to drill water wells. Deciding where to locate a water well is the joint responsibility of the drilling contractor and the well owner.	http://aep.alberta.ca/water/education-guidelines/documents/DrillingWaterWells-FactSheet.pdf
<i>Forestry Management Plans and Operating Ground Rules</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Restrict or prohibit operations in vulnerable areas such as riparian areas.	1. Industry 2. Municipalities 3. Developers	Operating ground rules provide direction for developing timber harvest planning. The Alberta Forest Management Planning Standard and its annexes, interpretive bullets, and updates comprise the standard for preparing and implementing Forest Management Plans in Alberta.	https://www.agric.gov.ab.ca/app21/forestry?page?cat1=Forest%20Management&cat2=Forest%20Management%20Manuals%20%26%20Guidelines

<i>Framework for Water Management Planning</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provide guidance for a consistent approach to water management planning.	1. Watershed Planning and Advisory Councils 2. Watershed Stewardship Groups 3. Municipalities	The framework outlines the process for water management planning and the components required for water management plans in the province. A water management plan can be developed by anyone following this framework.	http://aep.alberta.ca/water/programs-and-services/surface-water-quality-program/documents/FrameworkWaterManagementPlanning.pdf
<i>Green Acreages Guide</i>	Non-profit- Land Stewardship Centre	Provincial	Multiple	1. Help develop and implement stewardship practices that conserve and protect air, land, water, and wildlife associated with properties	1. Landowners 2. Crop producers 3. Livestock producers 4. Recreationists	The Green Acreages Guide is a workbook developed especially for acreage, hobby farm and recreational property owners, to help them develop and implement stewardship practices that conserve and protect the valuable natural assets, such as air, land, water, wildlife, associated with their properties.	http://www.landstewardship.org/green-acreages-guide/
<i>Guide to Sewage Holding Tanks</i>	Non-profit- Pigeon Lake Watershed Association	Regional/Watershed	Lake	1. Guidance for residents on how to make decisions on handling sewage on-site from septic field decommissioned until hook-up to a local collection system (interim period)	1. Watershed residents	Many summer villages and communities in the Pigeon Lake area have moved toward banning septic fields and grey water release systems. This paper presents ideas for action by Pigeon Lake area residents who must make decisions on how to handle sewage on-site from the time their septic field is decommissioned until the time of hook-up to a local collection system (the Interim Period).	http://files.townlife.com/public/uploads/documents/1486/PLWA_Guide_to_Sewage_Holding_Tanks.pdf
<i>Guide to Watershed Management Planning in Alberta</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Offers a useful reference for WPAC and WSG planning activities 2. Informs other collaborative community-led	1. Watershed Planning and Advisory Councils 2. Watershed Stewardship Groups	The Guide to Watershed Management Planning in Alberta guides local communities and <i>Water for Life</i> partnerships through the steps of developing and implementing a watershed management plan for their	http://www.nswa.ab.ca/sites/default/files/documents/Guide%20to%20Watershed%20Planning%20in%20AB%5B1%5D%20(1).pdf

				watershed management planning projects and programs about appropriate planning processes		respective watershed, encouraging active participation from all stakeholders along the way.	
<i>Laboratory Data Quality Assurance Policy</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Ensure that laboratory data submitted to the department is accurate and reliable	1. Waterworks operators 2. Municipalities 3. Laboratories 4. Industries	This information includes monitoring data obtained from the analysis of air, water, wastewater, waste, soil and other samples by analytical laboratories. Alberta Environment and Parks is implementing the Laboratory Data Quality Assurance Policy to ensure that laboratory data submitted to the department is accurate and reliable.	http://aep.alberta.ca/water/programs-and-services/drinking-water/protection/default.aspx
<i>Land-use Framework</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Improve provincial leadership on land-use issues through policy direction and guidelines; taking a new approach to manage public and private lands and natural resources to achieve Alberta's long-term economic, environmental and social goals 2. Increase certainty for industry through integration and coordination of provincial policy and aligned planning and decision-making 3. Encourage	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	The Land-use Framework sets out a new approach to managing our province's land and natural resources to achieve Alberta's long-term economic, environmental and social goals. The LUF establishes seven new land-use regions and calls for the development of a regional plan for each.	https://www.landuse.alberta.ca/Pages/default.aspx

				stewardship and conservation on public and private lands; clarifying roles and responsibilities for land-use decisions at all levels; and improved information sharing.			
<i>Our Water; Our Future; A Plan for Action</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provide short-term and long-term actions on four water topics: 1) Healthy Lakes 2) Hydraulic Fracturing and Water 3) Drinking Water and Wastewater 4) Water Management	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	Based on the input gathered through the Water Conversation, the Government of Alberta has identified several strategic actions in each of the four main topic areas. The strategic actions fall into two categories: short-term and long-term. The short-term actions are designed to respond to immediate priorities identified by Albertans. The long-term actions will inform the renewal of our Water for Life action plan, helping align the Government of Alberta's water priorities and initiatives.	http://aep.alberta.ca/water/water-conversation/documents/WaterFuture-PlanAction-Nov2014A.pdf
<i>Primer on Water Quality</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. To present specific examples from the primary literature of crop and livestock production practices from other regions of North America that have affected surface or ground water quality 2. To present background	1. Crop Producers 2. Livestock Producers 3. Landowners	There is increasing concern among the agricultural community and the public about the effects of agriculture on the quality of our surface and ground waters because of news about impacts in other areas of North America. Thus, agricultural producers can take a proactive stance toward increasing public pressure to safeguard the environment. The primary purpose of this primer is to present	https://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/wat3345

				information on agricultural contaminants and how these contaminants are transported from agroecosystems to surface and ground waters 3. To outline contaminant processes in lakes and rivers, and to describe the impacts of agricultural pollutants on aquatic ecosystems.		information on the impacts of agriculture on water quality from a North American perspective.	
<i>Recommendations to Improve Aquatic Invasive Species Management in Alberta</i>	Non-profit - Alberta Water Council	Provincial	Multiple	1. Document prevention and management approaches in the province 2. Document prevention and management approaches in other jurisdictions 3. Determine the need for a common definition for AIS	1. Waterworks operators 2. Municipalities 3. Irrigation Districts 4. Boat owners 5. Anglers	The Alberta Water Council established the AIS Project Team to identify gaps and opportunities to improve awareness, communication and coordination of activities by stakeholders in Alberta that are working to prevent and manage threats of AIS. The team documented the state of AIS prevention and management in Alberta and in six other jurisdictions to inform its work.	https://awchome.ca/LinkClick.aspx?fileticket=uDjLNTSUiIo%3D&tabid=59
<i>Recommendations to Improve Lake Watershed Management in Alberta</i>	Non-profit - Alberta Water Council	Provincial	Lake	1. Improve lake watershed management in Alberta and raise the profile of key issues and challenges	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities 5. The public 6. Industry	The project documented the current state of four components of lake watershed management: science and knowledge; lake watershed governance; lake watershed management planning; and education, stewardship and tools.	https://awchome.ca/LinkClick.aspx?fileticket=aLhhA4fUijw%3d&tabid=204

					7. Livestock producers 8. Crop producers 9. Landowners		
<i>Recommendations to Improve Non-Point Source Pollution Management in Alberta</i>	Non-profit - Alberta Water Council	Provincial	Multiple	1. To improve understanding and management of non-point source pollution in Alberta	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities 5. The public 6. Industry 7. Livestock producers 8. Crop producers 9. Landowners	Incorporating focused NPSP management into Alberta's land-use and watershed management systems will help the province move towards a more proactive approach. Several recommendations were put forward for implementation.	https://www.awchome.ca/LinkClick.aspx?fileticket=ff90Ucqhd_o%3d&tabid=134
<i>Caring for the Green Zone- Riparian Areas and Grazing Management</i>	Non-profit- Alberta Riparian Habitat Management Society	Provincial	Multiple	1. Provide guidance on influencing pastures, rangelands, and riparian management-ranchers and livestock producers	1. Livestock producers 2. Crop producers 3. Municipalities 4. The public	The Riparian Areas and Grazing Management booklet has been written for those people who can most effectively influence pastures, rangelands and riparian areas with their management - ranchers and livestock producers. This is a booklet on how to get started and directions on where your travels may take you.	http://cowsandfish.org/riparian/caring.html
<i>Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems</i>	Government- Provincial/Government of Alberta	Provincial	Multiple	1. Establishes standards and guidelines for municipal waterworks, wastewater, and storm drainage facilities	1. Waterworks operators 2. Municipalities	Alberta Environment and Parks is responsible for the drinking water and wastewater programs for large public systems in Alberta. The department considers the establishment of standards and guidelines for municipal waterworks, wastewater and storm drainage facilities an integral part of our regulatory program directed at ensuring public health and environmental protection.	https://open.alberta.ca/publications/5668185

<i>Water Conservation and Allocation Guideline for Oilfield Injection</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Support the conservation and management of water 2. Prevent excess use of water during enhanced recovery of hydrocarbon resources 	<ol style="list-style-type: none"> 1. Industry 2. Municipalities 3. Developers 	This document provides direction for regulatory agencies and developers where the use of non-saline water resources may be essential to an Enhanced Recovery Scheme for underground (oilfield) injection. The purpose of the guideline is to support the conservation and management of water and to prevent excess use of water during enhanced recovery of hydrocarbon resources.	http://aep.alberta.ca/water/education-guidelines/documents/Water-OilfieldInjectionGuideline-2006.pdf
<i>Water for Life: Alberta's strategy for sustainability</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Ensure safe, secure drinking water supply 2. Ensure healthy aquatic ecosystems 3. Ensure reliable, quality water supplies for a sustainable economy 	<ol style="list-style-type: none"> 1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 11. Watershed Planning and Advisory Councils 	<i>Water for Life: Alberta's Strategy for Sustainability</i> is the Government of Alberta's response to develop a new water management approach and outline specific strategies and actions to address these issues.	http://aep.alberta.ca/water/programs-and-services/water-for-life/strategy/default.aspx
<i>Water Quality Based Effluent Limits Procedures Manual</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Outline procedure for setting water quality based effluent limits for industrial and municipal discharges in Alberta 	<ol style="list-style-type: none"> 1. Industry 2. Municipalities 3. Waterworks operators 	This manual describes procedures for setting water quality based effluent limits for industrial and municipal discharges in Alberta. Appendix 8 of this manual is no longer effective, replaced by the Environmental Quality Guidelines for Alberta Surface Waters.	https://open.alberta.ca/dataset/f17edca8-f860-43c0-bf43-4507ea1ef456/resource/e207e0b8-998c-452d-b0ad-5d7469866342/download/waterqualitybasedeffluentlimits-manual.pdf
<i>Water Wells that Last</i>	Government-Provincial/Government of Alberta	Provincial	Groundwater	<ol style="list-style-type: none"> 1. Provide understanding about groundwater, water 	<ol style="list-style-type: none"> 1. Well owners 	There are 12 modules in this workbook, many with worksheets for well owners to complete. A	http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/wwg404

				wells, construction, maintenance, resources, and protecting well water		video was developed to be used in conjunction with this workbook.	
<i>Workbook for Developing Lake Watershed Management Plans in Alberta</i>	Non-profit - Alberta Lake Management Society	Provincial	Lake	1. Provide a step-by-step guide towards creating lake watershed plans 2. Advise on how to link science, opportunities, processes, and potential partners	1. Watershed Stewardship Groups 2. Watershed Planning and Advisory Councils 3. Summer Village Associations 4. The public	The Alberta Lake Management Society created this workbook and supporting reference materials as a decision support tool and procedural guide for citizens interested in protecting and managing their lake.	https://alms.ca/wp-content/uploads/2014/02/ALMS_WMPWorkbook.pdf

Plans							
Approach	Who	Scale	Drinking Water Source(s)	Main Goals/Purpose	Targeted Audience(s)	Details	Link
<i>Alberta Environmental Farm Plan</i>	Government - Provincial-	Provincial	Multiple	1. Help producers to identify their environmental risks and develop plans to mitigate them	1. Crop producers 2. Livestock producers 3. Landowners	The Environmental Farm Plan (EFP) is a voluntary, whole farm, self-assessment tool that helps producers identify their environmental risks and develop plans to mitigate identified risks. We are working together with farmers committed to environmental stewardship.	http://www.albertaefp.com/
<i>Baptiste and Island Lakes Watershed Management Action Plan</i>	Watershed Stewardship Group - Baptiste and Island Lakes Stewardship Society	Regional/Watershed	Lake	1. Bring people together to develop a comprehensive watershed management plan for Baptiste and Island	1. Governments 2. Industry 3. Watershed residents	In response to concerns regarding the health of lakes in the region, summer villages at Baptiste, Island and Skeleton Lakes have formed the Baptiste, Island, and Skeleton Lakes Watershed Management and	http://bails.ca/index.php/documents-info/12-bails-action-plan-and-wmp-update/file

				lakes		Lake Stewardship Council (BISL). BISL's vision for Baptiste Lake is to "maintain a healthy lake and watershed, recognizing the importance of living within the capacity of the natural environment and providing sustainable recreational, residential, agricultural, and industrial benefits".	
<i>Bow River Phosphorus Management Plan</i>	Government-Provincial/Government of Alberta	Provincial	River	1. Address sources of Phosphorus in the Bow River between Bearspaw and Basanno Dams	1. Municipalities 2. Watershed Stewardship Groups 3. Watershed Planning and Advisory Councils	The Bow River Phosphorus Management Plan (PMP) is a strategic plan to address sources of phosphorus in the middle reach of the Bow River between the Bearspaw and Bassano Dams.	http://aep.alberta.ca/land/programs-and-services/land-and-resource-planning/regional-planning/south-saskatchewan-region/subregional-plans/bow-river-phosphorus-management-plan.aspx
<i>Buffalo Lake Integrated Shoreland Management Plan</i>	Association - Buffalo Lake Management Team	Regional/Watershed	Lake	1. Guide land use and natural resource management on publicly owned shorelands of Buffalo Lake.	1. Municipalities 2. Watershed Stewardship Groups 3. Watershed Planning and Advisory Councils 4. Lakeshore residents	The Buffalo Lake Integrated Shoreland Management Plan serves as the operational plan that will guide land use and natural resource management on the publicly owned shorelands of Buffalo Lake.	http://blmt.ca/wp-content/uploads/2011/05/BLIMPS-Book-May11-2011.pdf
<i>Heart River Watershed Management Plan</i>	Association - Heart River Watershed Advisory Committee	Regional/Watershed	River	1. Improve source water quality in the Heart River watershed 2. Improve riparian health, wetland management and overall watershed health. 3. Increase public awareness and engagement of land stewardship activities.	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 11. Watershed Planning and Advisory Councils	Northern Sunrise County is facing extensive development pressures from industry and agriculture and the source water quality in the Heart River watershed has suffered as a result. The Heart River Watershed Advisory Committee was formed to direct the development and implementation of a watershed management plan for the Heart River Watershed.	http://mightypeacesow.org/pdf/Heart_River_WMP.pdf

<i>Headwaters Action Plan</i>	Watershed Planning and Advisory Council - Oldman Watershed Council	Regional/Watershed	Multiple	<ol style="list-style-type: none"> 1. Identify and understand hydrologically significant areas in the headwaters 2. Identify, mitigate, and prevent threats to headwaters and source waters 3. Define the kinds and intensity of land use activities as they relate to source water and headwater significant areas 	<ol style="list-style-type: none"> 1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 11. Watershed Planning and Advisory Councils 	The Headwaters Action Plan 2013-14 is the community's plan to maintain and protect the integrity of the Oldman headwaters and source waters. In 2012-13 the OWC began work on the second action plan of the Oldman Integrated Watershed Management Plan process addressing IWMP planning Goal 3: Manage and protect the integrity of headwaters and source waters.	http://oldmanwatershed.ca/headwaters-action-plan/
<i>Integrated Watershed Management Plans</i>	Watershed Planning and Advisory Council - Various	Regional/Watershed	Multiple	<ol style="list-style-type: none"> 1. Provide advice to governments and agencies that have policy and regulatory decision-making authority for land and resource management 	<ol style="list-style-type: none"> 1. Watershed Planning and Advisory Councils 	IWMPs are the second key deliverable produced by Watershed Planning and Advisory Councils (WPACs). These plans provide advice to governments and agencies that have policy and regulatory decision-making authority for land and resource management.	http://aep.alberta.ca/water/programs-and-services/water-for-life/partnerships/watershed-planning-and-advisory-councils/watershed-management-planning.aspx
<i>Lac La Biche Watershed Management Plan</i>	Watershed Stewardship Group -Lac La Biche Stewards	Regional/Watershed	Lake	<ol style="list-style-type: none"> 1. Strive to balance environmental, community, and economic issues with government legislation for the protection and management of water resources 	<ol style="list-style-type: none"> 1. Watershed residents 2. Municipalities 	The Lac La Biche Watershed Management Plan will aid Alberta Environment make water resource decisions in the Lac La Biche planning area under the <i>Water Act</i> and the <i>Environmental Protection and Enhancement Act</i> . The plan will also assist the municipality as well as neighboring municipalities and resource managers to make informed water management and land use decisions as well as provide	http://216.21.137.218/home/showdocument?id=104

						information to the public.	
<i>Lesser Slave Lake Watershed Management Plan</i>	Watershed Planning and Advisory Council- Lesser Slave Watershed Alliance	Regional/Watershed	Lake	1. Identify issues and establishes common goals and objectives for the long-term management of land and water resources in the basin.	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities	This document summarizes key content from the more comprehensive document, the Lesser Slave Integrated Watershed Management Plan. The complete Plan includes additional background information, the full suite of recommendations, targets and thresholds, implementation guidance, tables and maps, and references, and appendices.	https://www.lswc.ca/integrated_watershed_management_plan
<i>Mayatan Lake Watershed Management Plan</i>	Watershed Stewardship Group - Mayatan Lake Management Association	Regional/Watershed	Lake	1. Provide advice to key groups to guide decision-making in various areas 2. Recommend management actions for the lake	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities	This plan serves as advice to Parkland County, the Government of Alberta, the Mayatan Lake Management Association and all watershed stakeholders to guide future decision-making in their respective areas of responsibility and interest. It identifies specific actions that should be implemented, describes the roles and responsibilities of the various players to do so, and presents an implementation strategy based on both voluntary and statutory activities.	http://nswa.ab.ca/sites/default/files/Mayatan%20WMP%20June%2013%202016.pdf
<i>Moose Lake Watershed Management Plan</i>	Association - Moose Lake Water for Life Committee	Regional/Watershed	Lake	1. Improve water quality in the Moose Lake Watershed to pre-development conditions 2. Improve wildlife and fish habitat and overall aquatic environment,	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners	Residents and lake users have long been concerned about the environmental quality of Moose Lake. Past concerns have included algal blooms, weed growth, boating speed and noise, water quality, poor fishing, excessive crowds and excessive development.	http://www.laraonline.ca/media/1222/moose-lake-watershed-management-plan.pdf

				in conjunction with improving riparian health, wetland management, and watershed health 3. Increase public awareness and engagement of land stewardship activities	8. The public 9. Waterworks operators 10. Municipalities	Many of these same concerns still exist today. The Moose Lake Water for Life Committee, along with Alberta Environment and several other stakeholders, have been working together since 2004 to create this Watershed Management Plan.	
<i>Municipal Development Plans</i>	Government - Municipality	Municipal	Multiple	1. Provide policy direction on decisions related to growth and development.	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 11. Watershed Planning and Advisory Councils	A Municipal Development Plan (MDP) is a strategic plan that provides broad policy direction for future growth and development of a municipality (i.e., including drinking water systems and its infrastructure). It also provides direction for Council and Administration on decision-making related to growth and development. The MDP is the County's primary planning document, and as such, all other statutory and non-statutory plans developed by the County must be consistent with the MDP.	n/a
<i>Pigeon Lake Watershed Management Plan</i>	Pigeon Lake Watershed Association and Alliance of Pigeon Lake Municipalities	Regional/Watershed	Lake	1. Improve the watershed's natural environment and water quality by recommending action-oriented watershed policies and best practices that support the long-term health, protection, and restoration of the watershed.	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities 5. The public 6. Industry 7. Waterworks operators	Endorsed by the watershed community, this collaborative initiative is producing a series of action recommendations, created with the input of local leaders and watershed experts and the Alberta Government. This process marries the science and social considerations as practices and regulations are identified that people will support.	http://www.plwmp.ca/

<i>Regional Land-Use Plans</i>	Government – Provincial and Municipal also other relevant groups	Regional/Watershed	Multiple	1. Creates an approach for managing land and natural resources to achieve environmental, social, and economic goals	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 11. Watershed Planning and Advisory Councils	Land-Use Planning intend to: <ul style="list-style-type: none"> improve provincial leadership on land-use issues through policy direction and guidelines; take a new approach to manage public and private lands and natural resources to achieve Alberta's long-term economic, environmental and social goals; increase certainty for industry through integration and coordination of provincial policy and aligned planning and decision-making; 	https://www.landuse.alberta.ca/PLANFORALBERTA/LANDUSEFRAMEWORK/Pages/default.aspx
<i>Skeleton Lake Watershed Management Plan</i>	Watershed Stewardship Group - Skeleton Lake Stewardship Association	Regional/Watershed	Lake	1. Attain a balance between environmental, community, and economic issues with government legislation for the protection and sustainable management of aquatic resources and habitats of the Skeleton Lake Watershed	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities 5. The public 6. Industry 7. Livestock producers 8. Crop producers 9. Landowners 10. Well owners	The Skeleton Lake WMP will aid Alberta Environment to make water resource decisions in the Skeleton Lake planning area under the Water Act and the Environmental Protection and Enhancement Act. The plan will also assist the municipality, neighboring municipalities, and resource managers to make informed water management and land use decisions and provide information to the public.	http://www.skeletonlake.com/wp-content/uploads/2018/03/Skeleton_Lake_WMP_-_November_23_2009.pdf
<i>South Saskatchewan Regional Plan</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Identify regional objective indicators 2. Set regional threshold values, including triggers and	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship	The South Saskatchewan Regional Plan is an integrated resource management approach which looks at the relationship between all activities in a region, along with	https://www.landuse.alberta.ca/LandUse%20Documents/South%20Saskatchewan%20Regional%20Plan%202014-2024%20-%20February%202017.pdf

				limits 3. Establish a management response if triggers or limits are exceeded	Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	natural events, and the challenges facing the region, and sets the stage for robust growth, vibrant communities and a healthy environment over the next 50 years.	
<i>Stormwater Management Strategy</i>	Municipality - City of Calgary	Regional/Watershed	River	1. Lead by example 2. Align policy with stormwater objectives 3. Develop technical tools 4. Raise awareness 5. Education and outreach	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	To protect rivers and wildlife, the City of Calgary has developed a <i>Stormwater Management Strategy</i> . This strategy aims to protect watershed health as the city continues to grow. Around the city you can see the <i>Stormwater Management Strategy</i> in action through the construction of new rain garden projects, and wet ponds and wetlands in established communities.	http://www.calgary.ca/UEP/Water/Documents/Water-Documents/stormwater_report.pdf
<i>Sylvan Lake Cumulative Environmental Management Plan</i>	Association - Sylvan Lake Management Committee	Regional/Watershed	Lakes	1. Provide an integrated management framework 2. Share ideas, issues, and concerns regarding land and water management surrounding the lake	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	This document provides a management framework for the Sylvan Lake Watershed Cumulative Effects Management System (CEMS). It provides detailed background on general concepts associated with Cumulative Effects Management, and the specific vision, objectives and outcomes of the Sylvan Lake watershed as decided upon by all governing bodies and interest stakeholders.	https://reddeercounty.civicweb.net/document/19978
<i>Wabamun Lake Sub-Watershed Management Land-use Plan</i>	Watershed Stewardship Group and Consultant - Wabamun Watershed	Regional/Watershed	Lake	1. Maintain lake levels that support all uses of the lake, water quality and biological communities now and in the future	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups	In this sub-watershed land use planning process, it is acknowledged that land use activities can influence water, land and biological resources. When all effects within the area are taken into	http://www.wwmc.ca/index.php/what-s-new?id=378-wabamun-lake-subwatershed-land-use-plan

	Management Council			2. Maintain or improve current surface water quality 3. Maintain or improve current groundwater levels and quality	6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	consideration, decisions on land use planning can contribute to a sustainable system that preserves the values important to its citizens and Albertans as a whole.	
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Process and Protocol							
Approach	Who	Scale	Drinking Water Source(s)	Main Goals/Purpose	Targeted Audience(s)	Details	Link
<i>Action Protocol for Exceedance of Chemical Health Parameters in Drinking Water</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Outline the process followed to develop the Guidelines for Canadian Drinking Water Quality 2. Outline how guidelines will be implemented by Alberta Environment 3. Outline how guidelines will be monitored and reported	1. Alberta Environment and Parks 2. Alberta Health 3. Alberta Health Services 4. Waterworks operators	It is intended that this document will increase the awareness and confidence Albertans have in the drinking water provided to them by regulated waterworks systems.	http://aep.alberta.ca/water/programs-and-services/drinking-water/protection/documents/ActionProtocolExceedanceWater-2009.pdf
<i>Code of Practice for a Waterworks System Consisting Solely of a Water</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Establishes practices relating to the construction, operation, and reclamation of a waterworks systems that consists solely of a	1. Waterworks operators 2. Municipalities	The present Code enacts the <i>Environment Protection and Enhancement Act</i> . Section 2 of Part 2 of the above-mentioned Code establishes that any person who constructs, operates or reclaims a waterworks system that consists	http://www.qp.alberta.ca/1266.cfm?page=distribution2.cfm&leg_type=Codes&isbncln=9780778596370

<i>Distribution System</i>				water distribution system.		solely of a water distribution system must do so in accordance with this Code of Practice.	
<i>Code of Practice for Waterworks System Using High Quality Groundwater</i>	Government-Provincial/Government of Alberta	Provincial	Groundwater	1. Promotes awareness relating to the practice of waterworks systems using high quality groundwater.	1. Waterworks operators 2. Municipalities	The present Code enacts the <i>Environmental Protection and Enhancement Act</i> and the <i>Environmental Protection and Enhancement (Miscellaneous) Regulation (Alta. Reg. 18/93)</i> . The Code lays down provisions relating to the practice of waterworks systems using high quality groundwater.	http://www.qp.alberta.ca/1266.cfm?page=GROUNDWATER2.cfm&leg_type=Codes&isbncln=9780778596394
<i>Communication and Action Protocol for Failed Bacteriological Results in Drinking Water for Waterworks Systems</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Ensures that exceedances of bacteria in drinking water is reported and appropriate action taken.	1. Waterworks operators 2. Municipalities	This protocol is intended to ensure that test results that exceed the bacteriological criteria as described in the latest editions of the <i>Guidelines for Canadian Drinking Water Quality</i> , or other potential failures, are communicated to the appropriate parties so that follow-up action can be taken immediately.	http://aep.alberta.ca/water/programs-and-services/drinking-water/protection/default.aspx
<i>Dam Safety Regulatory System</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provide regulatory oversight to ensure dam owners take responsibility for the integrity and safe operations of dams through the <i>Water Act</i> and the <i>Water Ministerial Regulation-Dam and Canal Safety</i> .	1. Dam owners	AEP provides regulatory oversight to ensure dam owners take active responsibility for the integrity and safe operations of their dams through the <i>Water Act</i> and Part 6 of the <i>Water (Ministerial) Regulation – Dam and Canal Safety</i> . The <i>Dam Safety Regulatory System</i> ensures dam owners comply with the legislation.	http://aep.alberta.ca/water/programs-and-services/dam-safety/dam-safety-regulatory-system/default.aspx
<i>Environmental Quality Guideline for</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides science-based recommendations to	1. Waterworks operators 2. Municipalities 3. Industry	This document updates and expands surface water quality and aquatic ecosystem guidelines for Alberta	https://open.alberta.ca/publications/9781460115244

<i>Alberta Surface Waters</i>				protect water uses from a cornerstone of aquatic ecosystem management.		and provides science-based recommendations that protect water uses and form a cornerstone of aquatic ecosystem management and protection. Included are guidelines for surface water quality (to protect aquatic life, agricultural, and recreational uses), sediment quality, and tissue residue (to protect wildlife consumers).	
<i>Protocol for Safe Drinking Water in First Nations Communities</i>	Government-Federal/Government of Canada	Federal	Multiple	1. Upgrade and build water and wastewater facilities to meet standards 2. Have an effective water quality monitoring program 3. Ensure and effective and sustainable operation and maintenance program	1. Waterworks operators 2. Indigenous Communities	The Protocol for Safe Drinking Water in First Nations Communities contains standards for design, construction, operation, maintenance, and monitoring of drinking water systems in First Nations communities and is intended for use by First Nations staff responsible for water systems.	http://www.aadnc-aandc.gc.ca/eng/1100100034913/110010034920
<i>Southern Alberta's Water Charter</i>	Watershed Planning and Advisory Council - Oldman Watershed Council	Regional/Watershed	Multiple	1. Inspire organizations, municipalities, and businesses to act to improve the health of the watershed	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities	The charter was developed to encourage collaboration among groups in the Oldman watershed to protect water resources. Participating groups sign the charter and commit to active participation of their organization and citizens.	http://oldmanwatershed.ca/proj?tag=Water%20Charter
<i>Surface Water Quality Guidelines and Objectives</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provide science-based numeric concentrations or narrative statements	1. Waterworks operators 2. Municipalities 3. Industry	Water may be tested for a few characteristics or numerous natural substances and contaminants, depending on the need. This can be	http://aep.alberta.ca/water/education-guidelines/surface-water-quality-guidelines-and-objectives.aspx

				that are recommended to protect various water uses.		done using traditional methods, such as collecting a representative water sample from a waterbody and sending it to a laboratory for analysis. Surface waters may also be analysed more immediately using basic, hand-held electronic meters. More sophisticated electronic meters can also be installed that can store and transmit data via satellite technology.	
<i>Water Conservation Objectives</i>	Government-Provincial/Government of Alberta	Provincial	River	1. Provide direction on the volume and quality of water that should remain in a river to protect natural water bodies and its aquatic environment.	1. Industry 2. Municipalities 3. Developers	These objectives relate to the volume and quality of water to remain in rivers for the protection of a natural water body and its aquatic environment. They are flow targets under the first-in-time, first-in-right priority water allocation system and will apply to all new licences and existing licences with a retrofit provision.	http://aep.alberta.ca/water/legislation-guidelines/water-conservation-objectives.aspx
<i>Waterworks System Consisting Solely of a Water Distribution System</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides guidance on best practices for water distribution systems	1. Waterworks operators 2. Municipalities	This code provides best practices on general on provisions, administration, design, and construction, operational requirements, limits and monitoring requirements, reclamation requirements, reporting requirements, record keeping requirements and codes of practice for administration.	http://aep.alberta.ca/water/forms-applications/documents/WaterDistributionSystemForm-Feb08-2018.pdf
<i>Waterworks Systems Using High Quality Groundwater</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides guidance on best practices for waterworks systems using high quality groundwater	1. Waterworks operators 2. Municipalities	This code provides best practices on general on provisions, administration, design, and construction, operational requirements, limits and monitoring	http://aep.alberta.ca/water/forms-applications/documents/HighQualityGroundwaterForm-Feb08-2018.pdf

						requirements, reclamation requirements, wastewater management, reporting requirements, record keeping requirements, and code of practice administration.	
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Program							
Approach	Who	Scale	Drinking Water Source(s)	Main Goals/Purpose	Targeted Audience(s)	Details	Link
<i>Alberta Community Resilience Program</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Support the development of long-term resilience to flood and drought events 2. Support integrated planning and healthy functioning watersheds	1. First Nations 2. Improvement Districts 3. Metis Settlements 4. Municipalities 5. Special Areas	The ACRP invests in the design and implementation of projects that minimize risks and impacts to municipal infrastructure from flooding and drought events and help ensure public safety. It is a province-wide, cost-shared capital funding program with a focus on long-term community resilience.	http://aep.alberta.ca/water/programs-and-services/alberta-community-resilience-program/default.aspx
<i>Alberta Water Quality Awareness Day</i>	Non-profit-Alberta Lake Management Society	Provincial	Lake	1. Provide awareness among Albertans about water quality 2. Learn about the health of surface water	3. The public	AWQA Day is an exciting program that enables Albertans to get outside and explore the quality of their local waterways. AWQA Day is the perfect opportunity to begin learning about the health of surface waters, while also contributing to an overall snapshot of water quality across the province.	https://alms.ca/about-awqa/
<i>Aquatic Invasive Species Program</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Monitor lakes and reservoirs for invasive mussels	1. Waterworks operators 2. Municipalities 3. Irrigation Districts	AIS are species non-indigenous to a region or body of water that impact or pose threats to the environment,	http://aep.alberta.ca/fish-wildlife/invasive-species/aquatic-invasive-species/default.aspx

				<p>2. Implement legislation that provides for robust prevention and enforcement</p> <p>3. Implement provincial watercraft inspections</p>		<p>the economy, and human health. To combat the risk of an AIS infestation, a remarkable partnership of government, stakeholders, and industry has built an intricate system where none existed before.</p>	
<i>Canadian Aquatic Biomonitoring Network Program</i>	Association-Canadian Rivers Institute	Federal	River	<p>1. Provide participants with skills and knowledge to conduct freshwater benthic invertebrate monitoring and assessment to a nationally acceptable standard.</p>	<p>1. Municipalities</p> <p>2. Watershed Stewardship Groups</p> <p>3. Watershed Planning and Advisory Councils</p> <p>4. Researchers</p>	<p>CABIN is an aquatic biological monitoring program led and funded by Environment and Climate Change Canada for assessing the health of freshwater ecosystems across the country. Environment and Climate Change Canada has partnered with CRI to design and deliver the CABIN online and field training certification program.</p>	<p>http://canadianriversinstitute.com/training/cabin/</p>
<i>Circuit Rider Training Program</i>	Association - Technical Services Advisory Group Inc.	Provincial	Multiple	<p>1. Provide on-site hands on training and mentoring services to water and wastewater operators to promote safe, clean drinking water and proper care of wastewater systems</p>	<p>1. Indigenous communities</p>	<p>The Technical Services Advisory Group Strives to provide on-site, hands on training and mentoring services to operators to attain and maintain the level of certification required to operate, maintain and monitor their community drinking water and wastewater systems, year-round, 24/7 telephone support to operators, develop site-specific work plans based on the training needs of the operator and the repair and maintenance requirements of the system, assist with Remote Water Monitoring Systems installation, calibration, maintenance, and repairs.</p>	<p>http://www.tsag.net/crtp.html</p>

<i>Clear Water Landcare Program</i>	Association - Rocky Riparian Group/Clear Water Landcare	Regional/Watershed	Multiple	1. Promote awareness and education about agricultural best practices to water and land	1. Livestock producers 2. Crop producers 3. Municipalities	A farmer-based group formed in the late 1990's, taking the name Rocky Riparian Group, to bring awareness to and education around agricultural practices beneficial to water and the land immediately adjacent and further upland of it. To better communicate this the group took a broader view, rebranding as "Clear Water Landcare" in 2010.	http://www.clearwatercounty.ca/p/clear-water-landcare
<i>Compliance Assurance Program</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Sets out clear rules and obligations for the protection, enhancement, and wise use of the environment.	1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 11. Watershed Planning and Advisory Councils	Alberta's environmental legislation sets out clear rules and obligations for the protection, enhancement and wise use of the environment. Alberta Environment and Parks (AEP) works with Albertans to ensure the quality of our environment is maintained, using an effective and efficient regulatory framework.	http://aep.alberta.ca/about-us/compliance-assurance-program/default.aspx
<i>Creekwatch Citizen Science Program</i>	Non-profit - RiverWatch Institute of Alberta	Regional/Watershed	River	1. Connect communities with science and stewardship relevant to their local natural areas and stormwater creeks.	1. Watershed residents	CreekWatch is a community-based environmental monitoring program by the non-profit RiverWatch Institute of Alberta. The objective of CreekWatch is to connect communities with the science and stewardship relevant to their local natural areas and stormwater creeks.	http://creekwatch.ca/
<i>Engaging Recreationists in the Oldman Headwaters</i>	Project	Non-profit/Watershed Planning and Advisory	Regional/Watershed	1. Encouraging motorized recreationists to keep wheels out of water	1. Recreationists	This project is part of a multi-year pilot that is contributing to a major restoration and education effort in the Oldman headwaters. The	https://albertaecotruster.com/portfolio_page/engaging-recreationists-in-the-oldman-headwaters-through-education-restoration/

<i>through Education and Restoration</i>		Councils- Alberta EcoTrust and the Oldman Watershed Council		and protect headwaters, water quality, and critical habitat for endangered species		OWC's Integrated Watershed Management Plan identified the need to reduce threats to the headwaters using a collaborative approach of stewardship, education, and engagement. Through community-based social marketing, stakeholder engagement, education, streambank restoration, and stewardship activities, the Oldman Watershed Council is encouraging motorized recreationists to keep wheels out of water and thereby protect our headwaters, water quality, and critical habitat for endangered species.	
<i>Farm Water Supply Program</i>	Government- Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Support producers to improve their water supply security and more effectively and efficiently manage their on-farm water resources 2. Support producers to protect their water resources through beneficial management practices; and 3. Provide technical assistance to producers to complete an assessment for the management of their water resources (e.g., 	<ol style="list-style-type: none"> 1. Crop producers 2. Livestock producers 3. Landowners 	The Farm Water Supply Program shares costs relating to enhancements of a producer's on-farm water supply management, arising from a Long-Term Water Management Plan (LTWMP). These eligible costs are offered through Standard and Special Incentive projects described in detail in the Farm Water Supply Program Funding List.	https://cap.alberta.ca/CAP/program/FARM_WATER

				Long-Term Water Management Plan)			
<i>Healthy Lake Lawn Care</i>	Watershed Stewardship Group- Pigeon Lake Watershed Association	Regional/Watershed	Lake	1. Promote best practices around lawn-care adjacent to lakes	1. Watershed residents	The PLWA practices a good, better, best approach. Through this program, they encourage better lawn care by local residents.	http://www.townlife.com/world/Canada/Alberta/Pigeon%20Lake?page=Healthy-Lake-Lawns&web_site=641
<i>LakeKeepers</i>	Non-profit - Alberta Lake Management Society	Provincial	Lake	1. Raise the profile of new lakes 2. Empower stewards with some of the knowledge and tools needed to monitor, manage, and protect waterbodies	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups	LakeKeepers allows volunteers to independently monitor lakes or reservoirs for parameters important to ecological health. LakeKeepers is not an intensive monitoring program but will help put new lakes on the map and empower stewards with some of the knowledge and tools necessary to monitor, manage, and protect the waterbodies they love.	https://alms.ca/lakekeepers/
<i>LakeWatch</i>	Non-profit- Alberta Lake Management Society	Provincial	Lake	1. Collect information about local lakes and reservoirs	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups	LakeWatch is a volunteer-based water quality monitoring program offered to Albertans who are interested in collecting information about their local lake or reservoir. Once all of the data is collected we produce a LakeWatch Report for the lake which summarizes the data in an easy-to-understand manner. LakeWatch Reports can be used to educate lake users and guide water restoration and management efforts.	https://alms.ca/about-lakewatch/
<i>Love the Lake</i>	Watershed Stewardship Group - Pigeon Lake Watershed Association	Regional/Watershed	Lake	1. Provide guidelines to help landowners and agricultural users save the lake	1. Lakeshore residents 2. Crop producers	This stewardship and education program strive to promote guideline for landowners and agricultural users in the Pigeon Lake Watershed about best practices.	http://www.plwa.ca/pages/stewardship-education/love-the-lake

<i>Living by Water Program</i>	Non-profit-Nature Alberta	Provincial	Lake	1. Provide information to lake residents about healthy shoreline living.	1. Lakeshore residents	The program informs and educates lakeshore residents about the importance of maintaining the integrity of the natural ecosystem associated with their lake property, while supporting suitable recreational use, preserving property values and ensuring use for future generations.	http://naturealberta.ca/programs/living-by-water/
<i>Provincial Groundwater Inventory Program</i>	Government-Provincial/Government of Alberta	Provincial	Groundwater	1. To map and inventory groundwater resources in Alberta	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities 5. The public 6. Industry 7. Waterworks operators 8. Well owners 9. Well drillers	The Provincial Groundwater Inventory Program is a partnership between Alberta Environment and Parks and the Alberta Geological Survey. Airborne geophysical surveys were conducted to map various rock types. Thousands of existing water wells and oil and gas drilling records were used in conjunction with the airborne data, and supported by the drilling of boreholes, groundwater sampling and other field-based activities. The information was used to construct a geological model which will be used to build a regional groundwater flow model by adding various water inputs and outputs. This will enable better understanding of the occurrence and movement of groundwater in the subsurface.	http://aep.alberta.ca/water/programs-and-services/groundwater/science-and-knowledge/provincial-groundwater-inventory-program.aspx
<i>Respect Our Lakes</i>	Government-Provincial/Government of Alberta	Provincial	Lake	1. Support and engage Albertans in lake stewardship 2. Provides the tools and resources to help	1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups	The Respect Our Lakes program was developed within the Government of Alberta and aims to support and engage Albertans in lake stewardship. The program	http://aep.alberta.ca/water/programs-and-services/respect-our-lakes/default.aspx

				lake users understand, value, and manage lakes through the application of relevant legislation and science	4. Municipalities 5. Lakeshore residents	provides the tools and resources to help lake users understand, value, and actively manage lakes through the application of relevant legislation and science.	
<i>Riparian Improvement Program</i>	Association - Highway 2 Conservation	Regional/Watershed	Multiple	1. To increase agricultural sustainability within the rural landscape through workshops, programs, seminars, tours, demonstrations, and community involvement	1. Crop Producers 2. Livestock Producers 3. Landowners	Highway Two Conservation has a responsibility to the partnership communities to deliver timely information on a wide range of issues in a friendly, enjoyable manner. Through innovation and persistence, they bring solutions to area residents with a strong belief in life-long learning and an optimistic attitude.	https://www.highway2conservation.com/
<i>RiverWatch Science Program</i>	Non-profit-Alberta RiverWatch	Provincial	River	1. Promote ecosystem concepts, lab skills, and critical analysis among students	1. Students	The RiverWatch Science Program helps students answer the "big" question, "How healthy is your river?" To answer that question, students must first learn ecosystem concepts, lab skills and critical analysis. Their students use science as a tool in the construction of shared knowledge. The central focus of a day with RiverWatch is the taking of water quality measurements above and below a point source of pollution such as a wastewater treatment plant.	http://www.riverwatch.ab.ca/about
<i>Septic Sense</i>	Non-profit - Land Stewardship Centre	Provincial	Multiple	1. Provide landowners access to information, resources, and support to help them manage and maintain septic systems	1. Landowners 2. Watershed Residents	In partnership with the Alberta Onsite Wastewater Management Association, the Land Stewardship Centre offers Septic Sense workshops. The Alberta Onsite Wastewater Management Association will be coordinating	http://www.landstewardship.org/septic-sense/

						and delivering the workshops and Land Stewardship Centre will continue to work closely with them to support the program with marketing and promotions, resource development (e.g. fact sheets, workshop resources etc.), and promoting the workshop schedule.	
<i>Watershed Resiliency and Restoration Program</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	<ol style="list-style-type: none"> 1. Build long-term resiliency to flood and drought events through restoration and enhancement of Alberta's watersheds 2. Provide guidance on the current year of funding 	<ol style="list-style-type: none"> 1. Watershed Stewardship Groups 2. Watershed Planning and Advisory Councils 3. Municipalities 	Alberta Environment and Parks (AEP) established and administers the Watershed Resiliency and Restoration Program (WRRP). The WRRP aims to promote the long-term ability of watersheds to mitigate the effects of future flood and drought events. The primary objective of the program is to increase the natural capacity of watersheds to reduce the intensity, magnitude, duration and effects from flooding and droughts for the benefit of Albertans and their communities.	https://open.alberta.ca/dataset/e967ea8b-f3e9-4063-bb62-fb0077a243e4/resource/2fdae91e-ac30-485d-9ae6-63cc277369f9/download/wrrp-grantapplicationoverview-jul2018.pdf
<i>Yellow Fish Road Program</i>	Non-profit- Trout Unlimited	Federal	Multiple	<ol style="list-style-type: none"> 1. Educates Canadians about reducing water pollutions entering storm drains 	<ol style="list-style-type: none"> 1. Watershed Stewardship Groups 2. Watershed Planning and Advisory Councils 3. Municipalities 4. The public 	TUC's Yellow Fish Road™ program educates Canadians that storm drains are the doorways to our rivers, lakes and streams. Participants learn that together we can prevent pollutants from entering our storm drains and protect Canada's water.	https://tucanada.org/yellow-fish-road/

Tools							
Approach	Who	Scale	Drinking Water Source(s)	Main Goals/Purpose	Targeted Audience(s)	Details	Link
<i>A Toolkit for Protecting Source Water Quality in the Red Deer River Watershed</i>	Association - Red Deer River Municipal Users Group	Regional/Watershed	Multiple	<ol style="list-style-type: none"> 1. Broaden and improve an understanding of the importance of source water quality 2. Clarify the values of a watershed (regional) approach 3. Identify threats to water quality of sources within river quality 	<ol style="list-style-type: none"> 1. Municipalities 2. Watershed residents 	The toolkit addresses source water protection as a matter of vital concern to the future well-being and sustainability of municipalities, and other water users. The toolkit report addresses 21 threats, both continuous and periodic, to source water and source water quality. To address threats, it gives 39 tools. The intent of this report is to stimulate municipalities to act and protect source water and its quality.	http://rdrmug.ca/wp-content/uploads/2014/11/Final-3rd-printing-Toolkit-Report.pdf
<i>A Desktop Method for Establishing Environmental Flows in Alberta Rivers and Streams</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provide a method for setting instream flow requirements for flowing waters in Alberta.	<ol style="list-style-type: none"> 1. Municipalities 2. Waterworks Operators 	The approach described in this technical document provides a method for setting instream flow requirements for flowing waters in Alberta. This method can provide valuable information when considering environmental aspects in balancing natural river flows and water demand.	https://open.alberta.ca/publications/9780778599791
<i>Alberta River App</i>	Government-Provincial/Government of Alberta	Provincial	River	1. Provide real time data and advisories about rivers in the province	<ol style="list-style-type: none"> 1. Watershed residents 2. Industry 3. Crop producers 4. Landowners 	Obtain the latest information about Alberta's rivers, including low flow advisories, flood advisories, ice jam advisories, and comments issued by Alberta's River Forecast Centre.	https://itunes.apple.com/ca/app/alberta-rivers/id888325071?mt=8

					<ul style="list-style-type: none"> 5. Watershed Stewardship Groups 6. Livestock producers 7. Landowners 8. The public 9. Waterworks operators 10. Municipalities 	View all current surface water data for Alberta and monitoring stations.	
<i>Alberta River Water Quality Index</i>	Government-Provincial/Government of Alberta	Provincial	River	<ul style="list-style-type: none"> 1. Summarize physical, chemical, and biological data into a simple descriptor of water quality. 2. Provide a snapshot of annual water quality conditions in major rivers of the province. 	<ul style="list-style-type: none"> 1. Researchers 2. Decision-makers 	Alberta Environment and Parks (AEP) monitors surface water quality at many river and lake locations each year, but only data collected as part of the province's Long-term River Network are currently used for the Index. Index values are calculated annually for each site based on data collected monthly or quarterly from April to March. Sites are chosen to represent water quality conditions up- and downstream of areas of significant human activity.	http://esrd.alberta.ca/water/reports-data/alberta-river-water-quality-index.aspx
<i>Alberta Water Well Information Database</i>	Government-Provincial/Government of Alberta	Provincial	Groundwater	1. Provide a database on wells, drilling and chemical analysis reports in the province	<ul style="list-style-type: none"> 1. Researchers 2. Municipalities 3. The public 	The Alberta Water Well Information Database site contains a database of approximately 500,000 records with nearly 5,000 new drilling reports added annually. The database contains information about individual water well drilling reports, chemical analysis reports up to the end of 1986, springs, flowing shot holes, test holes, and pump tests conducted on the wells.	http://aep.alberta.ca/water/reports-data/alberta-water-well-information-database/default.aspx
<i>Bow is Below: Protecting Calgary's Water</i>	Municipality - City of Calgary	Regional/Watershed	River	1. Create awareness to the importance of protecting the Bow River	1. The public	This online tool provides information about potential impacts of various community activities on the Bow River. It also includes	http://www.calgary.ca/UEP/Water/Pages/Water-and-wastewater-systems/The-bow-is-below/Bow-is-Below.aspx#

				2. Provide techniques and information on how someone can help protect rivers		ways to prevent the spread of contaminants to the river with associated bylaws and programs.	
<i>Drinking Water Information Letters</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides advice on a variety of drinking water topics 2. Set out requirements for validating microbiological methods and the analysis of drinking water samples 3. Provide interim guidance on analytical requirements	1. Waterworks operators 2. Municipalities	Drinking Water Information letters strive to provide advice, guidance, and set out requirements for various activities such as achieving 4-log virus reduction, adoption of microbiological methods, analysis of drinking water for metals, drinking water safety plans, cyanobacterial toxins in drinking water, and granting exemption from 4-log virus reduction.	http://aep.alberta.ca/water/programs-and-services/drinking-water/legislation/drinking-water-information-letters.aspx
<i>Edmonton-Calgary Corridor Groundwater Atlas</i>	Provincial Authority - Alberta Energy Regulator	Provincial	Groundwater	1. Examines fresh groundwater sources 2. Help Albertans understand groundwater sources by describing the mapping process	1. Waterworks operators 2. Municipalities 3. Researchers	This groundwater-mapping atlas focuses on the Edmonton-Calgary Corridor (ECC) and examines fresh groundwater based on its geological, hydrological and hydrochemical properties. It will help Albertans better understand the province's groundwater resources by describing the groundwater-mapping processes used to map these resources, starting with a description of the physical and chemical properties of groundwater, and then providing details of the results of the mapping work.	http://ags.aer.ca/publications/INF_140.html
<i>Extend Water Distribution, Wastewater collection, and</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Mandates that approval or registration holders provide certain	1. Municipalities 2. Industry 3. Developers	Approval or Registration Holders, or their authorized agents (such as developers or consultants) must provide certain information to	https://open.alberta.ca/dataset/802a1a2c-bd8d-4117-b9ad-54e4d7380c60/resource/c7d24863-95fd-4652-91c4-

<i>Storm Drainage Systems: information requirements</i>				information to AEP prior to construction activities in relation to watermains, sanitary sewers and storm sewers		Alberta Environment, prior to construction, as part of the written notice required when extending or replacing watermains, sanitary sewers and/or storm sewers.	3fe6743238fc/download/extendsystemsinfo/requirements-oct2003.pdf
<i>Groundwater Observation Well Network</i>	Government-Provincial/Government of Alberta	Provincial	Groundwater	1. Provide information on the monitoring of groundwater levels in aquifers across the province	1. Waterworks operators 2. Municipalities 3. Well owners 4. The public	The Alberta Environment (AENV) Groundwater Observation Well Network (GOWN) is a network of groundwater wells that monitor groundwater levels in aquifers across Alberta. Within the network some wells are also monitored for a variety of groundwater quality parameters.	http://aep.alberta.ca/water/programs-and-services/groundwater/groundwater-observation-well-network/default.aspx
<i>Regulated Drinking Water in Alberta</i>	Government-Provincial/Government of Alberta	Provincial	Multiple	1. Provides annual reports received from drinking water facility owners and operators' facilities 2. Provide monthly reporting data summarizing the results of drinking water quality testing received from waterworks facilities	1. Waterworks operators 2. Municipalities 3. Watershed Planning and Advisory Councils 4. Watershed Stewardship Groups	Alberta Environment receives annual reports from drinking water facility owners and operators' facilities. In addition, facilities collect monthly reporting data summarizing the results of their drinking water quality testing. Alberta Environment is working with facilities to have all monthly reports available electronically, and to provide public access to this data.	http://environment.alberta.ca/apps/regulatteddwq/
<i>Vulnerability Screening Tool for Public Wells</i>	Alberta Health Services	Provincial	Groundwater	1. Identify direct or potential threats related to groundwater wells	1. Waterworks operators 2. Municipalities 3. Well owners	Undertakes and assessment of well vulnerability using a series of steps including looking at the well log, well construction details, summary of bacteriological history, undertaking a site evaluation, among other aspects.	n/a

<p><i>Rural Water Quality Information Tool</i></p>	<p>Government-Provincial/Government of Alberta</p>	<p>Provincial</p>	<p>Multiple</p>	<p>1. Assesses one water source at a time from the water analysis data you provide 2. Assesses water used for the following purposes: human drinking, livestock water, irrigation or mix water for chemical spraying application 3. Asks key diagnostic questions based on the selected use</p>	<p>1. Watershed residents 2. Watershed Planning and Advisory Councils 3. Watershed Stewardship Groups 4. Municipalities 5. The public 6. Industry 7. Livestock producers 8. Crop producers 9. Landowners 10. Well owners</p>	<p>This on-line tool assesses the quality and suitability of raw water sources for privately owned and operated water supplies. Information is provided on sampling, testing, and treatment.</p>	<p>http://www.agric.gov.ab.ca/app84/rwqit</p>
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Appendix F – Surveys and Targeted Questionnaire Findings

Disclaimer: These results provide a snapshot of SWP approaches collected by the team's surveys, targeted questionnaire, and literature review, and may not include all SWP work in Alberta.

PROTECTING SOURCES OF DRINKING WATER IN ALBERTA

ALBERTA WATER COUNCIL

September 2018



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1.0 Purpose

This report presents findings of 47 surveys from public and private organizations involved in source water protection (SWP) efforts across Alberta.

The purpose of these surveys was to document SWP drivers, risks, challenges, and best practices among organizations involved with public and private drinking water systems.

2.0 Context

Findings presented here reflect the diverse perspectives of the organizations who participated in the survey. The findings are not intended to be statements of consensus or representative of a specific organization or all organizations.

This report represents a general perspective on what is considered by participants as possible and desirable to improve SWP in Alberta based on the sample size examined.

3.0 Development of Findings

Surveys were designed to investigate perspectives and experiences on the focus, drivers, and scale of SWP work, risks, risk assessment, barriers, target audiences, collaboration, existing approaches, resources and networks as well as best practices communities across Alberta.

4.0 Methodology

A survey was distributed electronically to collect data and targeted organizations and/or individuals involved in, or supporting initiatives to develop, implement, and evaluate SWP efforts (i.e., plan, program, policy, legislation, tool) that focus on protecting drinking water sources in public and private systems.

5.0 Profile of Participants

Type of Organization

Participants varied from Watershed Planning and Advisory Councils (WPACs) to Watershed Stewardship Groups (WSGs), municipalities, Government of Alberta (GoA) ministries, other non-profits, and private organizations. Figure 1 below demonstrates that the majority of SWP work is spearheaded by municipalities, followed by other non-profit organizations, and private organizations.

Aside from WPACs and WSGs, other non-profit organizations who participated in the survey focus on the following areas as part of their mandate:

- land and water protection

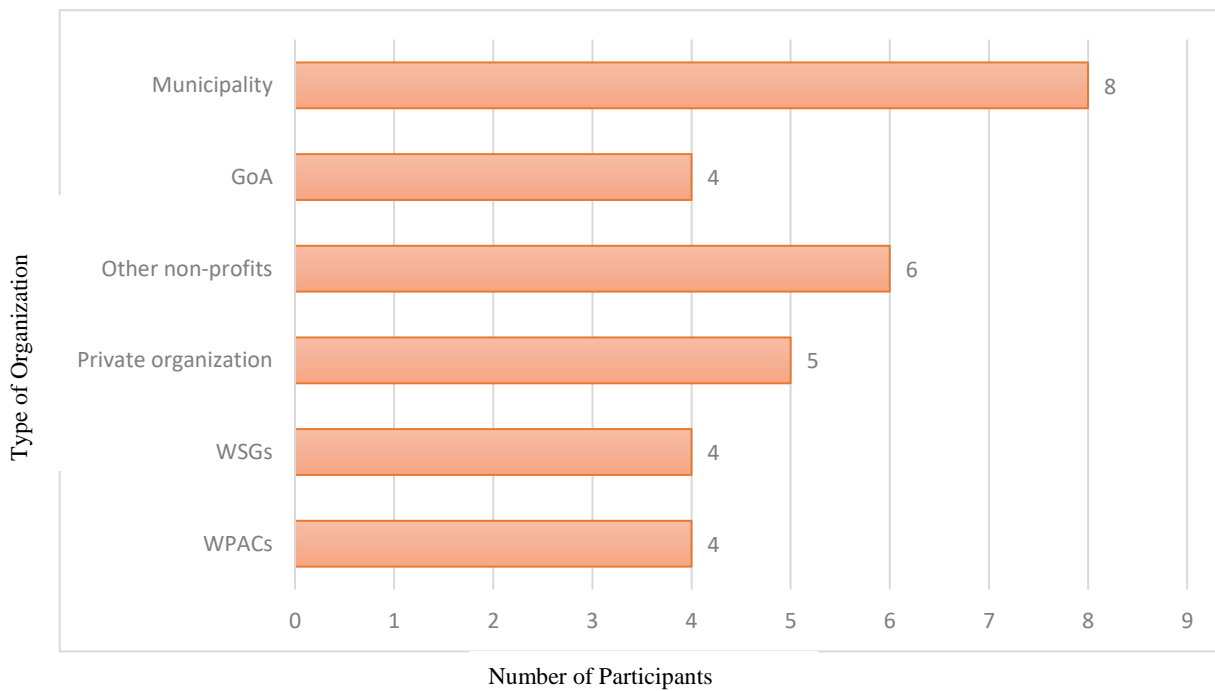


Figure 1: Type of Organizations Involved in SWP

- environmental stewardship
- wildlife and habitat conservation
- building community capacity

Private organizations who participated in the survey included regional water commissions and water utilities organizations. Sixty-two percent of systems are both public and private by nature, while 35 percent are predominantly public as seen in Figure 2.

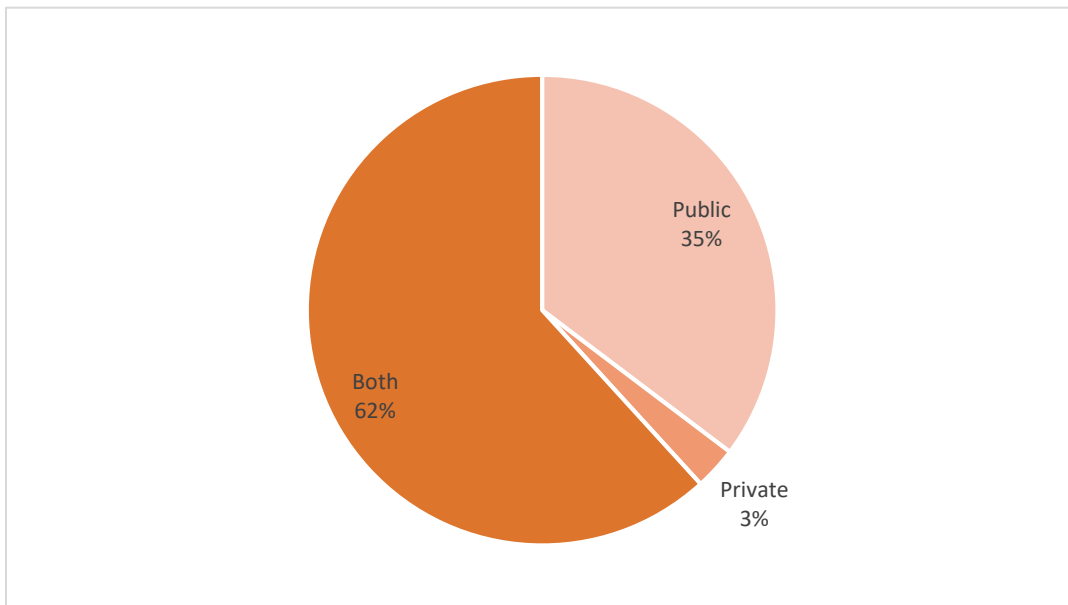


Figure 2: Types of Drinking Water Systems

Job Positions

Of the participants who answered this question, their job position in SWP work varied in area of focus and organizational hierarchy as shown in Table 1:

Table 1: Participants' Job Positions

Position	Number
Chief Administrative Officer	2
Councilor	2
Director	3
Executive Director	5
Manager	10
Other	8
Project Coordinator	2

The other category included Technical Coordinator, Communications Chair of a board, Grassroots Activist, Forest Hydrologist, Health Inspector, Outreach and Communications Specialist, Environmental Protection Officer, and Drinking Water Specialist. For the Manager

position, areas of focus were found to be watershed, town utilities, transmission, networks, and public works and infrastructure.

Involvement in SWP

Figure 3 demonstrates that 68 percent of participants have a direct (i.e., a SWP program, plan) and indirect (i.e., stewardship, collaboration) focus on drinking water protection, while 27 percent only have a direct focus. Five percent of participants indicated that SWP is not a focus for their organization as they are only responsible for water distribution and not treatment.

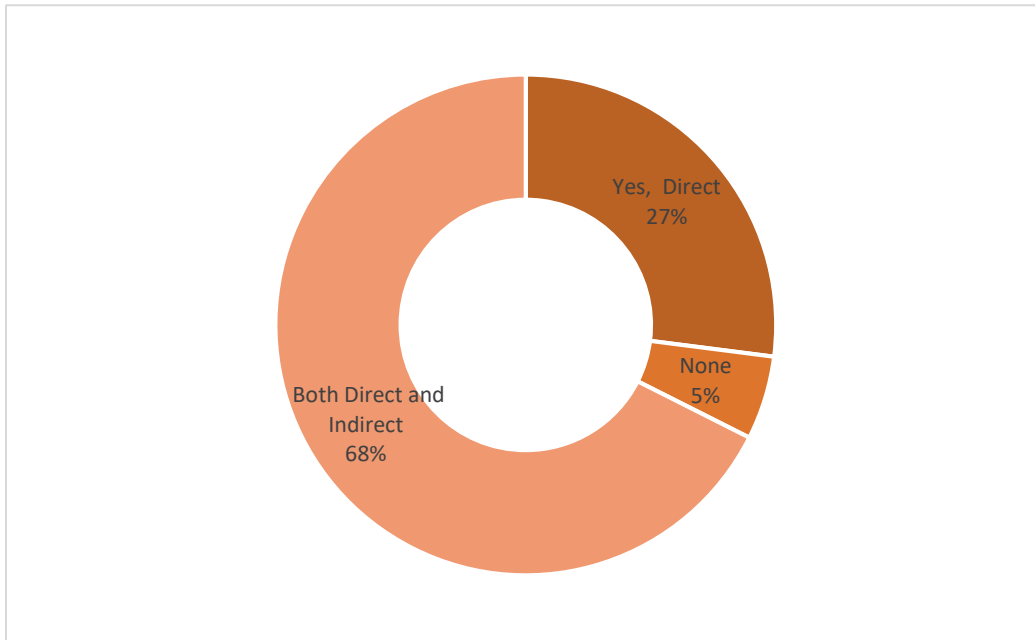


Figure 3: Involvement in SWP

SWP Drivers

With regards to what organizations' primary driver are for undertaking SWP, the majority indicated that environmental reasons are the main reason, closely followed by social/public health reasons, while economic drivers are not as big of a driver.

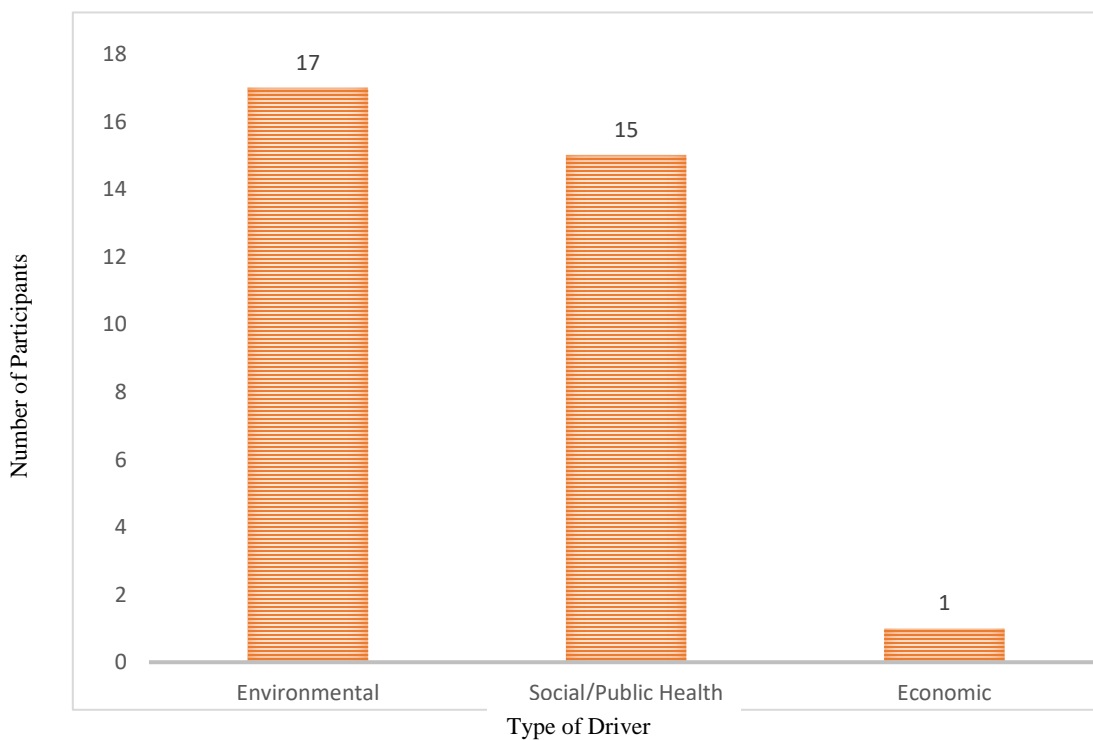
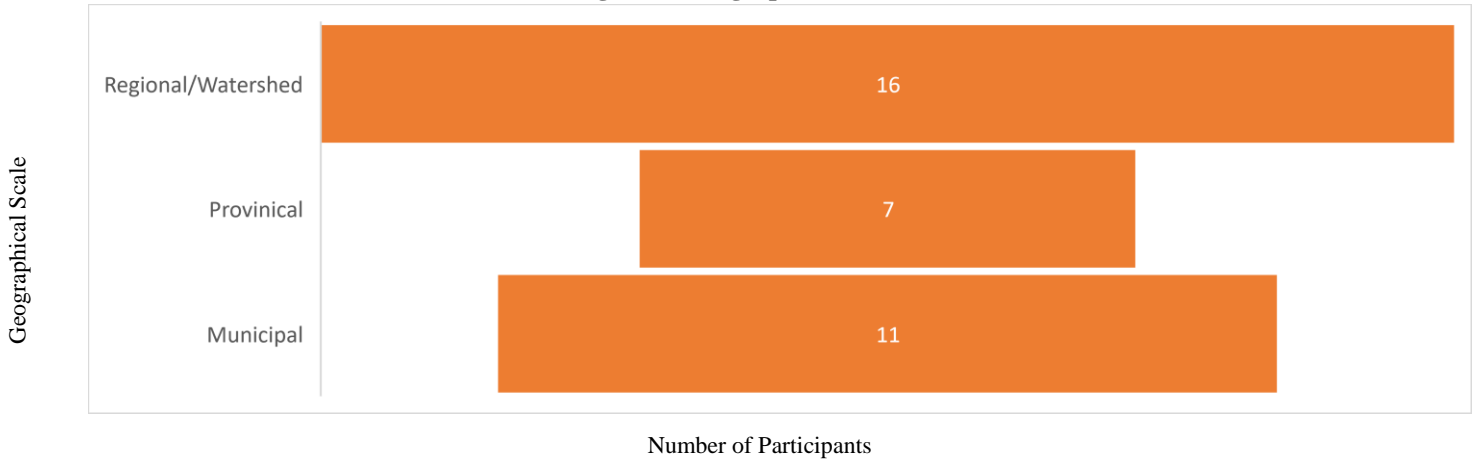


Figure 4: SWP Drivers

Geographical Scale of Work

The majority of SWP work reported through the survey is being done at a regional/watershed level by WPACs, WSGS, other non-profit groups, and private organizations, followed by government work at the municipal and provincial scale as seen in Figure 5.

Figure 5: Geographical Scale of SWP Work



Drinking Water Source

Figure 6 illustrates that 30 percent of the public and private systems surveyed rely on rivers, followed by 22 percent by groundwater, and 20 percent by wetland as their drinking water source. Only 12 percent of systems rely on reservoirs as their source.

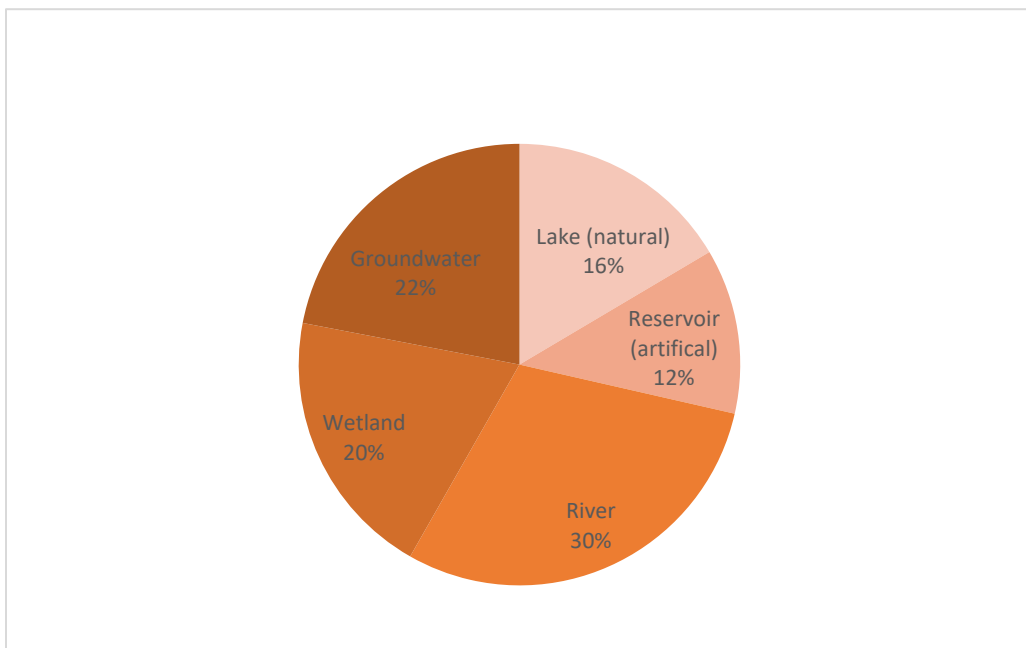


Figure 6: Types of Drinking Water Source

6.0 Risks, Risk Assessment, and Management

Extreme weather events (e.g., drought, flood) was observed to be the greatest risk to drinking water sources followed by construction and development, stormwater, recreation, and livestock activities. Participants noted the following as other risks:

- Government decision making and its implications
- golf course chemicals from upstream
- municipal policies are often ignored or not enforced
- Climate change and its impacts on water quality

It was found that 57 percent of public and private systems employ risk assessment and management approaches when protecting their drinking water source while 43 percent did not.

The following are some of the approaches being used:

- research studies on water quality, phosphorus sources, and its impacts
- watershed planning based on the science and social inputs
- incorporating SWP into a sub-basin watershed management plan
- collaborating on risk assessment and management approaches with other groups
- working with property owners and communities

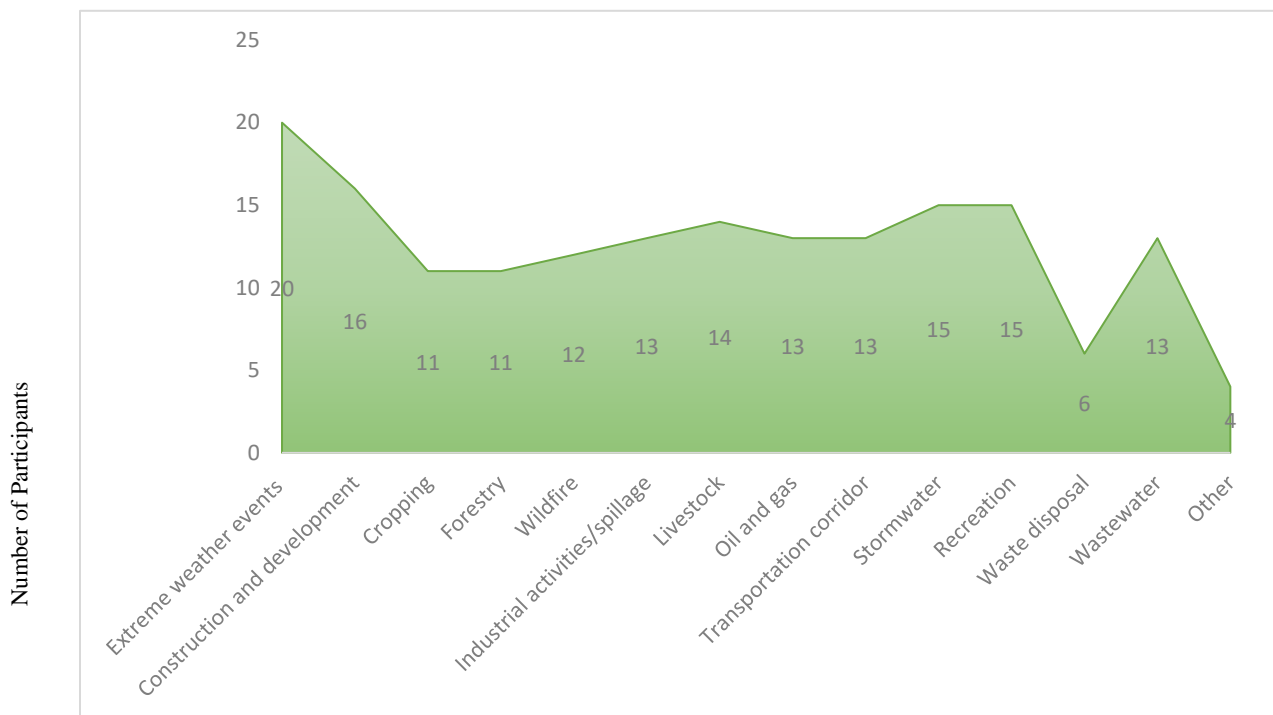


Figure 7: Risks to Drinking Water Sources

- developing a SWP plan for our community
- coordinating with organizations who are responsible for treating our water
- having a Drinking Water Safety Plan (DWSP)
- having a Vulnerability Risk Assessment Tool for water wells
- having a watershed advisory committee in place
- developing an internal risk management system
- risk management came with our source water protection plan
- asking the community to help prioritize risks in the SWP area
- having natural infrastructure in place (e.g., riparian areas)

7.0 Barriers to SWP Plan Development, Implementation, and Evaluation

The biggest barrier to SWP development, implementation and evaluation is insufficient resources (i.e., tools, programs, training, staff, expertise). Another noticeable barrier is challenges with integrating land and water plans, policies, and programs. For example, many participants are unclear as how DWSPs and SWP plans feed into Integrated Watershed Management Plans (IWMPs) and regional land-use plans. With regards other barriers, the following were shared:

- lack of opportunity to participate in SWP discussions
- no interest in SWP from important organizations
- discussions about SWP limited to the municipal level

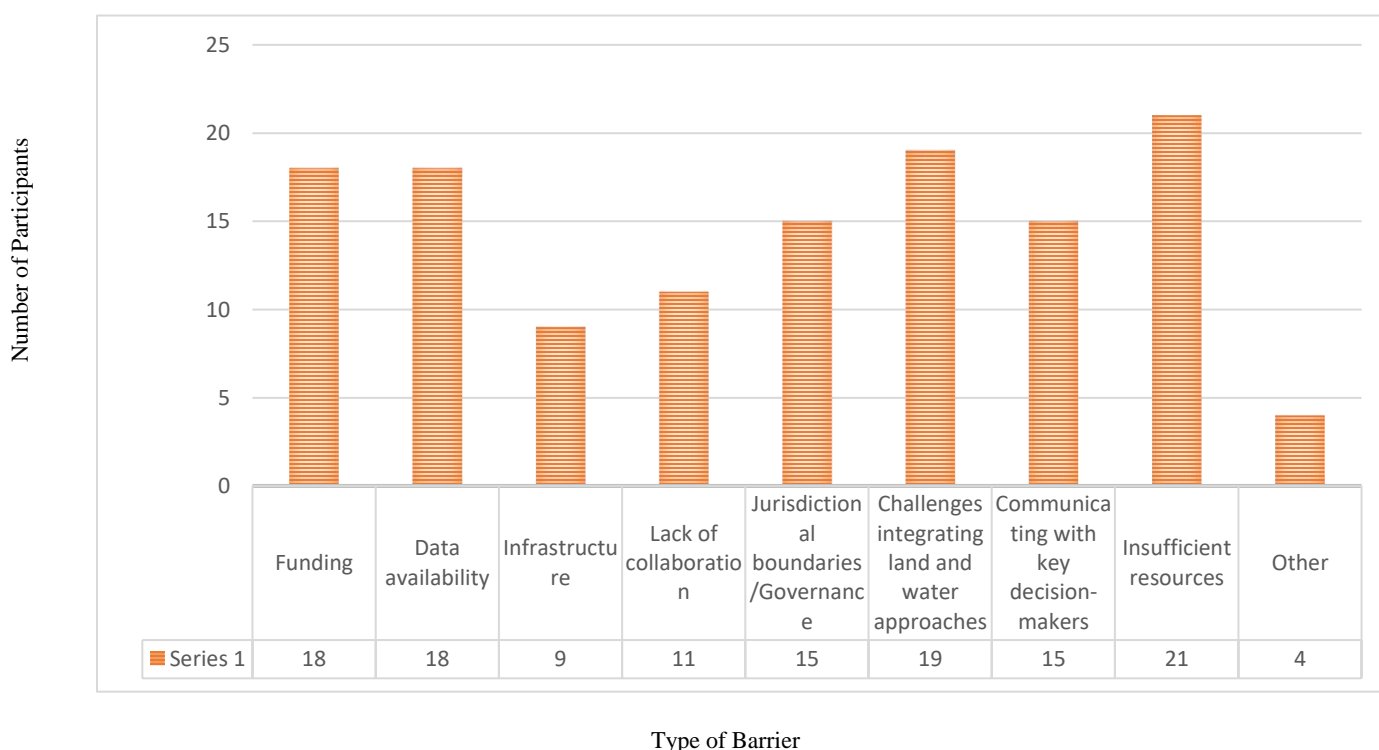


Figure 8: SWP Barriers

In terms of jurisdiction boundaries and government issues, this challenge is more prevalent among municipalities at 45 percent and provinces and territories at 35 percent. It is not as much of an issue within respective public and private organizations at 5 percent.

8.0 Focus of SWP Approaches

The SWP approaches reported in the survey focus on providing information about the topic and training, being involved with legislation, policies, plans, processes, or guidance, implementing and promoting best management practices and less on researching and monitoring the source as seen in Table 2.

Table 2: Focus of SWP Approaches

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

Many public and private organizations who are not necessarily government or have decision-making authority are involved with legislation, policies, plans, processes or guidance on SWP. Some specific examples of other SWP focus include:

- demonstration sites (e.g., residential Clean Runoff approaches, community rain gardens, and shoreline)
- Living by Water Program
- Love Your Lake shoreline assessments
- Alberta Clean Runoff Action Guide
- rain barrel campaign; native grass seed, native pollinators
- persuade municipalities that SWP is a priority
- voluntary versus mandatory legislation and policies and its connection to water governance
- forest hydrology research /watershed science

9.0 Target Audiences

It was observed that decision-makers are the priority audience for most public and private organizations followed by the public and landowners and agricultural producers (Figure 9). The least targeted audience are educators and researchers. Other audiences targeted are municipalities and Indigenous communities. With regards to the type of decision-makers, municipal decision-makers are most targeted by public and private organization for SWP work, followed by provincial and federal decision-makers.

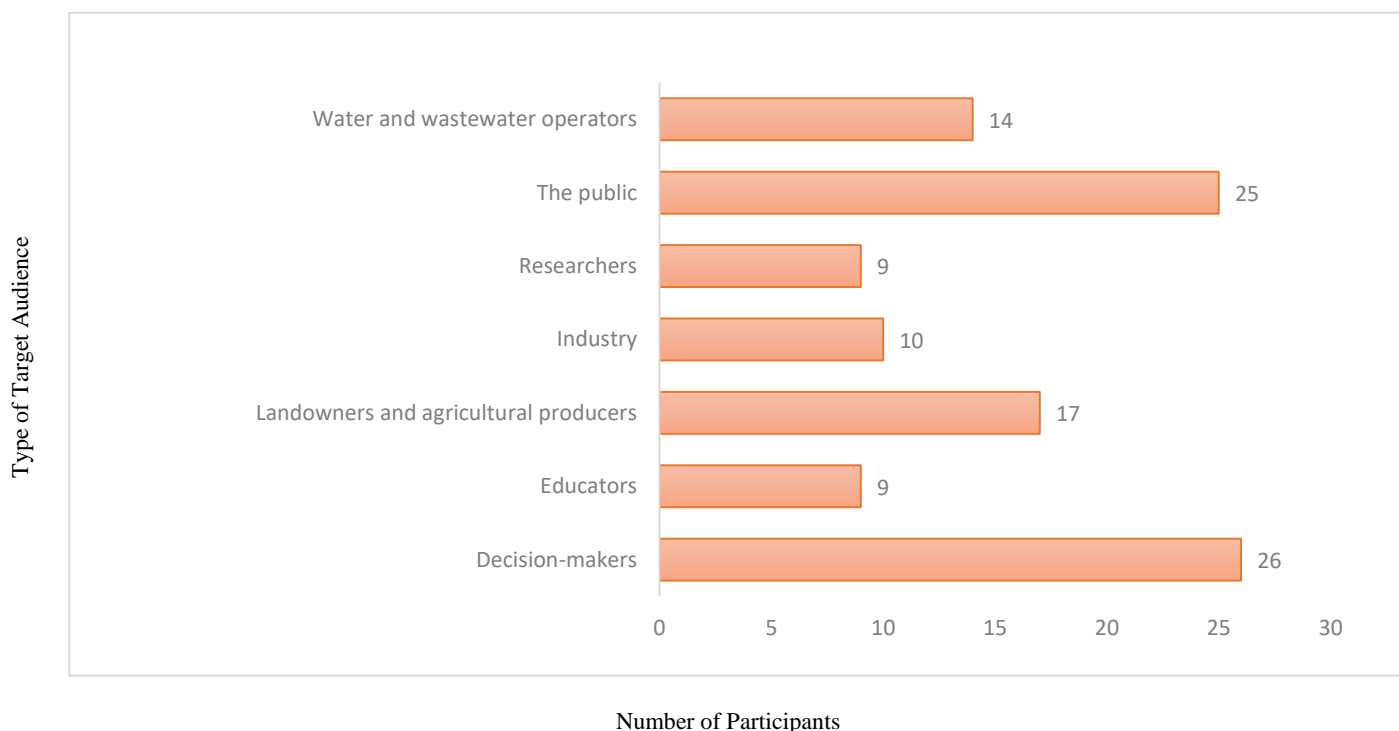


Figure 9: SWP Target Audiences

9.0 Collaboration

It was found that 81 percent of public and private organizations in Alberta are collaborating with other groups on SWP approaches at various geographical scales and targeting different drinking water sources. When asked with who and how they are collaborating, the following was shared as seen in Table 3.

Table 3: Collaboration Among Groups on SWP Approaches

Partners	Initiative
WPACs and WSGs	<ul style="list-style-type: none"> • Kids Lake Education Programs • Love the Lake Family Day
WSGs and Alberta Provincial Parks	<ul style="list-style-type: none"> • Fun Lake and nature learning activities
WSGs, WPACs, and watershed partners	<ul style="list-style-type: none"> • Lake Watershed Management Plan • IWMP • SWP plans
WSGs and Alberta Low Impact Development Program (ALIDP)	<ul style="list-style-type: none"> • Clean Runoff Action Guide
WSGs, WPACs, and Alberta Habitat Management Society (Cows and Fish)	<ul style="list-style-type: none"> • Shoreline restorations • Open houses • Love the Lake Family Fun Day
Nature Alberta and Land Stewardship Centre (LSC)	<ul style="list-style-type: none"> • Living by Water workshops • Love your Lake assessments • Homesite Consultations
LSC and WSGs	<ul style="list-style-type: none"> • Watershed Stewardship Grant (e.g., Love the Lake Program, Shoreline education and promotion)
Alberta Lake Management Society and WPACs, WSGs, and the public	<ul style="list-style-type: none"> • Lakewatch Program • LakeKeepers • Lake Watershed Management Workbook • Citizen science initiatives
GoA's Alberta Environment and Parks (AEP) and WPACs, WSGs, and the public	<ul style="list-style-type: none"> • Respect Our Lakes Program • Shoreline assessment studies
Government of Canada (GoC) and WPACs and WSGs	<ul style="list-style-type: none"> • EcoAction Program • Clean Runoff Projects
WSGs, WPACs, and Municipalities	<ul style="list-style-type: none"> • Alliance of Pigeon Lake Municipalities – Annual Leaders Session • Pigeon Lake Regional Chamber of Commerce
WSGs, WPACs, Industry, Non-profits, and Governments	<ul style="list-style-type: none"> • Sturgeon River Watershed Alliance is a group of 10 municipalities and the GoA developing a watershed management plan for the Sturgeon watershed • North Saskatchewan Watershed Alliance (NSWA) creating watershed management plan for the Wabamun Lake watershed • Headwaters Action Plan and engaging recreationists • Athabasca Basin: Tailings and Impacts on Aquifers project, 10 northern communities, partners are Alberta EcoTrust foundation, Regional Environmental Action Committee, GW Solutions, First Nations Technical Services Advisory Group and others • Red Deer River Municipal Users Group • Southern Eastern Slopes Collaborative • Water North Coalition • Highway 2 Conservation's riparian enhancement/protection projects
WPACs, WSGs, GoA, and the Alberta Water Council (AWC)	<ul style="list-style-type: none"> • <i>Water for Life</i> Strategy
GoA and research and academia	<ul style="list-style-type: none"> • Alberta Health Services' labs and AEP • AEP and the University of Alberta • AEP and the University of Waterloo
Water Utility, Municipalities, WPACs, and WSGs	<ul style="list-style-type: none"> • EPCOR Utilities and their SWP work with the NSWA, municipalities, and WSGs

Municipalities and non-profit	<ul style="list-style-type: none"> • Alternative Land Use Services (ALUS)'s programs in 12 municipalities and growing
Municipalities	<ul style="list-style-type: none"> • Upstream communities (Town of Turner Valley, Town of Black Diamond); Bow River Phosphorus Management Plan and Committee; Sheep River Valley Committee (local committee) collaborating on SWP approaches

From Table 3, we can deduce the following:

- more collaboration is occurring at the regional/watershed and municipal scales than the provincial or federal scales
- WPACs and WSGs are leading most SWP initiatives and bringing community partners together to work on watershed-scale challenges
- growing number of collaborative groups of municipalities in a region working to tackle environmental challenges (e.g., the Alliance of Pigeon Lake Municipalities, the Red Deer River Municipal Users Group)
- efforts focused 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 these collaborations as other groups
- collaborating with Indigenous communities is occurring but at a minimal level in some areas of the province
- coordinating SWP and other watershed-related work with regional land-use planning is not common

The majority of public and private organizations indicated that they are involved in leading and/or supporting SWP approaches. Fewer organizations were found to implement, or evaluate the success of SWP approaches.

10.0 SWP Approaches

Only one SWP plan were reported through the survey (i.e., plans that are created with the primary intention of protecting drinking water sources), however many participants reported SWP-related initiatives (i.e., approaches that was intended for another purpose such as stewardship) where protecting drinking water supplies is only one of many desired outcomes. For example, IWMP and regional land-use plans have a holistic approach of protecting land, water, air, and biodiversity.

While there is a lot of guidance and policies to help with SWP work, not many tools were reported that can be used to inform planning, implementation, and evaluation. There is a heavy focus on stewardship and education programs and projects. The integration of various types of plans with one another (e.g., SWP, IWMP, regional land-use plans) remains unclear.

SWP Plans

- EPCOR's [Source Water Protection Plan](#)

Legislation and Regulations

- [Alberta Water Act](#)
- [Agricultural Operations Practices Act](#)
- [Alberta Land Stewardship Act \(ALSA\)](#)

Policy and Guidance

- [Drinking Water Safety Plan](#) and supporting guidance notes and documents
- [Clean Runoff Action Guide](#)
- [Water for Life Strategy](#)
- [Our Water, Our Future; A Plan for Action](#)

Non-SWP Plans

- [IWMPs](#)
- Lake Watershed Management Plans
- [Environmental Farm Plan](#)
- [Regional Land-use Plans](#)

Processes and Protocols

- stormwater treatment and lagoons
- internal assessment protocols
- stormwater management programs

Programs

- [Working Well](#)
- [Clear Water Landcare Program](#)
- [LakeWatch](#)
- [Love the Lake](#)
- [Respect Our Lakes](#)

Projects and Research

- [Engaging Recreationists Project](#)
- [Dutch Creek Pilot Project](#)
- indicators project to evaluate risk/health and researched linear features density to set baseline
- bringing Traditional Knowledge holders together with western scientists
- pollution investigations and participation as consultants in various Social Sciences and Humanities Research Council projects
- deliver community water monitoring training
- produce topical workshops of interest, such as Indigenous Water Governance
- CreekWatch research, water testing, documenting groundwater springs
- [Smokey Applied Research and Demonstration Association](#)

Tools

- developing a data visualization tool for communities
- in-house Vulnerability Risk Assessment Tool for Water Wells to categorize threats to groundwater sources used for drinking

11.0 Tools, Information, Networks, Groups, and Resources

The following is a list of what is viewed as useful tools, information, networks, groups, and resources by participants:

- Clean Runoff Action Guide
- ALIDP
- ALMS
- BRWA
- Respect Our Lakes Program
- [Alberta Invasive Species Council](#)
- WPACs
- [Groundwater Observation Well Network](#)
- [AEPHIN water quality website](#)
- [Alberta Environment Network](#)
- DWSPs
- LSC
- WSGs
- [National Collaborating Centre for Environmental Health](#)
- Alberta Riparian Management Society (Cows and Fish)
- ALUS
- Smokey Applied Research and Demonstration Association
- ArcGIS and GoA open data to provide specific information about the watershed
- [American Water Works Association Guide to Source Water Protection](#)
- [Climate Smart Agriculture in Alberta](#)
- [Department of Fisheries and Oceans Canada](#)
- Public forums
- Guest speakers

In terms of what was lacking, participants were asked to rank on a scale of 1 to 5 from what was least needed (1) to what was most needed (5). Figure 10 reveals that partnerships, legislation and policy, and financial assistance and resources is lacking and most desirable by participants involved in SWP approaches.

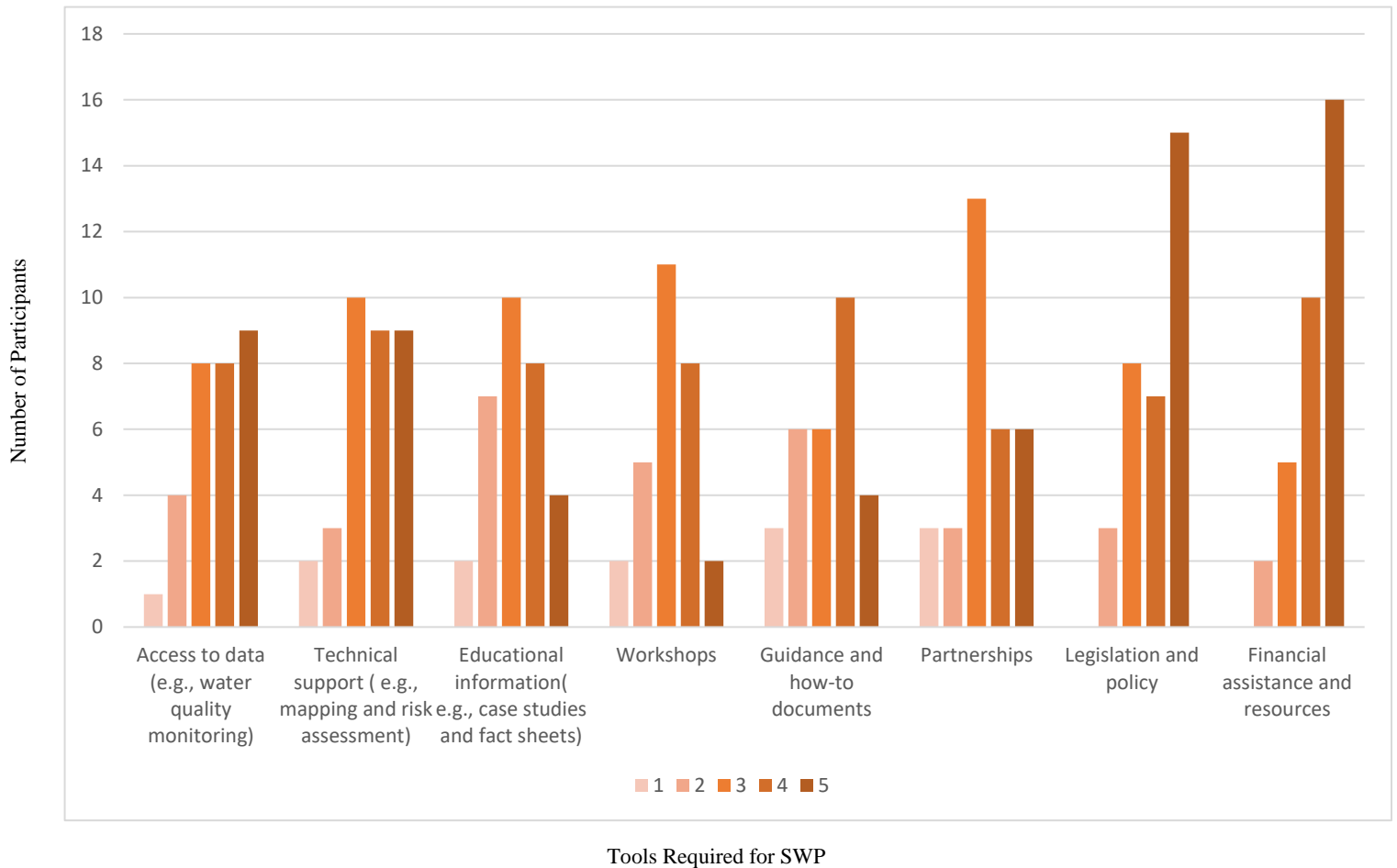


Figure 10: Ranking of SWP Tools

12.0 Success of SWP Approaches

Participants were asked to rank the success of their organization’s SWP approaches on a scale of 1 to 5 from what viewed as not so successful (1) to what was very successful (5). It was found that most organizations feel that their organizations were moderately successful in planning, implementing, and evaluating SWP approaches while a smaller number perceive that they are very successful in their efforts.

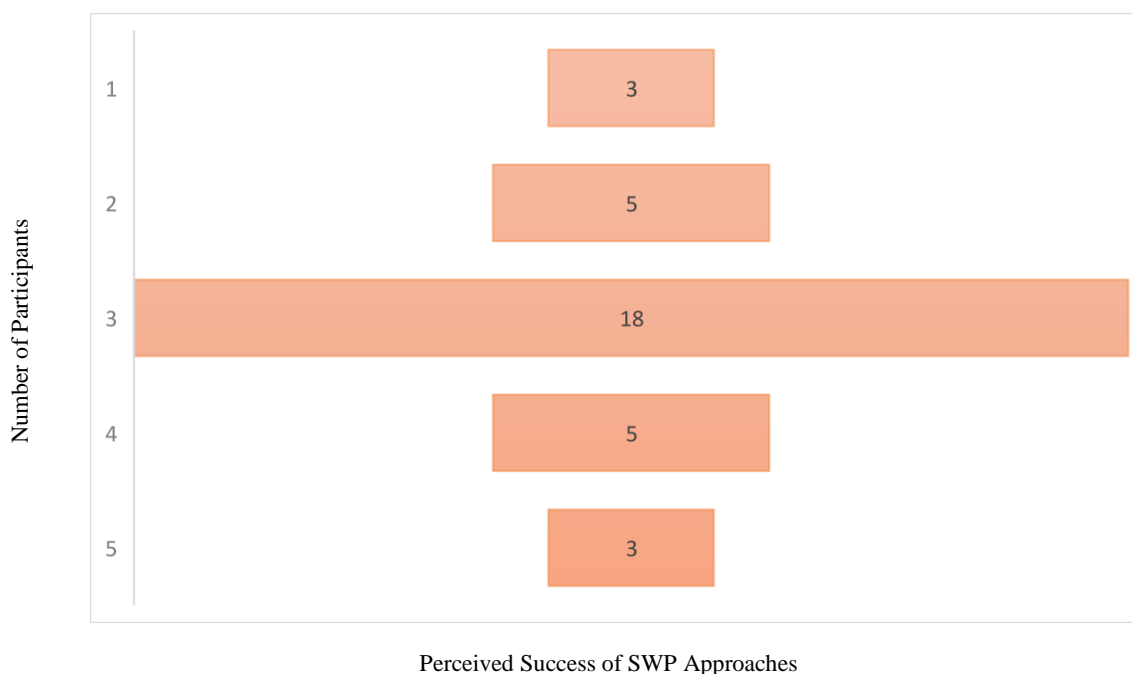


Figure 11: Perceived Success of SWP Approaches

When asked to elaborate on the rationale behind their ranking, the following was shared:

- difficult to see whether decisions made are affecting SWP
- takes time to assess change in habits and see watershed and water quality improvements
- too early to tell yet, but we have good municipal collaboration going towards developing a SWP plan
- we've made strides in informing watershed residents of their responsibilities as stewards, but municipal governments often let us down with the granting of developments that obviously will have negative impacts on the lake
- difficulty getting the public involved and knowledgeable about SWP and the watershed
- no opportunity to participate in SWP decision-making processes
- making progress, but it is slow; impossible to do it any faster given it is all voluntary, with little funding
- SWP in Alberta is skewed toward industry, with research taking place all around the issues without ever landing on them
- although we have met with municipal officials, the claims are there is complex jurisdictional issues
- no specific linkages to provincial SWP strategy
- lack of mandate to manage water
- SWP program performance is not evaluated
- work on land-use planning processes very collaborative and had a big impact on the outcome of the process
- work on forestry practices have been less successful
- we have been very successful in our water education programs
- some drinking water facilities are good but there are still some challenges with older existing facilities that have little money
- no measurable support, but believe interactions with the public are beneficial
- focus on raw water well protection measures, including well security and water quality
- limited development within well fields
- we have started riparian restoration; this work will need to continue for the foreseeable future to achieve measurable results
- supporting and driving primary research that has helped fill in data/knowledge gaps
- leveraged a large amount of funding and has coordinated several key players in the watershed to develop an enhanced and comprehensive monitoring program
- supported several organizations to complete activities that promote or enhance source water protection.
- collaborated with decision makers to protect source waters
- reached out to engage and inform the public, decision makers, researchers and others involved in SWP about the watershed and importance of SWP
- uptake of our programs, tools and service have been successful; however, there is always room for improvement
- difficulty is getting partners to the table
- our program has been exceptionally well received in the agricultural community and the model is well-proven
- lack of concern by some municipalities about SWP

12.0 Best Practices

Most participants indicated that they did not uncover any SWP best practices. Of the organizations that did find some, they shared the following:

- sponsoring workshops on the best practices for restoring damaged shoreline using natural process and native plant material
- using social science, environmental psychology, and identity to inform decision-making
- following the Indigenous water governance model
- community-based water monitoring and considering the concerns of those closest to the water and land represents best practices.
- ensuring there is funding for water quality programs
- timber harvest planning and operating ground rules, forest management planning standard

educating farmers; when and where to build roads.

- full, life cycle benefit/cost analysis of government subsidies
- pricing of pollution discharges, water withdrawals, and land-use impacts based on the full economic and environmental value of water and land
- community-developed, farmer-delivered model of ALUS has proven very successful
- ensuring communication is effective and approaches especially when working with other agencies are clear and concise.

13.0 Lessons Learned

The following lessons learned were shared:

Data Collection, Information, and Monitoring

- need data and technical information that is condensed into something meaningful for decision-makers to act on and inform policy
- data obtained through flood events has helped drive improvement initiatives and projects (i.e., well rehabilitation, flood mitigation)

Development, Regulatory, and Enforcement

- treat water quality as a public health issue and invest more money for water quality improvement
- investing in stormwater treatment improves source water for the future
- needs persistent monitoring of developers by the GoA—stronger regulations to be developed by the Province for municipalities to follow would increase enforcement

Collaboration and Engagement

- educate and involve the public and municipal governments
- if you push too hard, you tend to create resistance and matter how much communication some people say we did not tell them about SWP challenges
- education and demonstrations do get people involved
- get a community and diverse group of willing people to understand and participate
- difficult to get the source recognized, valued, and protected under current policies
- SWP can't be done in isolation, and requires engagement and relationships with a wide range of stakeholders
- need to engage private landowners and the agricultural community, but recognize the sacrifices they make
- tough to get some municipalities and the GoA to work together
- more comfortable with communication within our own borders and our direction of SWP than outside our borders
- communication is lacking as higher levels of government do not set this as a high priority

Resources and Training

- WPACs and WSGs need more and stable funding to keep doing SWP work
- time and money need to be allocated to protect drinking water sources
- provide grants for storm water facilities

Governance

- protecting the upland areas is as important to SWP as the water or watercourse
- SWP should be a mandated part of all regional plans under ALSA
- clarity about how SWP fits with regional land-use planning
- make SWP plans mandatory to adopt; if it is just voluntary, there will be very little adoption of the plan within municipalities
- confusion concerning responsibility between GoA and municipalities regarding SWP enforcement

Other

- a lot of talk and not much tangible action
- we should have started 30 years ago
- humans are their own worst enemy when it comes to pollution
- we must do a better job of managing our streams and waterways for future generations
- SWP is a slow, complex process because it involves change, reprioritization, making tradeoffs but there is not long-term funding to keep it going
- just start!

- Work hard at it, continue to monitor, have patience and be consistent
- SWP not a simple exercise, or a check-box you can complete; it is an on-going and ever-evolving process
- SWP does not start or end with a plan, and a plan should not be the focus; plans sit on shelves

Conclusions

From the survey responses, the main conclusions are as follows:

1. most SWP efforts are occurring at the regional/sub-regional scale
2. environmental factors followed by social/public health were the primary drivers for protecting drinking water sources
3. majority of organizations have risk assessment and management processes in place as part of a wider SWP approach
4. from the data collected, the focus of SWP approaches appears to be more on providing information and training as well as legislation, policies, plans, processes, and guidance and less on research and monitoring of the drinking water sources
5. decision-makers and the public are the main target audiences of SWP approaches but other important groups like public works and drinking water treatment plant staff were missing
6. collaboration was being undertaken by most organizations being more prevalent among WPACs, WSGs, and municipalities, but important groups were missing such as Indigenous communities, regional water commissions, and water co-operatives
7. more SWP planning approaches observed and less implementation and evaluation
8. SWP policy and guidance more available than applicable tools
9. partnerships, legislation, and policy as well as financial assistance and resources were viewed as lacking and desirable for enhancing SWP efforts
10. no clear SWP lead as there are multiple groups spearheading various initiatives across Alberta
11. disconnect between SWP plans and DWSPs, IWMPs, and regional land-use plans
12. increase of SWP plans in Alberta by WPACs, municipalities, and other types of collaborative groups (i.e., collection of regional municipalities)



Results of the Individual Survey



Protecting Sources of Drinking Water in Alberta Project Team
September 2018



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1.0 Purpose

This report presents findings from 98 surveys of individuals who rely on a private source of drinking water (i.e., well, dug-out, other) on their property, and potentially involved in source water protection (SWP) efforts.

The purpose of this survey was to document drinking water use, type of source and system, sources of contamination, barriers, perceived safety of drinking water, collaboration, tools, resources, information best practices, and lessons learned from an individual's perspective.

2.0 Context

Findings presented here reflect the diverse perspectives of the individuals who participated in the survey. The findings are not intended to be statements of consensus or representative of a specific community.

This report represents a general perspective on what is considered by individuals as possible and desirable to enhance protecting drinking water sources in Alberta based on the sample size that data was collected from.

3.0 Development of Findings

Surveys were designed to examine perspectives and experiences on the drinking water use, type of source and system, sources of contamination, barriers, perceived safety of drinking water, collaboration, tools, resources, and information as well as best practices and lessons learned.

4.0 Methodology

A survey was distributed electronically to collect data. It individuals who rely on a private source of drinking water (i.e., well, dug-out, other) on their property.

5.0 Profile of Participants

Geographic location

Of the participants who responded to this question, there was representation from the following communities classified by land-use region in Alberta as seen in Table 1:

Table 1: Geographic Location of Participants

Region	Community
Lower Peace	n/a
Lower Athabasca	Lac La Biche
Upper Peace	n/a
Upper Athabasca	Athabasca, Sunset Beach, Hinton
North Saskatchewan	Parkland County, Barrhead, Pigeon Lake, Bonnyville, Camrose, Strathcona County, Willingdon, Sundance Beach, Cherry Grove, St. Paul, Lloydminster, Vermillion, Manola, Westlock, Kavanagh, Mulhurst Bay, Tofield, Leduc
Red Deer	Red Deer, Gull Lake, Lacombe, Sylvan Lake, Vegreville, Delburne, Erskine Hutterite Colony
South Saskatchewan	Calgary, Taber, Pincher Creek, Cardston, County of Newell, Lethbridge, Willow Creek, Ghost Lake, Bragg Creek, Harvie Heights, Foremost

There was participation from most regions in Alberta with more individuals from rural communities than urban ones.

Primary Use of Property

Fifty-two percent of participants indicated that they use their property for residential purposes and 8 percent used it for recreational purposes as shown in Figure 1.

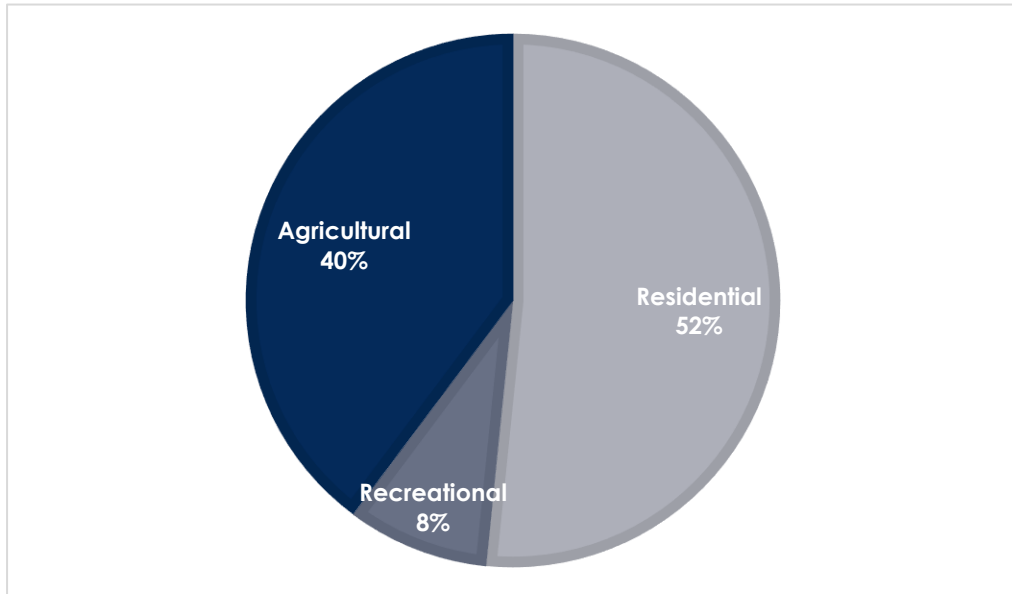


Figure 1: Types of Property Use

Source of Drinking Water

Figure 2 illustrates where participants obtained their drinking water from. Most participants obtain their drinking water from groundwater and fewer obtain it from reservoirs, lakes, rivers/creeks, and bottle/store water.

A few participants indicated that they get their drinking water from other sources such as town water in buckets, hauled/trucked water, and filtered rain water. All participants knew where their drinking water came from.

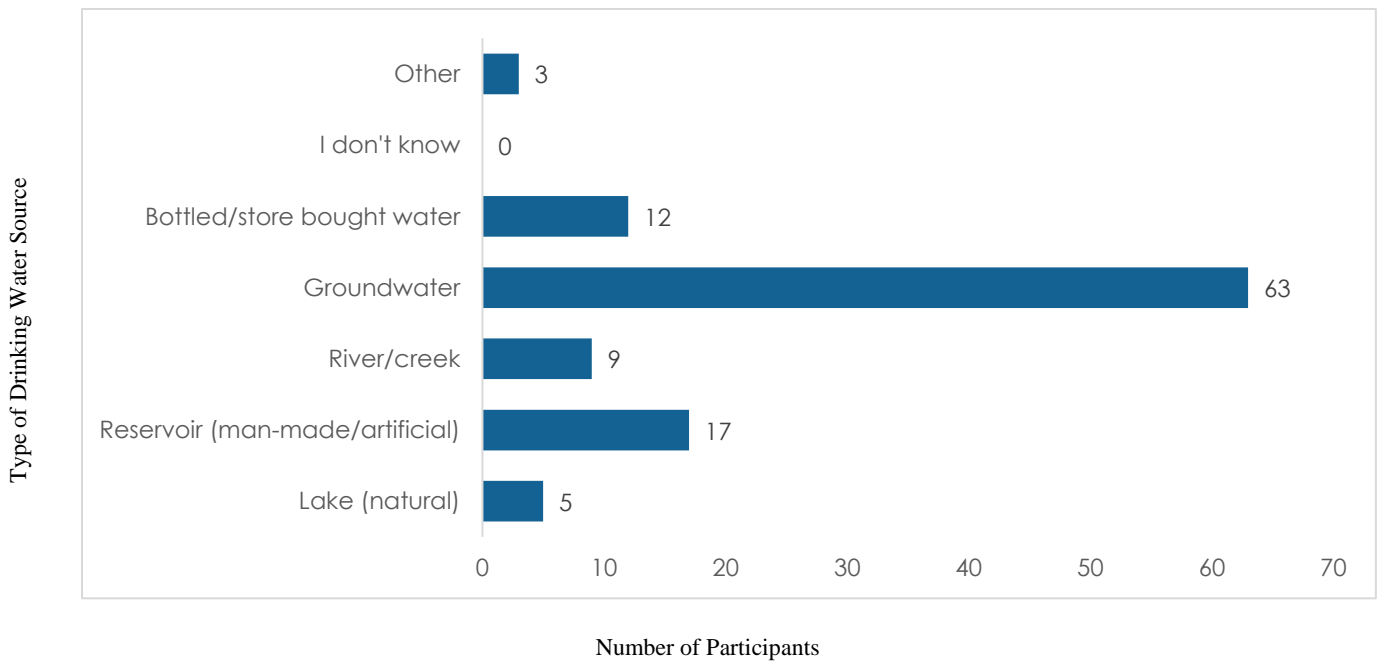


Figure 2: Sources of Individual Drinking Water

Type of Drinking Water System

Figure 3 illustrates the type of drinking water system participants rely on. Most participants rely on drinking water from water wells and fewer get their water from dugouts, cisterns, and trucked water.

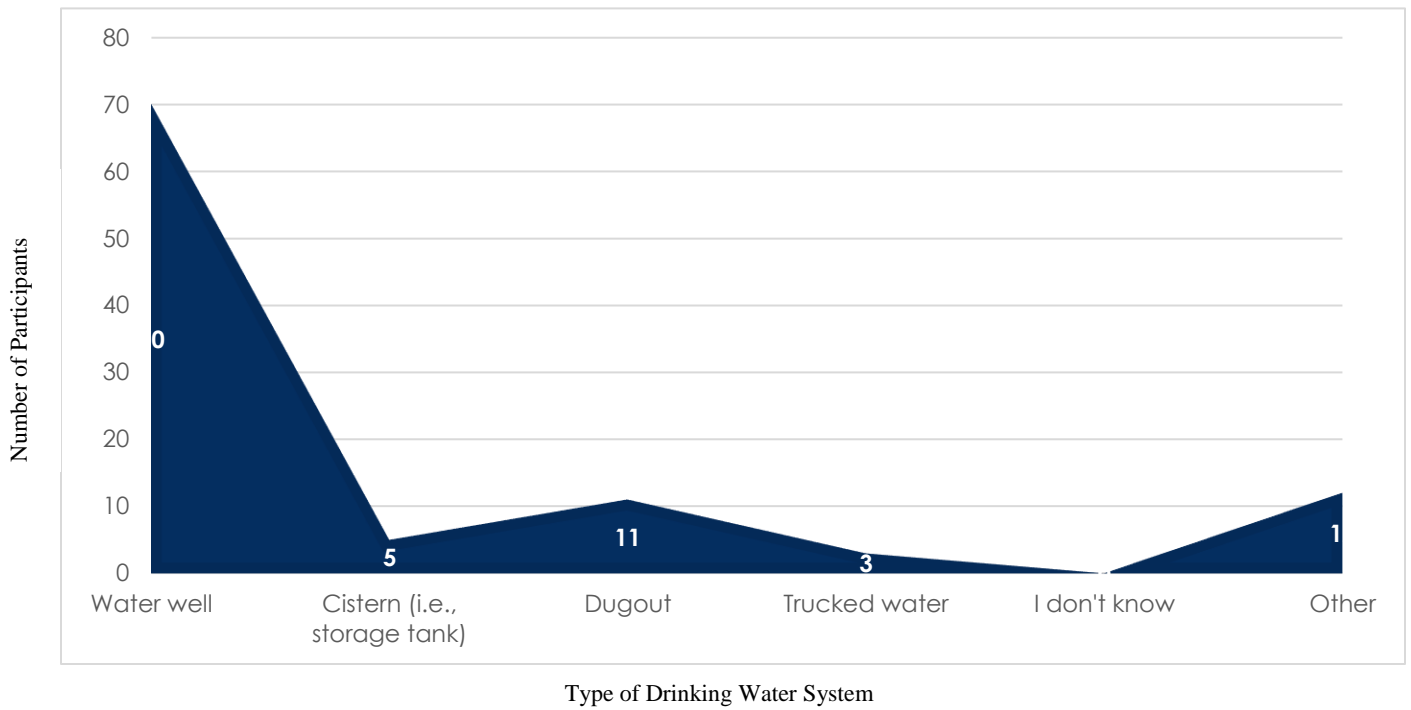


Figure 3: Types of Drinking Water Systems Used by Individuals

A few participants indicated that they rely on drinking water from other sources such as pressured water from a nearby lake, water cooler, rain water, and nearby creeks. All participants were aware of the type of drinking water system they get their water from.

6.0 Sources of Contamination

Most participants expressed that extreme weather events such as drought and flood are the main source of contamination followed by oil and gas, industrial activities/spillage, and constructions and development activities as illustrated in Figure 4.

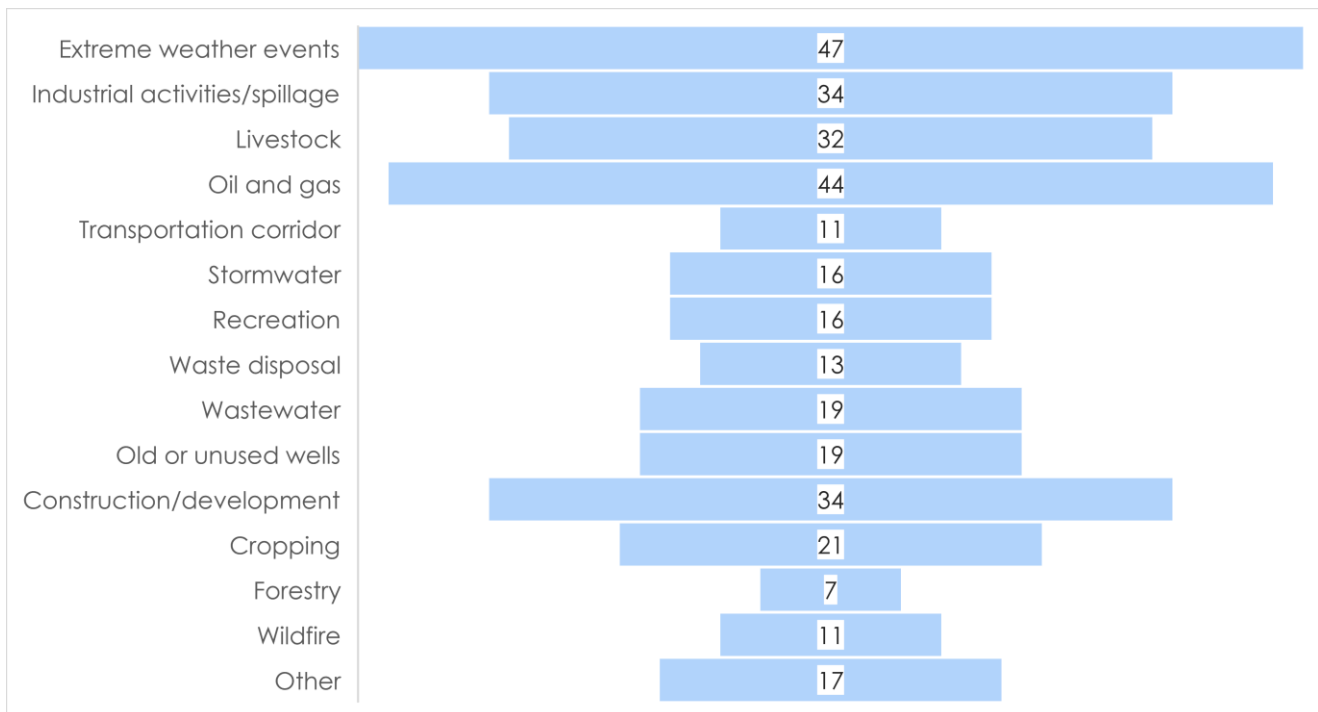


Figure 4: Sources of Drinking Water Contamination

Other specific examples of contamination are as follows:

- toxic geoenvironmental fallout
- chemical spraying of crops by aircraft
- too many people using the same aquifer and their harmful activities on it

- Arsenic
- asbestos water pipes
- pesticides and herbicides

7.0 Barriers

Most participants shared that lack of money is the main barrier preventing them from protecting their drinking water source as seen in Figure 5. This is followed by other barriers such as unpredictable water supply, and not knowing to ask for help when it comes to protecting drinking water sources.

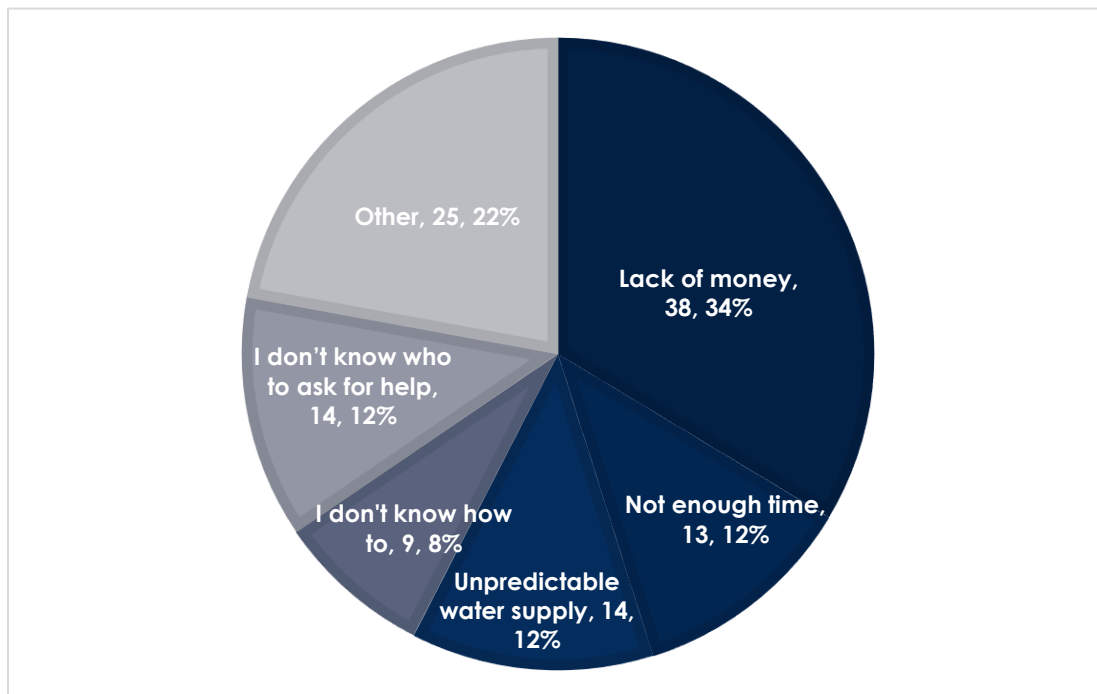


Figure 5: Barriers to Protecting Drinking Water Sources

Other barriers were noted as follows:

- dropping lake levels
- increasing water metering costs
- lack of equipment
- unaffordable reverse osmosis
- family members in household against shocking the water well
- lack of laws to protect groundwater
- land-use decisions made by county go against protecting drinking water
- insufficient help for the public
- limited options and contractors available for water well drilling
- injection of wastewater and unknown substances in water wells
- low aquifer recharge rate
- dumping of sewage by developers in nearby creek
- government politics
- pollution of rainwater

8.0 Perceived Safety of Drinking Water

Participants were asked to rank how safe they felt their drinking water source is on a scale of 1 to 5 from what viewed as not very safe (1) to what was very safe (5) as presented in Figure 6.

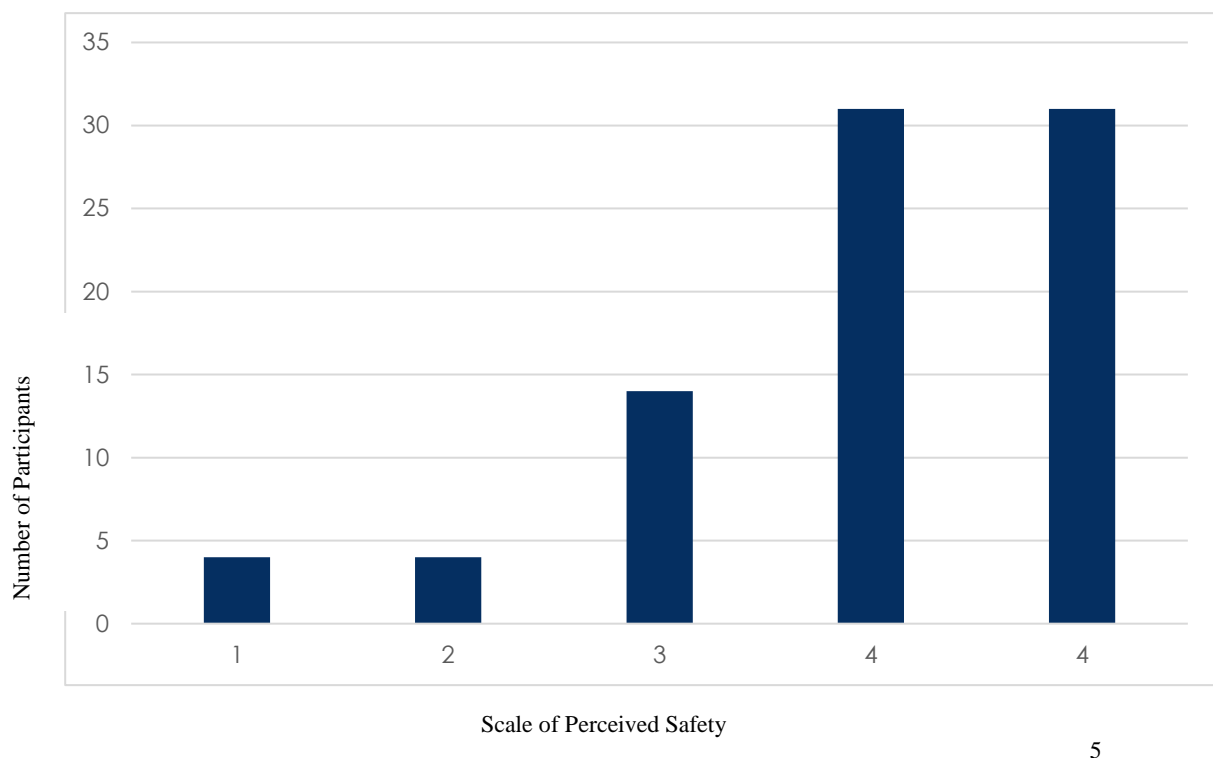


Figure 6: Perceived Drinking Water Safety

Most participants felt that their drinking water is very safe and less felt it is not very safe. When asked to explain the reason for their ranking, the following was shared:

- it is mechanical filtered, chlorine added, retention tank, sand filter, and charcoal filtered
- we have a deep well that is usually undisturbed
- not all water wells are registered; old wells are not properly closed
- careless handling/disposal of fluids that can infiltrate the sand esker overlying the coal/shale seams providing groundwater
- I know how to take care of my well and treat my water
- we test our drinking water every two years
- the source is on my land in sandstone formation
- filtered well water in rural area
- drinking water comes out of a reservoir and it tested and well taken care of
- we have a commercial treatment system
- the water well is super shocked
- the smell is good, and it appears clean with no rust or cloudiness
- high in tannins, Sodium, and Iron
- ever since my neighbor's well was fracked, my water quality has decreased
- it is trucked and should be regulated and have assurances in place to assure its safety
- we have a properly completed well
- have a surface well with little development around us
- we distill the water
- we disinfect the cistern every two years
- agricultural practices including intensive livestock operations, use of herbicides, and fertilizer threaten ground water supply
- we try very hard to follow best practices to ensure good water quality
- asbestos water pipes
- when algae blooms and increased chlorine bleach, tastes nasty, ruins our hot water tanks
- ozone treatment system and circulator in dugout
- new well with new casing and clean supply
- too many people driving their vehicles across nearby streams to access their summer cabins
- corrupted politicians at all levels of government
- UV system installed to treat anything bad if it does happen
- no fecal coliform bacterial problems
- demands of system mean more opportunities for safety failures

- bottled water from municipal source
- no farm animals accessing it and there are no oil and gas wells close by
- we are at least 1 km from any other farm
- we can see the spraying of the skies almost daily
- geoengineering fallout

9.0 Frequency of Water Testing

Thirty-two percent of participants have their drinking water tested every two to five years, 27 percent have it tested annually, and 19 percent did not have it tested often (over five years ago) as shown by Figure 7.

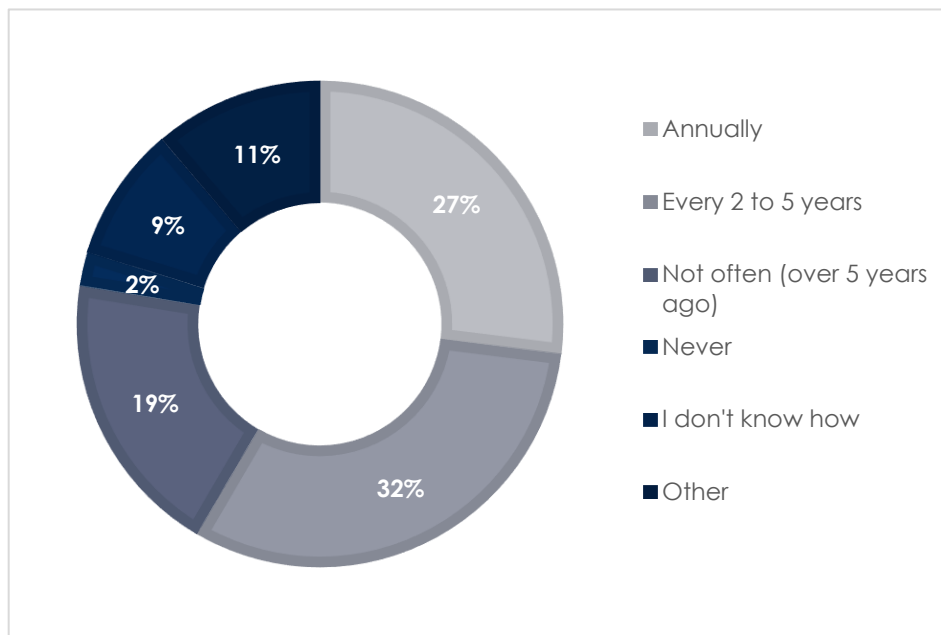


Figure 7: Frequency of Drinking Water Testing

When asked who was doing the testing, most of this work is being done by the local community health center as seen in Table 2. A few participants were unsure who was responsible for testing and other specific examples was as follows:

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

Table 2: Drinking Water Testers

Who is doing the testing?	Percentage
Community Health Center	70 %
Private consultant and/or laboratory	20%
Unsure	8%
Other	2%

10.0 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 are working with, the following was shared:

Community members

- neighbors
- adjacent landowners
- community association
- farmers
- municipalities

Watershed Groups

- [North Saskatchewan Watershed Alliance](#)
- [Oldman Watershed Council](#)

- [Pigeon Lake Watershed Association](#)
- Gull Lake Watershed Society
- Lacombe Lake Watershed Stewardship Society
- [Baptiste and Island Lakes Stewardship Society](#)
- Boundary Creek Landowners Association

Environmental Non-profits

- [ReThink Red Deer](#)
- [Alberta Riparian Habitat Management Society \(Cows and Fish\)](#)
- [Lakeland Industry and Community Association](#)
- [Alberta Water Portal Society](#)

Others

- water cooperative
- oil company
- [Alberta Health Services](#)
- regional water commission
- lake property owners' group

11.0 Information and Resources

The following information and resources are viewed by participants as lacking and important for better drinking water protection:

Access to Information, Data, Equipment, and Technology

- information on well shocking for me and my neighbours
- know where to find information about drinking water quality
- access to equipment that can enable an individual (e.g., cottage owner) to chlorine shock a well
- know when a water well has passed a certain level of contamination
- understand municipal government responsibilities with regards to managing land use to protect source water
- learn about how we can protect drinking water
- understand the impacts of nearby well-drilling on water wells
- know how much water is available and what is the cost of protecting it
- learn about which geographic regions are at risk for specific contaminants that are injurious to humans, animals, and plants, with indication of the depths at which those contaminants might become a risk in water wells
- list of water well companies and what they charge per foot for a new water well

Create Awareness about Protecting Drinking Water Sources

- periodic updates from the municipality with notices to remind people of the need to test water
- awareness about protecting drinking water through advertising and educating
- encourage people to get their water tested
- have local counties host workshops and seminars about SWP
- awareness of where drinking water comes from (e.g., campaigns, education, signage)

Provide more Resources and Support

- government grant in place for drilling new wells
- bursaries for farmers to bring their drinking water supplies up to a safe level
- have more places to get testing done and where to drop and pick up locations
- organize annual or bi-annual volunteer drives to drop off testing kits and pick them up; include a "What you need to know about wells in this (specific) area" pamphlet with signs of contamination, what to do
- make water well testing free
- increase monitoring at key points in the system

Other

- mandatory screening of individuals' water to determine pollution risks
- ensure that testing is done upstream (i.e., towns that use the same water)
- invest more resources and increase authority to deal with negative developments at the headwaters

12.0 Improving Drinking Water Protection

Seventy-three percent of participants believe that the protection of drinking water can be improved. When asked which factors they thought can make it more successful, they had the following to offer:

Table 3: Potential Strategies for Improving Drinking Water Protection

Theme	Potential Strategies
<i>Data Collection, Information and Monitoring</i>	<ul style="list-style-type: none"> • provide knowledge on how to establish static water depth • monitor seismic, drilling and production methods used by Oil and Gas industries • ensure that current information is reaching Albertans as to how contaminants are getting into water sources and where it's happening • controlled monitoring wastewater injection into old well formations • improve understanding of aquifers and their flow paths • increasing water quality monitoring
<i>Development, Regulatory, and Enforcement</i>	<ul style="list-style-type: none"> • have better control of agricultural pesticide spraying • encourage well owners to shock their wells • protect aquifer from sub terrain activities above ground • ensure upstream pollution management • have responsible Oil and Gas development where they are liable for water quality • more quality assurances put in place (e.g., labelling) • restrict cattle access to protect riverbanks and nearby water • maintain ranching as the primary land use in area as opposed to residential, industrial or cropped lands • implement a mandatory agriculture policy prohibiting unsafe practices that impact water • have rules in place through South Saskatchewan Regional Plan to stop development in Environmentally Significant Areas and source water aquifers • ensure that groundwater recharge areas are not unnecessarily deforested, or contaminated with harmful chemicals • clean up local lakes • stop aerial spraying • use fewer toxic chemicals on the land • ensure no further development takes place upstream • reduced use of potable water by industry • impose fines on developers who willfully ignore Alberta Environment and Parks (AEP)'s regulations
<i>Collaboration and Engagement</i>	<ul style="list-style-type: none"> • educate individuals about the surrounding watershed and its importance • have annual water test drives so that individuals are aware of the need for testing and will be able to do so • connect animal husbandry to SWP organizations; the challenge is knowing who to go to for help in an emergency • ensure hydraulic fracturing doesn't harm drinking water sources
<i>Resources and Training</i>	<ul style="list-style-type: none"> • provide funding to take of abandoned wells • enable reduced rates for more specific water tests • increase the number of potable water treatment plants and wastewater treatment plants

	<ul style="list-style-type: none"> • have a trained volunteer who lives in the community who can provide kits and collect water samples during a specific week or month; would be better than each house having to travel to far places
<i>Governance</i>	<ul style="list-style-type: none"> • governments need to do a better job protecting headwaters, source waters, and our forests • give advice and support when something outside an individuals' control damages the water source
<i>Access to Equipment and Technology</i>	<ul style="list-style-type: none"> • ensure equipment is more readily available for undertaking Chlorine shock of well • aid recondition well and buy a reverse osmosis system
<i>Other</i>	<ul style="list-style-type: none"> • drill deeper water wells where possible • be proactive with well maintenance; don't wait for it to fail • routine shocking of water system • remove the asbestos water pipes and install new plastic pipe • build bridges over nearby streams so that people are not driving their vehicle through • have proper investigation of all spills, leaking wells, pipelines • protect water wells from tree growth and deceased animal infiltration • vegan incentives and tax credits

13.0 Useful Methods or Techniques

Fifty-seven percent of participants expressed that they have come across some useful techniques or best practices when protecting their drinking water supply. The following list is what they have come across so far:

- [Working Well Program](#)
- use of a carbon filter
- fencing dugout and riparian area so no wildlife can enter
- [Environmental Farm Plan](#)
- fencing off my riparian area and dugout.
- off site watering of cattle away from the source
- [Land Stewardship Centre](#)
- Oldman Watershed Council and their stewardship programs
- UV filtration
- regular forest clean-up
- clearing of snow and proper care of land
- trickle water system
- chlorination and reverse osmosis for drinking water
- use of large tanks to vent gas from the water for livestock

As indicated by Figure 8, 78 percent of participants took part in one of AEP's Working Well workshop and was aware of the program.

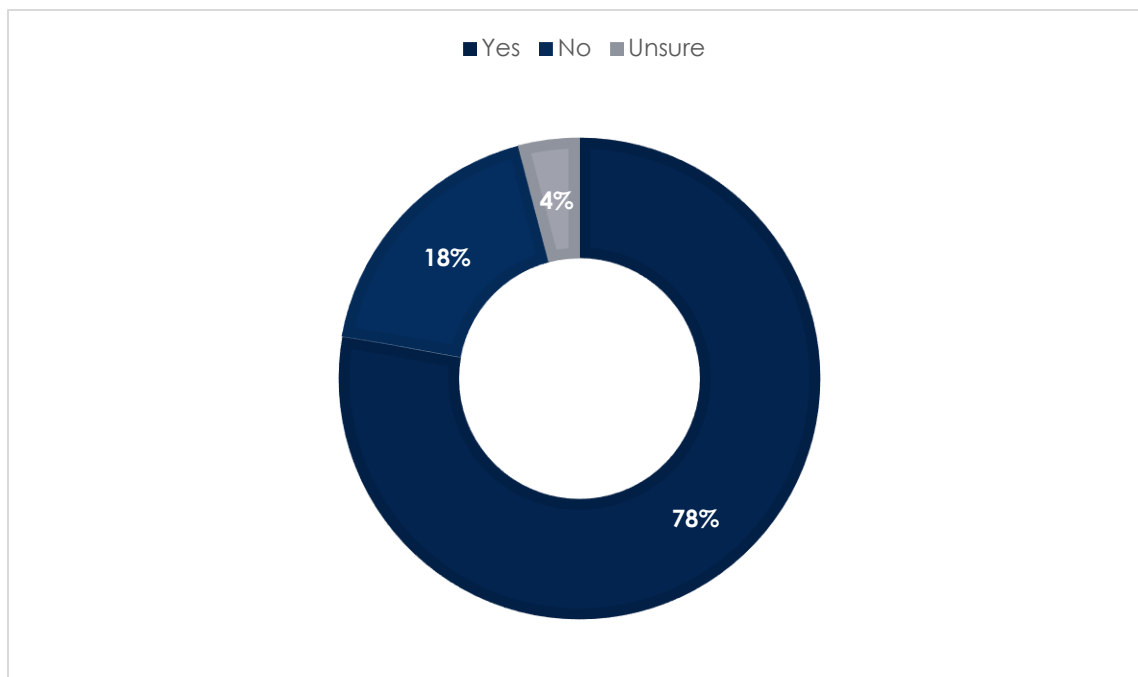


Figure 8: Participation in a Working Well Workshop

14.0 Lessons Learned

The following are lessons learned about taking care of drinking water sources by individuals:

- do not have cattle close to the well, make sure there is good drainage around the well
- prevent hydraulic fracturing close to drinking water sources
- have a backup dugout so you can clean the other on an annual rotation
- never allow seismic activity in your area
- be aware of the risks to your drinking water and take the initiative to maintain its quality
- shock the well on a regular basis, don't let seismic people test your well with out disinfecting their tools
- advocate among the community for safe water and against agricultural expansion that threatens water
- protect ground surface for clean groundwater recharge
- replacing old wells without pit-less adapters to prevent groundwater contamination
- properly cap unused or dried up wells
- limit land clearing and deforestation, especially in boreal forest areas
- frequent sound bites and information drives (with small pieces of information) would work better
- Stay on top of issues-regular testing in spring/fall
- don't rely on shock chlorination; a UV system is inexpensive and guarantees water quality
- don't count on government or their regulators to protect the public
- ensure regular testing and shocking
- keep your sewer water away from your water well
- ensure that the well head area sloped away from the water well
- use plastic cribbing is better than the old wooden or metal ones
- water testing is not convenient and should be improved
- do not dump fluoride in drinking water

Conclusions

From the survey responses, the main conclusions are as follows:

1. primary use of property is residential rural
2. groundwater via a water well system is the main source of drinking water for individuals
3. extreme weather events (e.g., drought, flood) are the main contaminants of drinking water followed by oil and gas and industrial/spillage activities

4. lack of money and unpredictable water supply is viewed as the main barriers to drinking water protection
5. most participants believe that their water source is safe for drinking
6. water testing at intervals of every two to five years is most common among participants
7. cooperation between participants and others (e.g., WPACs, WSGs, municipalities, neighbours) is occurring
8. greater access to information, data, equipment, and technology, providing support and resources, as well as creating awareness of SWP and the importance of water testing is required by participants
9. data collection, information, and monitoring of the source and exercising greater restrictions on harmful upstream activities is needed
10. creating awareness about the importance of SWP, the watershed, and having water tested must be better promoted

PROTECTING SOURCES OF DRINKING WATER IN ALBERTA

Results of the Targeted Drinking Water Provider
Questionnaire
September 2018



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1.0 PURPOSE

This report presents findings from 13 questionnaires with drinking water treatment staff in municipalities, utility companies, regional water commissions, and (i.e., drinking water providers) across Alberta. This includes 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 the City of Edmonton.

The purpose of this questionnaire was to document source water protection (SWP) risks, challenges, barriers, best practices, and lessons learned from drinking water providers in selected communities across Alberta.

2.0 CONTEXT

Findings presented here reflect the diverse perspectives of the drinking water providers who participated in the questionnaire. The findings are not intended to be statements of consensus or representative of the entire community.

This report represents a broad perspective on what is considered by drinking water providers as possible and desirable to improve SWP in Alberta and based on the sample size examined.

3.0 DEVELOPMENT OF FINDINGS

These drinking water providers and their respective communities were targeted due to their knowledge, expertise, and involvement in various aspects of SWP. The criteria that was used to select drinking water providers was careful to include those involved in drinking water treatment operations in urban and rural areas, north, central, and south regions of Alberta; small, medium, and large plant classifications, and lake/reservoir, river, groundwater, and groundwater.

The questionnaire was designed to investigate drinking water treatment staff perspectives and experience on SWP risks, risk assessment and management processes, challenges and barriers, coordination of activities with others, useful tools, information, and networks (i.e., what is useful, what is lacking), best practices, and lessons learned.

4.0 METHODOLOGY

An electronic questionnaire was circulated among target drinking water providers to collect information. A survey process was selected as the team wanted to obtain in-depth information about drinking water providers roles, and experience in SWP, better understand certain actions through follow-up, and collect relevant information about experiences in their respective fields.

Several specific topics and questions were adopted as a guide to collecting information in a format that was user-friendly to drinking water treatment staff.

5.0 PROFILE OF DRINKING WATER PROVIDERS

Figure 1 demonstrates that out of the 13 drinking water providers, 54 percent have large systems, 23 percent have medium systems, and 23 percent have small systems. This ensured that a representative sample of drinking water systems was examined for this study.

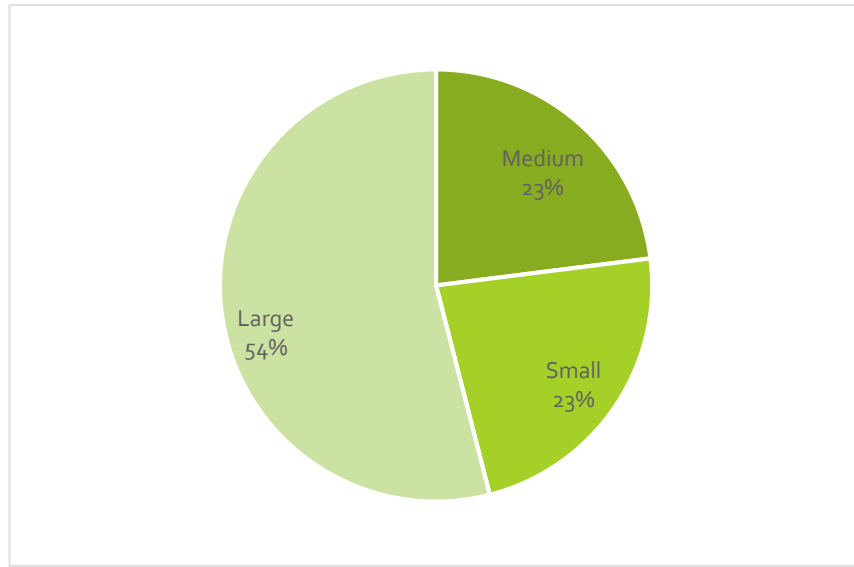


Figure 1: Size of Drinking Water Treatment System

The population served by each drinking water system varied from one community to the next as illustrated in Figure 2. Out of the 13 drinking water providers, Table 1 shows that the highest population being served is found in the City of Calgary at 1,239,220 people and the lowest in the Town of Hardisty at 554 people.

Table 1: Population Served by Drinking Water Provider

Drinking Water Provider	Population
Town of Hardisty	554
Town of Sedgewick	850
Town of Milk River	1,070
Town of Grimshaw	2,600
Town of Sundre	3,000
Aspen Regional Water Services Commission	4,500
County of Lac La Biche	12,000
Town of Banff	25,000
Newell Regional Services Corporation	26,000
Regional Municipality of Wood Buffalo	84,000
City of Red Deer	130,620
City of Edmonton	800,000
City of Calgary	1,239,220

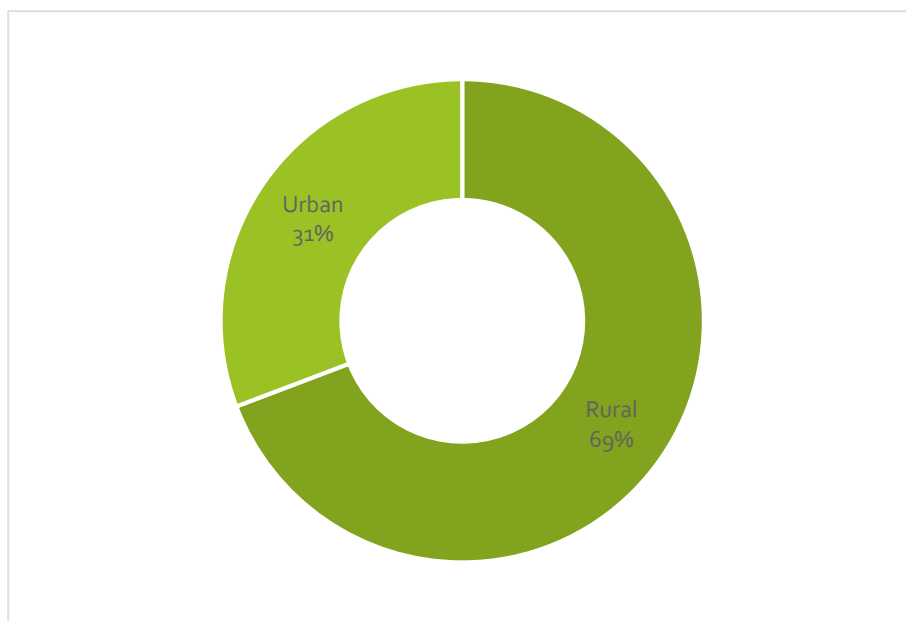


Figure 2: Distribution of Urban versus Rural Drinking Water Provider

Figure 2 shows that 69 percent of drinking water providers serve the drinking water needs of rural communities while 33 percent are in urban areas of the province.

Except for the Upper Peace Region, there was participation from drinking water providers in most regions as shown in Figure 3.

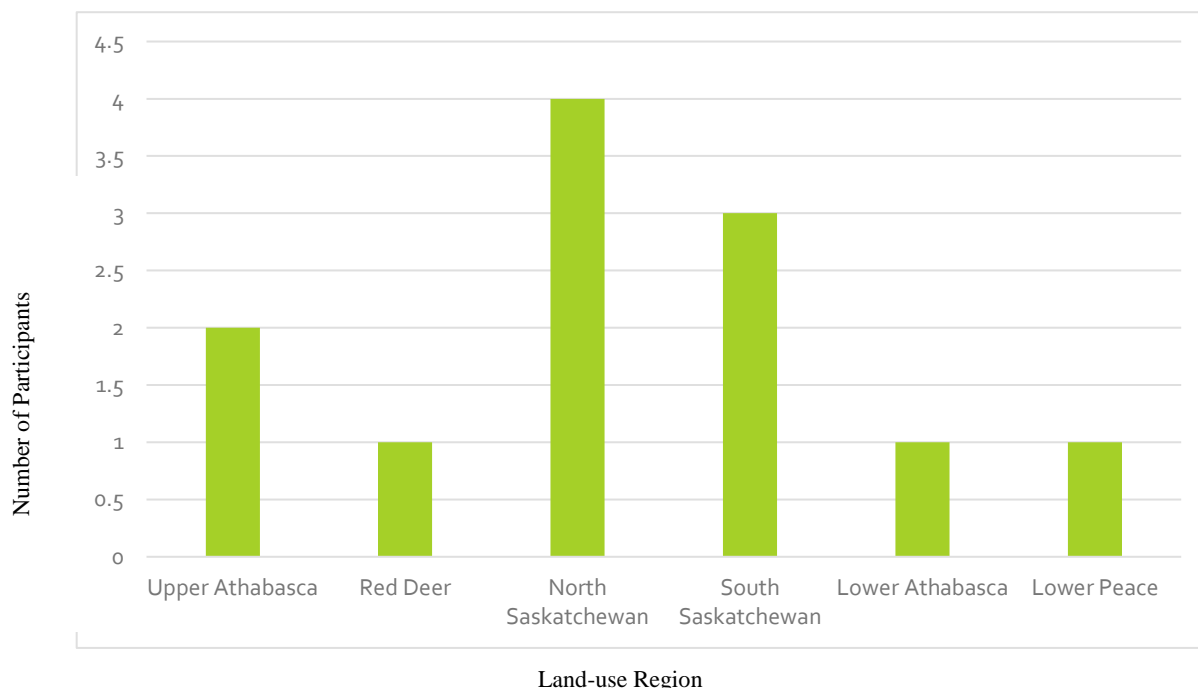


Figure 3: Drinking Water Provider by Land Use Region

It was found that the number and type of communities and/or groups supplied with drinking water, varied from one provider to the next as seen in Table 2.

Table 2: Communities/Groups Served by Drinking Water Provider

Drinking Water Provider	Communities/Groups Served
Aspen Regional Water Services Commission	Town of Athabasca, Village of Boyle, Colinton, Grassland, Wandering River, private connections to farms and acreages
City of Red Deer	Red Deer, Red Deer County, Blackfalds, Lacombe, Ponoka
Town of Hardisty	Town of Hardisty
Newell Regional Services Corporation	City of Brooks, Hamlet of Lake Newell Resort, Hamlet of Rainier, Hamlet of Scandia, Hamlet of Rolling Hills, Hamlet of Tilley, Hamlet of Patricia, Village of Duchess, Village of Rosemary, Town of Bassano, county wide distribution of rural home owners with acreages and ranches
County of Lac La Biche	Lac La Biche, Plamondon, other surrounding areas
Town of Banff	Town of Banff, adjacent resorts and campground outside the park boundary
Town of Sedgewick	Town of Sedgewick
Town of Sundre	Town of Sundre
Town of Grimshaw	Town of Grimshaw, West Water Co-op
Regional Municipality of Wood Buffalo	Fort McMurray, Anzac, Gregoire Lake Provincial Park, 468 First Nation, Sapræe Creek
Town of Milk River	Town of Milk River, Village of Coutts

City of Edmonton	Abee, Alexander First Nations, Bellis, Bon Accord, Bonnie Lake, Cardiff, DND Lancaster Park, Gibbons, Legal, Morinville, Newbrook, Radway, Redwater, Rivere Qui Barre, Smoky Lake County, St. Albert, Smoky Lake County, Sturgeon Valley, Spedden, Thorhild, Thorhild County, Villeneuve, Waskatenau, Armena, Beaumont, Calmar, Camrose County, Hay Lakes, Leduc County, Leduc, New Sarepta, Nisku, International Airport, Wetaskiwin County, Andrew, Antler Lake, Androssan, Beaver County, Beauvallon, Bruce, Bruderheim, Chipman, Collingwood Cove, Egremont, Fort Saskatchewan, Fultonvale, Hairy Hill, Half Moon Lake, Hillard, Holden, Innisfree, Josephburg, Josephburg Co-op, Kingsman, Kinsella, Lamont, Lamont County, Lavoy, Mannville, Minburg County, Mundare, Parkland County, Ranfurly, Round Hill, Ryley, Sherwood Park, South Cooking Lake, Strathcona County, Tofield, Two Hills, Two Hills County, Vegreville, Vermillion, Vermillion River County, Viking, Willingdon, Enoch, Parkland County, Spruce Grove, Stony Plain, Wabamun
City of Calgary	City of Calgary, Airdrie, Chestermere, Strathmore, Tsuut'ina Nation

With larger drinking water systems (e.g., City of Calgary, City of Edmonton, City of Red Deer), higher populations increase the demand for drinking water. There has been a growing trend towards regionalization and providing drinking water to users outside of respective municipal boundaries to neighboring municipalities, regional water systems, water co-operatives, and other uses. For smaller drinking water systems (e.g., Town of Hardisty), lower populations mean a smaller demand for drinking water. Due to financial constraints and a limited source (i.e., one well), providing drinking water to neighboring communities is not feasible.

The water sources used by drinking water providers varied from one community to the next as seen in Figure 4. Five providers rely on rivers, while 3 providers used High Quality Ground Water (HQGW) for drinking water. For example, drinking water providers in urban areas such as the City of Edmonton, City of Calgary, and the City of Red Deer rely predominantly on rivers, while those in smaller, rural areas such as the Town of Hardisty, Town of Banff, and the Town of Grimshaw depend on HQGW. Fewer drinking water providers rely on lakes and reservoirs such as the County of Lac La Biche and the Newell Regional Services Corporation.

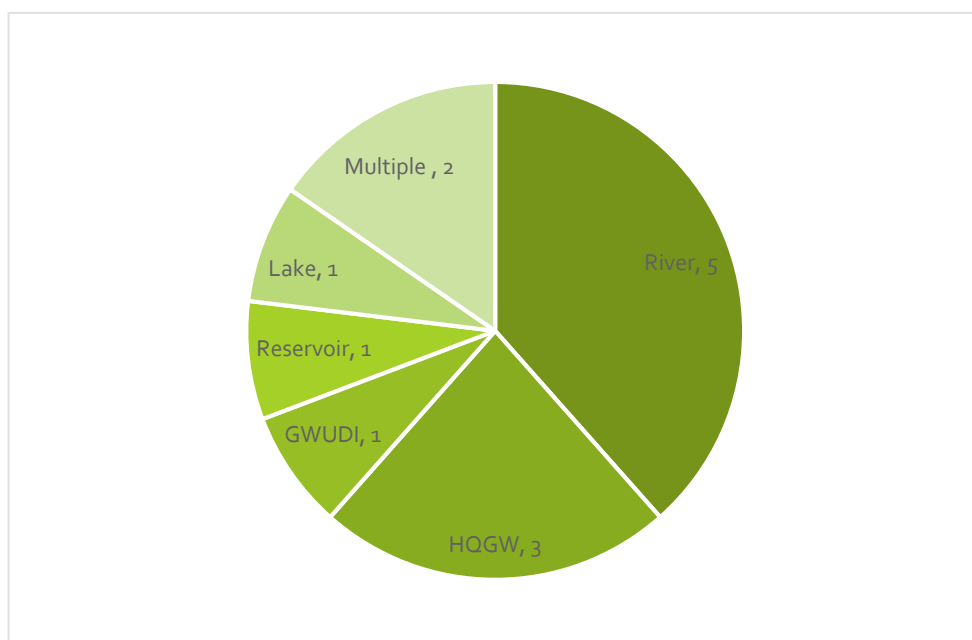


Figure 4: Sources Used by Drinking Water Providers

The Town of Sedgewick is the only provider that utilize Groundwater Under the Direct Influence (GWUDI) as their only source of drinking water. A few drinking water providers rely on multiple sources of drinking water such as truck and bottle fill stations and hauled water to supplement their main source to match the demands of their respective communities.

From the questionnaire, participants identified the following risks as summarized in Table 3.

Table 3: Drinking Water Risks

Risk	Details
The Source	
Lower water levels	In some areas of the province that experience water scarcity, the source can shrink while demand remains the same or increases. This shifting balance can make it a challenge for some municipalities to balance the needs of growing communities. For example, extended droughts can cause the Town of Banff's aquifer to become reduced resulting in water shortages.
Over-abstraction	Over-abstraction of groundwater in aquifers pose a risk as water is pumped faster than it is replenished. This can result in sinking water tables, empty wells, and higher pumping costs. This a risk for the Town of Grimshaw as they rely heavily on aquifers for their drinking water source.
Warm water	When air temperatures increase, water temperatures increase resulting in lower levels of dissolved oxygen, increase in pathogens, nutrients, and invasive species, increased concentration of some pollutants (e.g., ammonia, pentachlorophenol), increase in algal blooms, and increased rates of evapotranspiration from drinking water sources. Warmer water levels in the Athabasca River poses a risk to drinking water sources for the Aspen Regional Water Services Commission.
Contaminants	
Algal Blooms	Toxins from algal blooms can contaminate sources waters and drinking water treatment facilities. People who encounter visible blue-green algae (cyanobacteria), or who ingest water containing blue-green algae (cyanobacteria), may experience skin irritation, rash, sore throat, sore red eyes, swollen lips, fever, nausea and vomiting and/or diarrhea. For the Newell Regional Services Corporation, algal blooms have become a risk to their drinking water sources.
Animal Fecal Matter	Animal feces contains various types of fecal coliform bacteria that can contaminate drinking water sources and lead to cramps, diarrhea, intestinal illnesses, and serious kidney disorders in humans. This has been a concern for the City of Red Deer.
Aquatic Invasive Species	Aquatic invasive species are species non-indigenous to a region or body of water that impact or pose threats to the environment, the economy or human health. In Alberta, zebra and quagga mussels pose a threat and have impacted irrigation and hydropower generation infrastructure. For the Newell Regional Services Corporation, zebra mussels threaten the quality of drinking water sources for the communities they serve.
Drought	Drought can worsen sediment run-off during much needed rainfall and it can warm surface water and the extra sediment encourages algae and bacteria growth. Climate change has the potential to increase the frequency and magnitude of droughts with surface water sources being more vulnerable than groundwater sources. For the Town of Hardisty and the Newell Regional Services Corporation, drought is a risk to maintaining the quantity and quality of their drinking water sources.
Flooding	During a flood, contaminants such as bacteria, fuel, chemicals, nitrates, and other pollutants flow from the surface into drinking water supplies from farms, septic systems, and other sources aided by rain and simple gravity. The force of floodwaters can also disrupt or damage well or water supply infrastructure and introduce contaminated water into wells. For example, in the County of Lac La Biche, periodic flooding of low-lying areas poses a threat to drinking water sources.
Livestock	Livestock activities (e.g., feedlots, dairies, wintering sites, pasture, cow-calf operations, watering sites) can influence water quality. Water quality parameters related to livestock production include nutrients (nitrogen and phosphorus), microorganisms (e.g. bacteria, fecal coliforms, Cryptosporidium, Giardia) and organic material such as livestock wastes.

Stormwater	Stormwater is rainwater and melted snow that flows off lawns, streets, and other land surfaces. With increased urbanization, stormwater poses a risk to drinking water sources as it can introduce sediments, oil, grease, pesticides, nutrients from lawns, gardens, pets, failing septic systems, viruses, bacteria, road salts, heavy metals from vehicles, roofs, and thermal pollution from dark impervious surfaces like rooftops and streets.
Pipeline Spill	Industrial activity on land has the potential to impact water quality. Both mining and in situ oil sands operations must be carefully managed to avoid affecting the quality of surface and groundwater. Water with high level of hydrocarbon content may have negative effect on the kidney and liver of the consumers. The Regional Municipality of Wood Buffalo identified this as one of several risks to their drinking water source.
Transportation Corridor	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 road side water quality. Pollution results during salting of roads for winter maintenance and during periods of low stream flow. Due to the small size of the Town of Hardisty, they are not able to limit the transportation of dangerous goods in the community.
Wildfires	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 taste, colour, and smell of drinking water; and if fire retardant is present, there may 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 functionality of the town's drinking water infrastructure, with source water quality being a concern. The costs to provide clean drinking water for the city spiked after the 2016 wildfire as they had to increase chemical dosages to remove contaminants.
Wildlife Death	Death of wildlife such as deer and moose (particularly in remote areas or park lands) and carcasses that are sometimes not disposed of properly, can decay over time allowing bacteria and other organisms (e.g., salmonella, streptococcus) to seep into drinking water sources affecting drinking water quality. This has been a risk for the City of Red Deer when protecting their drinking water sources.
Maintenance	
Lack of Funding for Upgrades	Some communities in the province don't have enough funding for water infrastructure upgrades. This can lead to failure of the drinking water system and potential contamination of the source. For example, the Town of Grimshaw requires funding for upgrades to their distribution system.
Failure of Wells	Well failure can occur due to equipment failure, depletion of the source (e.g., aquifer), corrosive qualities of the water, over pumping, biofouling, and improper well design and construction. This can be a risk to the quality and quantity of drinking water sources. For example, one of the Town of Hardisty's drinking water risks is well failure.
Governance and Strategic Planning	
Upstream Activities	There is disconnect between upstream and downstream water users. The City of Red Deer encounters limited ability to restrict certain upstream activities from their water treatment plant. In Town of Sedgewick, lack of control over adjacent land use is a huge risk—land surrounding their water wells are out of their control and sometimes outside municipal boundaries.
Development Impacts	It is a challenge to regulate and enforce restrictions for municipal activities (i.e., industry, subdivision expansion, recreation) in a SWP area. In the County of Lac La Biche, non-compliant uses such as residents altering environmental and municipal reserves by building boat launches, having livestock living close to drinking water sources, and destruction of riparian areas poses a threat. In the Regional Municipality of Wood Buffalo, unrestricted public access to riverbanks immediately upstream of their intake is a huge risk to their drinking water source.

Uncoordinated Activities	Several groups seem to be doing various or similar SWP pieces (i.e., governments, municipalities, WPACs). This is a risk to managing drinking water sources particularly in times of a crisis, and knowing who is responsible for activities (e.g., a chemical spill, severe multi-year drought). For the Town of Sundre, insufficient coordination among municipal, provincial, and federal governments is viewed as a risk to managing drinking water sources.
Size of watershed/SWP area	For some regions, the size of the SWP area is extensive and poses a risk to management actions. In the Lower Peace and Upper Athabasca Regions, inadequate staff, resources, and funding makes it difficult to protect drinking water sources.
Training and Education	
Uninformed Public	Lack of understanding among the public about the importance of a watershed, where drinking water comes from, and how we must protect it poses a risk to SWP.
Inadequate Staff Training	Some communities don't have enough funding and resources to train their staff. For example, the Town of Grimshaw encounters this challenge and if staff (e.g., water treatment operators, public works managers) are not up to date on the latest technology and information, it can be a risk to protecting drinking water sources.
Data Collection and Monitoring	
Insufficient data and information	Not enough water quality and quantity parameter data and information for some drinking water sources in Alberta. For example, in the Upper Athabasca region, there is no IWMP (still in progress) and the UARP regional planning process has not started yet. While some data and information are being collected, it is not being shared with some groups who require it such as water treatment plants, water co-operatives, or regional water systems.
Lack of Monitoring	Lack of real time monitoring and public reporting on the condition of drinking water sources for some regions.

7.0 RISK ASSESSMENT AND MANAGEMENT PROCESSES

All drinking water providers have a Drinking Water Safety Plan (DWSP) as required by Alberta Environment and Parks (AEP). A DWSP represents a system-wide approach to ensuring that drinking water quality is safe, secure, and of consistent quality for Albertans. An important component of a DWSP is its comprehensive risk assessment process that encourages drinking water providers to assess potential risks in their SWP area and determine how these can be mitigated and monitored. The following are examples of risk assessment and management processes used by the drinking water providers who participated in this questionnaire:

- raw water storage ponds
- using a multi-barrier approach which identifies barriers
- having a multi-disciplinary consulting team to complete a Source Watershed Assessment and Risk Characterization study (i.e., mapping risks and landscape characteristics, identifying vulnerable areas)
- upstream hydrocarbon detectors
- conventional water treatment and UV process
- education campaigns
- annual drinking water source sampling for water quality parameters, heavy metals, and Volatile Organic Compounds
- fenced off, secured drinking water source areas
- upstream monitoring for potential flood mitigation
- proactive upgrades to water infrastructure
- develop a business continuity plan for drinking water treatment
- using the American Water Works Association tools and resources

As seen in Figure 5, 38 percent of drinking water providers are collaborating with other groups while 62 percent are not.

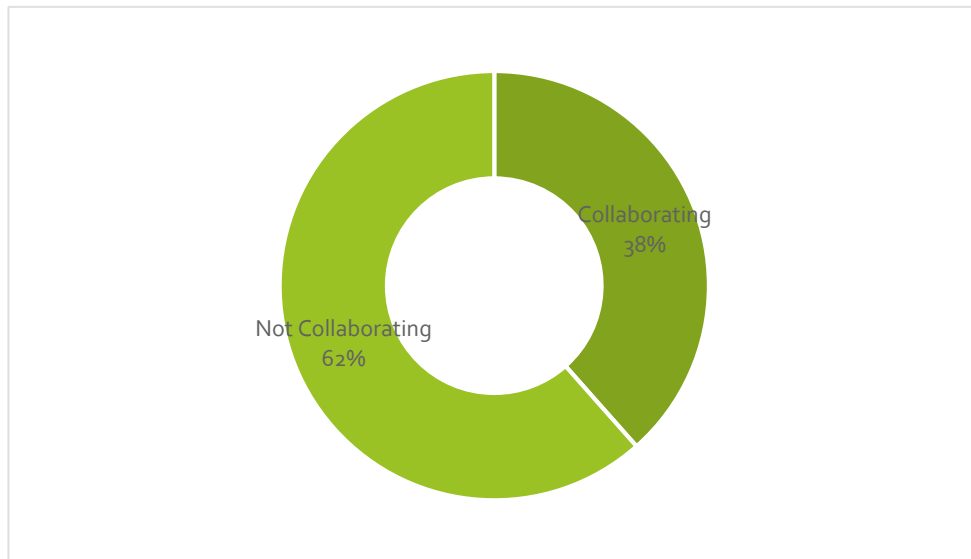


Figure 5: Collaboration Between Drinking Water Providers and Other Groups

It should be noted that drinking water providers collaborate with AEP to create their DWSP. Aside from AEP, 38 percent are collaborating with the following groups:

- Alberta Health Services
- Watershed Planning and Advisory Councils
- Watershed Stewardship Groups
- Irrigation Districts
- Environmental non-profit organizations (e.g., Alberta Lake Management Society, Alberta Alternative Land Use Services, Alberta Low Impact Development Partnership, Clearwater Landcare, Trout Unlimited, Riverwatch, The Water Network)
- Municipalities
- Regional water systems
- Water co-operatives
- Research institutions and academia (e.g., Prairie Adaptation Research Collaborative, University of Victoria, University of Calgary, Alberta WaterSMART)
- Industry
- Environment Canada
- Indigenous Communities

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

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

9.0 CHALLENGES AND BARRIERS

The following were noted as challenges and barriers by drinking water providers in their respective communities:

DATA COLLECTION, INFORMATION, AND MONITORING

- lack of day-to-day SWP operational information and tools to inform management actions (e.g., drinking water risk mapping tool, pollutant loading tool, using models and real-time data to estimate the origin, fate, and transport of contaminants into water bodies)
- insufficient data, information, and monitoring of the drinking water source (e.g., water quality, biological, and physical data, directory of information on contaminants of concern to drinking water with response guidelines and treatment options)
- important data and information about the source not shared with drinking water providers

DEVELOPMENT, REGULATORY, AND ENFORCEMENT

- limited ability to restrict upstream activities from the drinking water treatment plant
- inability of smaller communities to limit the transportation of dangerous goods in their SWP area
- difficult to manage recreational activities and enforce violations happening close to or upstream of the source
- non-compliant land use (e.g., residents altering environmental and municipal reserves by building private boat launches, livestock living along water bodies, destruction of riparian areas)
- limited control over land use activities (i.e., land surrounding the source is not within a drinking water provider's municipal boundary or may transcend multiple boundaries)
- extensive size of the SWP area makes it challenge to manage activities
- competing values and considerable privately-owned lands

COLLABORATION AND ENGAGEMENT

- too many activities happening upstream of the SWP area to have meaningful engagement with users
- insufficient collaboration among the municipal, provincial, Indigenous, and federal groups
- lack of education and understanding among the public about the importance of a watershed and what it provides, the need to protect the source
- communication can be challenging due to the number of stakeholders with different backgrounds

RESOURCES AND TRAINING

- limited resources to install monitoring equipment
- lack of funding for upgrades to drinking water infrastructure
- insufficient resources for training new water treatment plant operators

GOVERNANCE

- lack of clear leadership in terms of SWP management
- unclear who is responsible for monitoring, reporting, or managing the source
- land-use decisions are not linked to water quality and quantity changes
- unclear of which groups are doing what in specific SWP areas, and their specific roles and responsibilities in the overall management system
- lack of clarity about the integration of watershed/sub-regional drinking water initiatives and how they feed into other plans and vice-versa
- proactive" long-term sustainability approaches do not have the same importance as "reactive" issue resolution for more urgent problems

ENVIRONMENTAL INFLUENCES

- impacts of climate change and extended droughts cause the source to be severely reduced leading to water shortages
- non-point pollution sources a challenge when it comes to managing the source

10. TOOLS, INFORMATION, NETWORKS, GROUPS, AND RESOURCES

Drinking water providers shared what they believe are useful and lacking tools, information, networks, and resources. These were documented as follows:

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 Environment and Parks
<http://aep.alberta.ca/default.aspx>
- Alberta Agriculture and Forestry
<https://www.agric.gov.ab.ca/app21/rtw/index.jsp>
- Bow River Basin Council
<https://brbc.ab.ca/>
- Alberta Energy Regulator
<https://www.aer.ca/>
- American Water Works Association (AWWA) (i.e., conferences, seminars, elearning, webinars)
<https://www.awwa.org/conferences-education.aspx>
- Alberta Water and Wastewater Operators Association (AWWOA) (i.e., annual operators' seminar, Water Week Conference, annual golf tournament)
<https://awwoa.ca/>
- Canadian Water and Wastewater Association (CWWA)
http://www.cwwa.ca/home_e.asp
- Western Canada Water (WCW)
<http://wcwwa.ca/>
- Red Deer River Municipal Users Group (RDRMUG)
<http://rdrmug.ca/>

INFORMATION AND RESOURCES

- Drinking Water Safety Plan and supporting materials (i.e., guidance framework and notes, training course, template) by AEP
<http://environment.alberta.ca/apps/regulatteddwq/DWSP.aspx>
- AWWOA:
 - Training Courses
<https://awwoa.ca/training/courses-offered>
 - Online and Correspondence Training
<https://awwoa.ca/training/online-correspondence-training>
 - Certification Prep Courses and Manuals
<https://awwoa.ca/training/certification-prep-courses>
 - Resource Materials and Videos
<https://awwoa.ca/resources/water-and-wastewater-resource-materials>
- AWWA:
 - Resources and Tools
<https://www.awwa.org/resources-tools.aspx>
 - Publications (i.e., manuals of practice, standards, handbooks, videos, and DVDs)
<https://www.awwa.org/publications.aspx>
 - Legislation and Regulation
<https://www.awwa.org/legislation-regulation.aspx>

- Project Blue Thumb
<http://projectbluethumb.com/>
- Alberta Municipal Health and Safety Association (safety training courses and resources)
<https://www.amhsa.net/safety-training/browse/>
- Alberta Lake Management Society's programs:
 - Lakewatch
<https://alms.ca/about-lakewatch/>
 - LakeKeepers
<https://alms.ca/lakekeepers/>
- Integrated Watershed Management Plans (IWMPs) by WPACs
<http://aep.alberta.ca/water/programs-and-services/water-for-life/partnerships/watershed-planning-and-advisory-councils/watershed-management-planning.aspx>
- Alberta Health Services (i.e., blue-green alga advisories, water quality advisories)
<https://www.albertahealthservices.ca/eph/eph.aspx>
- Ducks Unlimited's water programs
<http://www.ducks.ca/our-work/water/>
- Alberta Riparian Habitat Management Society (Cows and Fish):
 - Riparian Areas and management
<http://cowsandfish.org/riparian/riparian.html>
 - Publications
<http://cowsandfish.org/publications/publications.html>
 - Photos and videos
http://cowsandfish.org/photos/photo_video.html
- WCW Education Manuals
<http://wcwwa.ca/resources/education-manuals/>
- CWWA Policies
http://www.cwwa.ca/policy_e.asp
- Athabasca River Basin Initiative by Alberta WaterSMART
https://www.google.ca/search?q=ARB+Initiative&rlz=1C1CHBF_enCA759CA759&oq=ARB+Initiative&aqs=chrome..69i57.3551j0j4&sourceid=chrome&ie=UTF-8
- Environmental Codes of Practice by the Government of Canada
<https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/guidelines-objectives-codes-practice/fact-sheet.html>

LACKING

TOOLS

- lack of real-time tools for data collection and monitoring (e.g., drinking water risk mapping tool, pollutant loading tool, using 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 (i.e., implementing policy recommendations from the Alberta Water Council, regional land-use plans, IWMPs, lake watershed plans)
- inadequate information sharing among WPACs, research institutions, and drinking water providers
- public education about the importance of watersheds and protecting drinking water sources is needed
- integration about how watershed/sub-regional drinking water initiatives feed into regional and provincial plans and vice-versa

There are several networks bringing drinking water providers together and offering training, guidance, and resources; but monitoring and data collection is not being undertaken and this is

important for informing management. Additionally, there are not enough tools available for drinking water providers to enhance their day to day operational work (e.g., mapping tools, resource repository, list of contacts).

11.0 BEST PRACTICES

Most drinking water providers struggled to provide best practices, as most of them do what is required of them under AEP's DWSP process. A few providers did offer the following:

- chlorination of the source using calcium hypochlorite pucks
- undertaking capital projects to ensure the source is proactively protected (e.g., switching from a diesel to a gas emergency generator)
- implementing regulations that require setbacks from water bodies for various activities or structures that could adversely affect water quality
- adhering to applicable legislation and regulations (e.g., *Environmental Protection and Enhancement Act*, *Alberta Safety Codes Act*, *Public Health Act*)
- collaborating with key organizations in the SWP area such as WPACs, WSGs, municipalities, non-profits, research institutions and academia
- focus on water quantity and not only on water quality
- maintain pre-disturbance hydrological function and reduce the rate of runoff to manage peak flow events which pose the greatest seasonal challenge to water treatment plants

12.0 LESSONS LEARNED

From their experience, drinking water providers shared the following lessons learned:

- not feasible for small and rural drinking water providers to implement SWP plans alone in larger regions but they should be allowed the opportunity to participate in the management process
- Alberta's rivers should have dedicated managers who are responsible for their management—someone needs to be accountable and capable of answering questions from involved groups that work on the ground
- several groups seem to be doing various or similar SWP pieces—better oversight would be helpful
- SWP is difficult for one organization to make much headway on, but collaborative efforts can make a difference
- more resources required to achieve the overarching *Water for Life* goal of safe, secure drinking water
- networking is a key component in the drinking water industry for troubleshooting
- the importance of communication channels with upstream users during a time of crisis is critical
- never get complacent, always look at how to improve the drinking water system
- the lack of integrated land use planning continues to be a major barrier to those attempting to implement SWP plans for their operation, independent of the scale (major river to small lake)
- SWP is complex, and all aspects of watershed processes and risks must be considered and continually updated as new knowledge is developed
- planning and executing SWP is a lengthy, time-consuming process that requires patience and consistent resourcing
- lack of drinking water source protection requirements in existing provincial legislation

CONCLUSIONS

From the targeted questionnaires with drinking water providers, the main conclusions are as follows:

1. disconnect between SWP plans and DWSPs' development, implementation, and monitoring
2. roles and responsibilities of the drinking water provider in the SWP process unclear to most
3. collaboration between drinking water providers and other key groups (e.g., WPACs, WSGs, research and academia) in small and rural communities lacking

4. restricted ability to influence upstream activities
5. more data collection and monitoring of the source is required
6. greater emphasis on managing water quality over water quantity
7. information, resources, and guidance on SWP readily available, but not enough tools
8. limited resources (i.e., funding, training, expertise) hinder the ability of drinking water providers in small and rural communities to protect the source
9. lack of public awareness about the importance of a watershed and the source impede SWP efforts
10. integration of watershed/sub-regional, SWP, and DWSP initiatives with other land and water plans and vice-versa remains unclear