ALBERTA WATER COUNCIL

JULY 2016

Recommendations to Improve Water Literacy in Alberta

About the Alberta Water Council

The Alberta Water Council (AWC) is a multi-stakeholder partnership with members from governments, industry and non-government organizations. All members have a stake in water. The AWC is one of three types of 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 the implementation of the *Water for Life* strategy and continues to administer water and watershed management activities throughout the province.

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Acronyms

AAMDC	Alberta Association of Municipal Districts and Counties
ACEE	Alberta Council for Environmental Education
AEP	Alberta Environment and Parks
AAF	Alberta Agriculture and Forestry
ALMS	Alberta Lake Management Society
AUMA	Alberta Urban Municipalities Association
AWC	Alberta Water Council
BRWA	Battle River Watershed Alliance
CAPP	Canadian Association of Petroleum Producers
CRTP	Circuit Rider Training Program
GoA	Government of Alberta
TSAG	Technical Services Advisory Group
TUC	Trout Unlimited Canada
WPAC	Watershed Planning and Advisory Council
WSG	Watershed Stewardship Group

Executive Summary and Recommendations

Water literacy is an integral component of the *Water for Life* strategy, which states "Albertans will have access to the knowledge needed to achieve safe drinking water, healthy aquatic ecosystems and reliable, quality water supplies for a sustainable economy." Water literacy forms the foundation for successful education and outreach by cultivating a stewardship and compliance ethic and enabling informed public input to the Government of Alberta (GoA) and other decision makers.

The Alberta Water Council established the Water Literacy Project Team to provide recommendations for improving water literacy in Alberta. This work supports the GoA's *Water for Life* strategy, *Our Water, Our Future: A Plan for Action* and the development of a provincial water literacy strategy.

The team surveyed water literacy practitioners to develop an inventory of programs, products, assessments and research in Alberta and other jurisdictions. The findings were used to compile a list of program best practices. A consultant then helped develop an assessment tool, sampled Albertans and provided advice on future assessments. This report summarizes the research, inventory survey and assessment, which form the basis for five recommendations.

Although many organizations in Alberta promote water literacy through various initiatives, some areas could be improved and new tools developed. Key findings highlighted a need to:

- bolster collaboration between policy makers and water literacy practitioners
- augment existing tools and develop new ones to inform program design, delivery and evaluation techniques
- strengthen the capacity of water literacy practitioners by providing further support and resources

Referring to the water literacy ladder (Figure 1 in Section 1), most programs in Alberta focus on the first two rungs — cultivating awareness and knowledge of specific topics in concentrated delivery areas. Programs were not as focused on fostering skills and collective action, and a number of essential topics and target audiences are missing.

Water literacy assessment is a valuable tool that can enhance program design, delivery and evaluation. The assessment of a sample of Albertans suggested that people are aware and knowledgeable about certain topics, but less equipped with the skills to take collective action. Respondents shared their attitudes towards some topics, including lake management, wetland management and water management (supply and allocation). However, if Albertans are to become better stewards of water, practitioners need to design and deliver programs that address gaps in water topics, build skills and encourage collective action.

Five recommendations emerged from this project; these recommendations will inform the GoA as it develops a provincial water literacy strategy.

Recommendation 1

The Government of Alberta collaborate with partner organizations such as the Alberta Council for Environmental Education to improve the water literacy component of existing water portals, or develop a new interactive water literacy portal. These portals would promote water literacy tools, events, networking, collaboration and information sharing among water literacy practitioners and policy makers and should be in place by the end of 2017.

Recommendation 2

The Government of Alberta work with partner organizations to build on existing work and develop new tools to assist water literacy practitioners in designing, delivering and evaluating the success and effectiveness of programs, by the end of 2018.

Recommendation 3

Between now and the end of 2018, the Government of Alberta work with partner organizations such as Watershed Planning and Advisory Councils and others to:

a) improve the dissemination of existing water literacy products and programs

b) develop products and programs to inform Albertans on basic water topics to address gaps identified in this report

Recommendation 4

The Government of Alberta and partner organizations annually assess their distribution of funding and resource support to ensure supported initiatives are improving water literacy in Alberta through effective program planning and evaluation.

Recommendation 5

The Government of Alberta and partner organizations use the assessment tool described in this report through outreach and engagement activities to inform water literacy program design, delivery and evaluation.

1.0 Introduction

Being "water literate" means having an understanding of the significance of water in life, and understanding where water comes from and how to use it sustainably. The Government of Alberta (GoA) is responsible for advancing the goals of the *Water for Life*[1] strategy, which sets the direction for water management in Alberta. The strategy's goals are:

- safe, secure drinking water
- healthy aquatic ecosystems
- reliable, quality supplies for a sustainable economy

Water Literacy Practitioners

Water literacy practitioner is a working definition adopted in this report to refer to a group or an individual involved in planning, directing and delivering information about water to an audience. Water literacy practitioners are people who work in the formal education system (from K-12, colleges and universities) and also include federal, Indigenous, provincial and municipal governments; policy makers; regulators; not-for-profit organizations; industry and other communicators. Depending on the practitioners and their mandate, initiatives vary by topic, audience and delivery area. Throughout this report, sidebars feature examples of water literacy practitioners and their work.

1 For more information about *Water for Life* see http://aep.alberta.ca/water/programs-and-services/water-for-life/default.aspx. Accessed May 2016.

To achieve these goals, a key direction of *Water for Life* is that "Albertans will have access to the knowledge needed to achieve safe drinking water, healthy aquatic ecosystems and reliable, quality water supplies for a sustainable economy."[2] The GoA also committed to developing a water literacy strategy that includes actions to promote environmental stewardship among Albertans by "…increasing awareness, knowledge and skills in order to bring about collective action…"[3].

Water literacy is a narrower focus of environmental literacy. Environmental literacy is "the capacity to perceive and interpret the relative health of environmental systems and to take appropriate action to maintain, restore or improve the health of those systems."[4] Water literacy can include aspects of air, water, land and/or biodiversity, which are inter-connected; it can also relate to discussions around sustainable development. The team was unable to find much work in the area of water literacy; however, work on the researched topic of environmental literacy can be translated for this project's purpose.

1.1 The Need to Enhance Water Literacy

Many Albertans who participated in the GoA's public engagement initiative in 2013, the Water Conversation, reported gaps in their knowledge and awareness around some water management subjects.[5] A risk of not improving water literacy is that some Albertans would be unable to participate fully and constructively in relevant public engagement processes. This may result in a disengaged public that does not comprehend the government's water management decisions or the benefits of stewardship.

2 Government of Alberta. 2008. *Water for Life*: A Renewal. p. 13. Available online: http://aep.alberta.ca/water/programs-and-services/water-for-life/strategy/documents/WaterForLife-Renewal-Nov2008.pdf. Accessed May 2016.

3 Government of Alberta. 2014. *Our Water, Our Future: A Plan for Action*. p. 10. Available online: http://aep.alberta.ca/water/water-conversation/documents/WaterFuture-PlanAction-Nov2014A.pdf. Accessed May 2016.

4 Charles E. Roth.1992. *Environmental Literacy: Its Roots, Evolutions and Direction in the 1990s.* p. 10.

5 Government of Alberta. *Water Conversation*. Available online at http://aep.alberta.ca/water/water-conversation/default.aspx. Accessed May 2016.

1.2 The Water Literacy Project

The GoA is developing a water literacy strategy to enhance the literacy of Albertans. Through this work, the GoA hopes to achieve:

- public understanding, awareness and support for regulatory requirements
- informed public participation towards the creation and review of policy (e.g., Water Conversation)
- involvement in stewardship activities to safeguard water (e.g., the Clean, Drain, Dry Your Boat[6] campaign)

To develop this strategy, the GoA sought knowledge of relevant products, programs, assessments and research. The GoA was also looking for opportunities to address gaps and improve water literacy, and decided to bring this project to the Alberta Water Council (AWC).

As a multi-stakeholder partnership, the AWC members from governments, industry and non-government organizations could facilitate gathering advice from a wide cross-section of organizations in the province. Terms of Reference for an AWC project team were approved in March 2014 and defined the strategic intent of the project "to enhance knowledge of, and provide recommendations for improved water literacy in Alberta" (see Appendix A). Project objectives were:

- improved understanding of existing organizations with water literacy programs, products, assessments or research in Alberta and/or similar resources available to Albertans from other jurisdictions
- improved understanding of successful approaches/best practices to assessing and improving water literacy
- development of a tool and an assessment of a sample of Albertans' water literacy
- recommendations on improving water literacy in Alberta

6 Government of Alberta. *Aquatic Invasive Species: Clean, Drain, Dry Your Boat.* Available online at http://aep.alberta.ca/recreation-public-use/invasive-species/aquatic-invasive-species/default.aspx. Accessed May 2016.

1.3 Approach

Work on this project[7] began in June 2014 with a literature review to improve understanding of water literacy in Alberta. The intent of the review was to identify organizations that develop and/or deliver water literacy and education programs, products, assessments and research. An online survey[8] was then distributed to these organizations and the AWC's 24 sectors and member organizations to develop an inventory of existing programs, products and other initiatives. The inventory allowed the team to identify gaps in topics, audiences and locations, and compile a list of best practices identified by water literacy practitioners. Case studies highlighted in this report demonstrate some of these best practices. A consultant worked with the team to design an assessment tool (questionnaire) to evaluate water literacy levels on six water management topics. Two focus groups tested the questionnaire, which was revised before being administered to a representative sample of 100 Albertans. More details on the methodology and results appear in Section 4. The assessment tool can be administered via paper, telephone or online. If re-applied at periodic intervals, it could also track changes in literacy levels over time.[9]

The findings on the state of water literacy in Alberta are presented in Section 2. Section 3 reports findings on best practices. Section 4 presents the water literacy assessment of a sample of Albertans and recommendations appear in Section 5.

7 See Appendix B for a list of project team members.

8 Alberta Water Council. 2016. *Water Literacy Project Team Inventory Survey and Results.* Available online: http://awchome.ca/Projects/WaterLiteracy/tabid/199/Default.aspx. Accessed June 2016.

9 Feltham Research Services. 2016. *Water Literacy Assessment Tool and Public Water Literacy Survey in Alberta, Final Report*. Prepared for the Alberta Water Council. Available online: http://awchome.ca/Projects/WaterLiteracy/tabid/199/Default.aspx. Accessed June 2016.

1.4 The Water Literacy Ladder

The water literacy ladder adapted from the environmental literacy ladder[10] outlines five steps to become water literate, as shown in Figure 1. The ladder suggests that learning is a linear process. Learning may unfold this way in some cases; however, learners may stall at certain steps or their progress may reverse if the environment does not encourage or have the infrastructure to sustain the new behaviour. Learners will also begin the process again when learning new literacy skills.

Feature Water Literacy Practitioner: Watershed Planning and Advisory Councils

Watershed Planning and Advisory Councils (WPACs) are important stewards of Alberta's watersheds. They are independent, multi-stakeholder, not-for-profit organizations designated by Alberta Environment and Parks to report on the health of watersheds, lead collaborative planning and facilitate education and stewardship activities. There is one WPAC in each of Alberta's major watersheds. See Appendix C for a list of all 11 WPACs.

Human behaviour is complex and individual decisions are influenced by social, economic and environmental factors. A single program would not necessarily change behaviour, but could be a step in the right direction. Many factors contribute to the evolution of a water-literate Albertan, including the establishment of social norms that create a wider cultural shift. As explained by the Campaign for Environmental Literacy, the ladder is "designed to be a loose hierarchy from the simple to the more complex, each building on the step below. However, as with many models, the steps overlap in real life. Most important to appreciate is that water literacy cannot be achieved without all steps of the ladder; achieving any one step alone is inadequate."[11]

10 Campaign for Environmental Literacy. *Environmental Literacy Ladder*. Available online: http://www.fundee.org/facts/envlit/whatisenvlit.htm. Accessed May 2016.

11 Campaign for Environmental Literacy. *What is Environmental Literacy?* Available online: http://www.fundee.org/facts/envlit/whatisenvlit.htm. Accessed May 2016.

Feature Water Literacy Practitioner: Government of Alberta

A number of GoA ministries play an important role promoting water literacy to Albertans. Some examples are:

- Alberta Environment and Parks (AEP) offer education and interpretation programs for the public (e.g., school programs in parks, parks in the classroom, videoconferencing for students and teachers who are not able to travel to Alberta parks).[12] AEP also provides funding for the Watershed Grant Program, which the Land Stewardship Centre administers. In 2013, the Water Conversation was a series of public engagement sessions across the province to discuss water management issues with Albertans.
- Alberta Education lists Environmental and Outdoor Education in its programs of study for junior high students.[13] Environmental education resources are available on a broad variety of topics for teachers.[14]
- The Agriculture and Forestry department's webpage provides access to a number of informative documents relevant to farmers and the broader public in water quality[15], air[16] and environmental stewardship.[17]

12 Alberta Environment and Parks. *Education and Interpretation*. Available online: http://www.albertaparks.ca/albertaparksca/education-interpretation/school-programs/. Accessed May 2016.

13 Alberta Education. *Programs of Study*, Resources and Provincial Assessments. Available online: https://education.alberta.ca/media/3114964/eoed.pdf. Accessed May 2016.

14 Alberta Environment and Parks. *Education Resources*. Available online: http://aep.alberta.ca/about-us/education-resources/default.aspx. Accessed May 2016.

15 Alberta Agriculture and Forestry. *Soil/Water/Air: Water Quality*. Available online: http://www.agriculture.alberta.ca/app21/infopage?cat1=Soil%2FWater%2FAirandcat2=Water%20Quality. Accessed May 2016.

16 Alberta Agriculture and Forestry. *Soil/Water/Air: Air.* Available online: http://www.agriculture.alberta.ca/app21/infopage?cat1=Soil%2FWater%2FAirandcat2=Air. Accessed May 2016.

17 Alberta Agriculture and Forestry. *Soil/Water/Air: Environmental Stewardship*. Available online: http://www.agriculture.alberta.ca/app21/infopage?cat1=Soil%2FWater%2FAirandcat2=Environmental%20Stewardship. Accessed May 2016.

Figure 1 shows desired outcomes for each ladder level where Albertans become aware of an issue; acquire knowledge, skills and attitudes; and take action or change their behaviours to address the issue in response to intentionally designed environmental education programs and initiatives.

To determine the water literacy of an Albertan, an assessment would have to include a comprehensive list of topics, which is a limitation of the ladder's ability to assess desired outcomes. Due to limited resources, the water literacy of a small sample of Albertans could be assessed on a selection of topics; thus, the findings presented in this report should not be interpreted as reflecting the overall water literacy of all Albertans.

Ladder Level	Desired Outcome
Actions	Albertans are active stewards of water and watersheds.
Skills	Albertans have the skills and resources required to apply their knowledge and participate in the creation of water policies, plans and stewardship activities.
Attitudes	Albertans adopt attitudes of appreciation and concern for water and healthy watersheds.
Knowledge	Albertans understand watershed function and provincial water management functions.
Awareness	Albertans are aware of the significance of water within social, economic and ecological systems.

Figure 1: Water Literacy Ladder

Table 1 illustrates an example of how people could move from awareness to action as they learn about a specific issue (in this case, aquatic invasive species). The table also shows educational tools that could be applied at each ladder level.

Table 1: Water Literacy Ladder Example: Aquatic invasive species

Level	Description	Example	Educational Tools
Pre-Awareness	No level of awareness of the environmental issue	What are invasive species?	N/A
Awareness	A basic understanding that the environmental issue exists and how it relates to ourselves	Some people are concerned about certain species that come here from other places	Fact sheets, brochures, flyers, newspaper articles, videos, web pages
Knowledge	An increasingly holistic understanding and analysis of an environmental issue, the natural systems at play and the connection to our lives	Zebra and quagga mussels are invasive species in Alberta that could harm our ecosystems, water resources and economy	Hands-on exhibits, field trips, extension programs, conferences and presentations, teaching kits
Attitudes	One appreciates and is concerned for the environment with a sense of urgency to apply new knowledge in a meaningful way	Invasive species are a serious concern; we all have a role to play in preventing their spread	Guided hikes, field studies, learning circles, dialogues, mentorship, storytelling
Skills	Problem solving and critical thinking skills are used to apply new knowledge to the individual's existing environment	I know how, where, and when to Clean, Drain, and Dry Your Boat to prevent the spread of aquatic invasive species	Community-based engagement, workshops, extension programs, leadership training, mentorship
Action	Capacity for personal and collective action	I have shared information on invasive species with my friends at the marina	Incentives, award and recognition programs

2.0 State of Water Literacy in Alberta

To characterize the state of water literacy in Alberta, the team designed an online inventory survey and distributed it through the AWC's network between August and September 2014.[18]

Feature Water Literacy Practitioner: First Nations Technical Services Advisory Group

Technical Services Advisory Group (TSAG) is a not-for-profit organization created by the Chiefs of Alberta to provide technical support and training to First Nations in the Treaty 6, 7 and 8 regions. Its purpose is to assist Alberta First Nations gain the tools and knowledge that will help to achieve and maintain high standards in technology and services within the community. One of TSAG's programs is the *Circuit Rider Training Program,* highlighted in Section 4. For more information on TSAG see: http://www.tsag.net/

2.1 Water Literacy Programs in Alberta

One hundred twenty-two survey responses were received from 65 organizations. Water literacy practitioners indicated that they offered 152 programs with objectives to:

- educate or raise awareness among the public or a specific audience
- provide tools for practitioners
- provide a basis for informed discussions and decision-making
- increase skills and change the behaviour of a target audience to develop a conservation ethic
- provide stewardship tools for sustainable management
- support water and wastewater operators and stormwater management
- provide industry-led consultation and communication with landowners and affected communities

18 The inventory survey and results are available on the AWC website: http://awchome.ca/Projects/WaterLiteracy/tabid/199/Default.aspx.

Table 2 lists the number of organizations who offered water literacy programs by group. Figure 2 illustrates the number of programs offered by each group. Programs identified in the survey varied by topic, target audience and delivery area.[19]

Table 2: Water Literacy Organizations by Group

Group	No. of Organizations
Goverment of Alberta	4
Industries	9
Municipalities	14
Non-government organizations	24
Watershed Planning and Advisory Councils, Watershed Stewardship Groups	14
Total	**65**

Water literacy practitioners from non-government organizations noted that most of their funding came from grants. The sources of these grants included federal, provincial and municipal governments; conservation organizations and foundations, industry and industry groups; and academic institutions.

19 Alberta Water Council. 2016. *Water Literacy Project Team Inventory Survey and Results.* Available online: http://awchome.ca/Projects/WaterLiteracy/tabid/199/Default.aspx. Accessed May 2016.

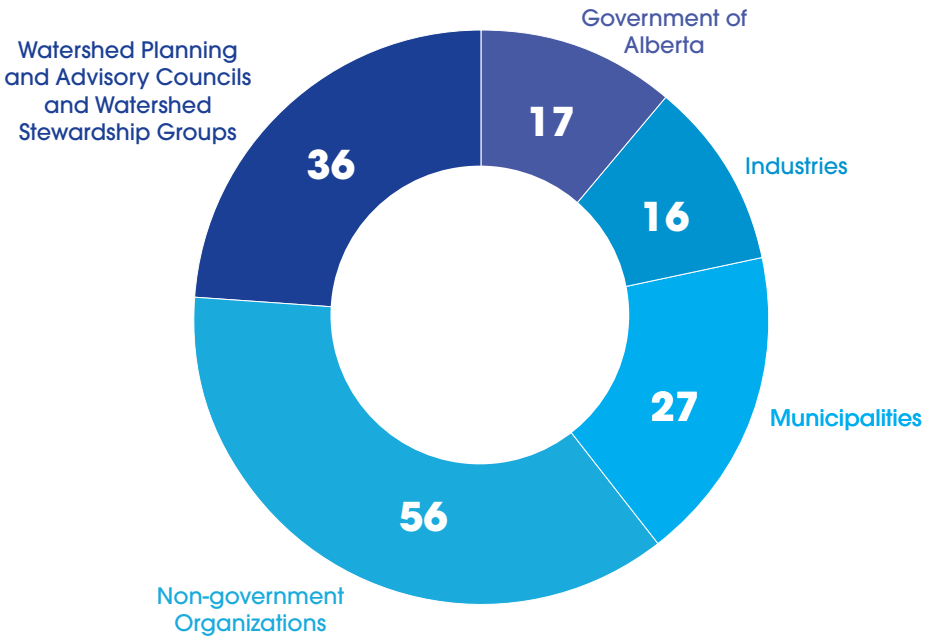

Figure 2: Water Literacy Programs Offered by Various Groups

Topics

Table 3 shows the variety of topics reported among the 152 programs in the survey.

Table 3: Water Literacy Program Topics

Program Topic	% of programs
Watersheds (awareness, health, management, monitoring)	16%
Water conservation and efficiency	11%
Water (general, water cycle)	10%
Wetlands	9%
Stormwater and drainage management (erosion and sediment control)	8%
Water quality (pollution, monitoring)	8%
Lakes (water quality, public health, monitoring, management)	7%
Wastewater (treatment, management)	6%
Water use (agriculture, urban, hydroelectric, irrigation, general)	6%
Aquatic species (fish, beavers, biodiversity, invasives)	6%
Riparian and shoreline health	6%
Water issues (global, local, value of water, sustainability)	5%
Rivers (health, monitoring, protecting)	4%
Drinking water (source protection, dugout maintenance, treatment, well water management)	4%
Water research	3%
Flood management	1%
Surface water	1%
Other[20]	<1%

20 All these topics had <1% of programs (environmental science, forests, freshwater, groundwater, land use, moraine, ponds, rain harvesting, spring water awareness, sustainability, water management planning, water literacy and water bodies)

While a wide variety of topics is listed, some relevant and important water management topics were missing from the inventory, including:

- water allocation
- water and human health
- water quality concerns and rural water quality monitoring
- climate variability and adaptability (e.g., flooding, drought)
- water use by the agricultural and industrial sectors, including the hydraulic fracturing (fracking) sub-sector, and the risks to groundwater from spills and contamination associated with these uses
- drinking water and wastewater system requirements
- role of Indigenous governments and traditional knowledge in water management

Audiences

Not all water literacy practitioners provided information about their target audience. Figure 3 shows the target audiences reported in the survey. Some programs were very specific in who they targeted (e.g., First Nations water works operators, property owners, irrigators). Youth and students were a target audience in approximately one-third of programs, with many programs aimed at primary grade students. Fewer programs offered life-long learning opportunities[21] to students in higher grades, post-secondary students, young professionals and middle-aged adults. Other programs were designed for a variety of audiences (e.g., public, students, homeowners), some were developed for the public, and a smaller number of programs targeted the following audiences:

21 Lifelong learning is learning undertaken throughout life, with the intent of improving knowledge, skills and competences within a personal, civic, social and/or employment-related perspective. For more information see http://www.skillsyouneed.com/learn/lifelong-learning.html

- landowners, including acreage owners
- crop and livestock producers
- individual industries (not including agriculture)
- municipal councillors, planners and developers

Delivery Areas

Figure 4 illustrates delivery areas identified by practitioners in the survey. Many programs are offered in central Alberta, and the cities of Calgary, Medicine Hat and Edmonton have higher numbers of programs. Fewer programs are offered in the north, rural centres and Indigenous communities. While it is important that Albertans learn about watershed-specific issues, including local watershed characteristics, challenges and involved players (e.g., WPACs, municipalities, industry), they should also be aware of concerns and challenges of other watersheds in Alberta.

Feature Water Literacy Practitioner: Alberta Council for Environmental Education

The Alberta Council for Environmental Education is a champion of environmental education, convenes stakeholders, facilitates leadership, builds networks, increases capacity and connects communities. For more information, see: http://www.abcee.org/

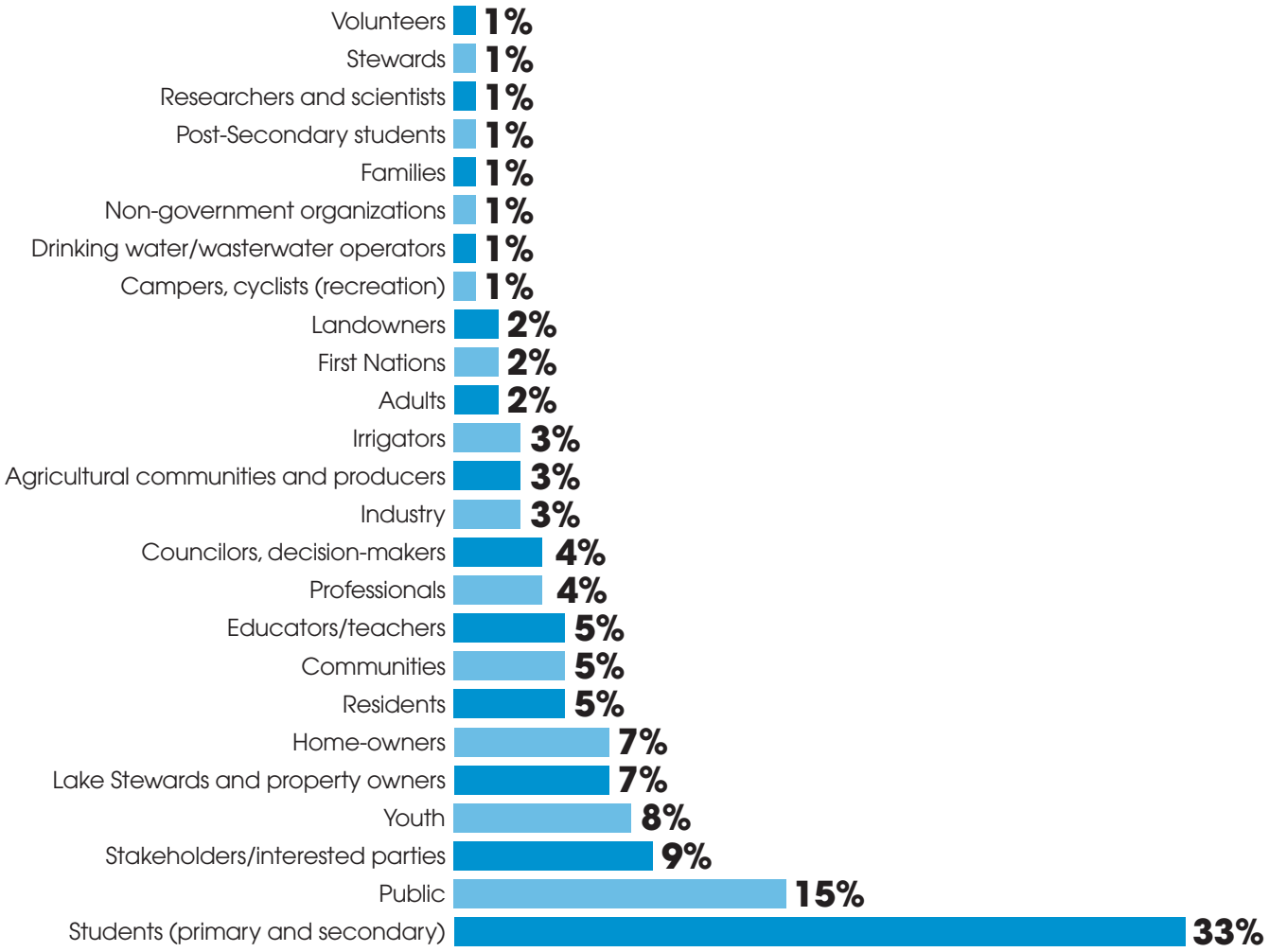

Figure 3: Water Literacy Program Audiences

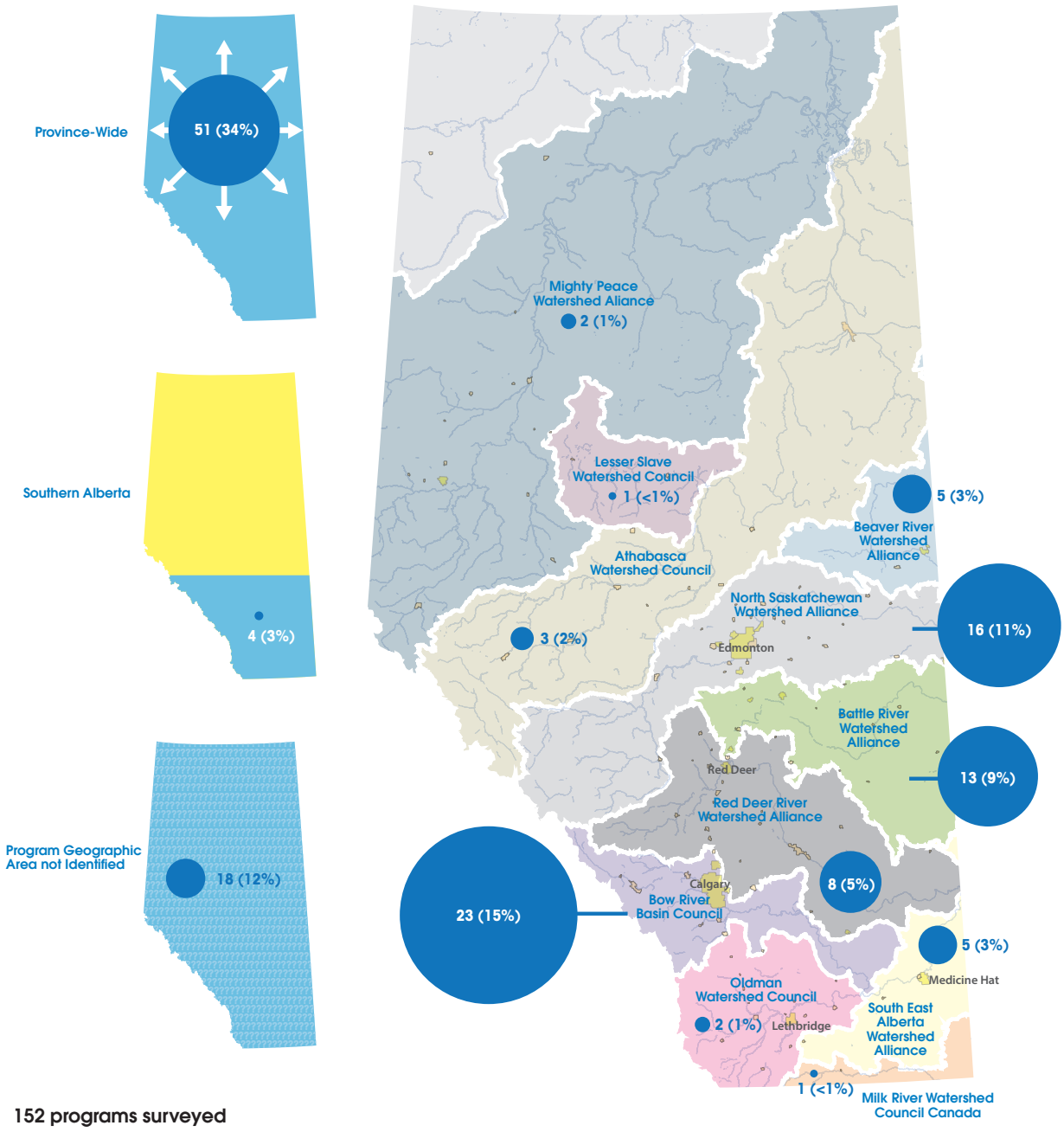

Figure 4: Geographic Distribution of Water Literacy Programs in Alberta

Tools and Techniques

Tools used to deliver programs noted in the survey included:

- demonstration sites, displays, exhibits
- case studies, land use simulator
- citizen science — water quality monitoring
- events — beach days, Aggie Days, festivals, puppet show
- fieldtrips, camps, tours
- games — outdoor, board, classroom, models
- incentives (grants, rebates)
- media campaigns
- networking events or tools
- presentations, workshops, conferences
- publications — brochures, calendars, teachers kits, posters
- research
- stormwater drain marking
- surveys
- training and certification
- webinars, courses
- websites, social media, videos, movies

Successful program techniques:

- started with a pilot, then learned from this early experience
- provided one-on-one advice
- created a sense of community
- were interactive, hands on, experiential and fun
- were relevant to the targeted local audience (place-based information and tools (e.g., my backyard, my watershed)
- provided the big picture of water management and watersheds
- got board members or community leaders involved
- offered incentives
- made it easy to deliver (transparent and universally applicable approach)
- had well-trained, engaging staff
- incorporated technology
- were interdisciplinary
- guided field study
- included a variety of topics
- used inquiry-based learning including an action or challenge project

Depending on the topic and the audience, some tools and techniques are more effective than others. For example, incentives were viewed as a good tool for changing behaviour but they are rarely used in water literacy programs. It is important that practitioners understand which tools and techniques are available and most suited to the topic and target audiences.

Program Challenges

Practitioners shared the following challenges:

- geography — large area (i.e., entire watershed) to cover with limited resources
- school limits to time and budgets
- lack of teacher interest in some areas
- ensuring information is current
- limited local expertise
- staff turnover and having well trained staff
- promotion of programs
- decreasing rural population and
- funding (diverse sources, consistency and quantity) — almost half the programs identified operate with a budget less than $25,000; only 16% had a budget greater than $200,000

Feature Water Literacy Practitioner: City of Calgary

Calgary is situated at the confluence of the Bow River and the Elbow River in southern Alberta. With a growing population of over one million residents, water resource management is critical. Through a number of water services, the city promotes water literacy to residents. Some programs include Counting on your Water, Be YardSmart and Water Treatment Tours, among others. For more information about the City of Calgary, visit:

http://www.calgary.ca/UEP/Water/Pages/Water-Services.aspx

2.2 Summary of Gaps in Water Literacy Programs

The survey of water literacy programs in Alberta highlighted the importance of aligning content with audiences in specific locations using appropriate delivery tools. Some programs are limited to a geographic area and not available to other audiences in Alberta. Being cognizant of varying needs in different locations around the province, there is value in expanding program delivery geographically and demographically through collaboration. For example, larger municipalities with established programs could mentor and support smaller communities to deliver programs scaled to their size and unique circumstances. Similarly, programs that target grade schools could be enhanced and expanded for post-secondary audiences. Figure 5 summarizes several gaps and opportunities in water literacy programs.

Drinking Water and Wastewater

The GoA and local governments do not provide programs for the public on how drinking water is treated, drinking water quality, pharmaceuticals and other chemicals in drinking water, stormwater treatment and the cost of drinking water and wastewater infrastructure using tools more innovative than flyers or webpages. An opportunity exists for the GoA, Alberta Urban Municipalities Association (AUMA) and Alberta Association of Municipal Districts and Counties (AAMDC) to develop public programs using interactive tools such as online videos, television ads, art, music, photography, storytelling and community forums.

Municipal programs about household water use, conservation and wastewater are delivered almost exclusively in larger urban centres. The AAMDC or AUMA could arrange urban mentors for smaller communities. Delivery tools like bill inserts could include information on rebates, metering, recognition programs and other aspects of the local water system.

Few programs in Alberta cover the role of traditional knowledge, jurisdictional and legal aspects of water management. These gaps could be improved by enhancing collaboration among Indigenous, federal and provincial governments.

Healthy Aquatic Ecosystems

Many non-government organizations (e.g., Ducks Unlimited Canada, Trout Unlimited Canada) provide programs on wetlands, lakes, rivers and riparian areas for primary school students, but these tend to be delivered more in large urban centres than in smaller rural centres. As well, few programs are available for other groups like 4-H, Junior Forest Wardens, post-secondary students and young professionals. There is an opportunity to create more programs with both in-class and field trip components, for other youth groups in smaller rural areas. Additionally, mentorship programs could be developed to help post-secondary and young professionals.

Few programs for the public link water and aquatic health issues to human health issues (e.g., impact of blue-green algae on pets, impact of water quality on livestock and food fish). Greater collaboration between health agencies and water managers could facilitate the development of tools that use popular media (e.g., social media, television, radio) to share important human health information about water via school curricula and health clinics.

Water Allocation

Few programs provide information about how water is allocated to various sectors and how much water is actually used by each sector.

Hydraulic Fracturing

Few non-industry programs exist that provide and disseminate information related to hydraulic fracturing (fracking) and potential risks to water quality for landowners using water wells and for concerned citizens in fracking areas.

Overall

A stronger connection is needed between policy makers (who identify policy issues) and water literacy practitioners (who provide the information) to target audiences in specific delivery areas.

Figure 5: Water Literacy Program Gaps and Opportunities

3.0 Water Literacy Program Best Practices

A number of **best practices** used by practitioners were documented using the results of the survey. The team adopted a working definition of a **best practice** as referring to any method or process that represented a successful and/or effective way of achieving a desired program objective.

3.1 Successful versus Effective Programs

In the inventory survey, practitioners shared any program evaluation or performance measures they used, how they measured success and if they considered their program(s) to be effective.

Measuring Program Success

A successful program is one that accomplishes the desired objectives (identified in a particular program's literacy ladder) while making efficient use of time and resources, but may not necessarily result in positive environmental changes. Of the 34 water literacy practitioners who responded to this question, 25 said their program was moderately to highly successful. Some practitioners did not indicate if they thought their program was successful, or if they expect it to be in the future.

Most practitioners could state if their program was highly, moderately or not successful, but how they made this assessment was harder to discern. Respondents provided the following measures of success:

- evidence that people liked the program (i.e., participants were excited and interested)
- comments or ratings received via feedback mechanisms (e.g., satisfaction surveys)
- increasing participation rates, attendance versus registrations, re-bookings, returning participants, program is popular, program is in high demand

- media attention, social media hits, number of website hits, resource downloads
- number of enquiries about the program
- number of sessions held, longevity of the program
- awards won, grants received
- internal analysis (e.g., Strengths Weaknesses Opportunities and Threats Analysis)
- number of information items or educational kits distributed
- number of partnerships established and/or volunteers recruited
- percent of participants that agree they have tools and capacity to engage others or influence behaviour change in others as a result of the program
- number of publications in reputable international journals, presentations (conferences and public), enrolment, evidence of interdisciplinary areas in teaching and learning

Measuring Program Effectiveness

A program may be successful but not necessarily influence behaviours that result in positive environmental changes. An effective program was described as one that accomplishes desired objectives while making efficient use of time and resources, and results in environmental or behavioural changes. Most programs have simple feedback mechanisms (e.g., workshop evaluation forms, participant satisfaction forms) but many programs did not have robust performance measures to assess program effectiveness.

Most water literacy practitioners believe that program evaluation is important but found it a challenge to measure behavioural or environmental change. Practitioners reported using the following elements, some of which are program- or project-specific, to determine if a program has been effective:

- participants learned and retained information
- percent of participants who say they have an increased awareness of an issue or of available resources, or increased knowledge or skills as a result of the program
- participants were inspired to learn and took action (i.e., stewardship activities)
- program had a measurable positive environmental impact
- behaviour change or knowledge outcomes were met
- percent of participants who report behavioural changes
- number of stakeholders adopting best management practices
- number of participants certified or re-certified in their speciality after completing the program
- water savings or potential water quality improvements
- increase in number of lakes monitored, increase in parameters sampled
- volume of pollutants reduced

Using the water literacy ladder as a guide, practitioners could determine if they are meeting the desired outcomes of a program by educating at the appropriate ladder level. Programs should strive to move people up the literacy ladder from awareness level to collective action. Both practitioners and funders need to know if programs are successful and effective.

Feature Water Literacy Practitioner: Canadian Association of Petroleum Producers

The Canadian Association of Petroleum Producers (CAPP) represents most of the upstream oil and gas industry. As such, CAPP promotes the industry's safe, environmentally and socially responsible performance through publications such as the CAPP Hydraulic Fracturing Operating Practices; The Facts on Oil Sands; and The Facts on Canada's Natural Gas. CAPP has a community outreach program that connects with stakeholder groups in communities across Alberta. The industry must also meet specific regulatory requirements for consultation in their areas of operation, which can include a water literacy component. For more information, visit: http://www.capp.ca

3.2 Considerations when Building a Water Literacy Program

A summary of best practices was developed from the practitioners' input on what makes water literacy programs successful and effective. Table 4 presents a checklist that could be used to design, deliver and evaluate future programs, along with some examples from existing programs. The checklist aligns with four stages of developing and evaluating literacy programs: research, design, implementation and evaluation.

Table 4: Water Literacy Program Best Practices

Program Stages	Examples
Stage 1 — Research	
Identify the water issue or water literacy gap that needs to be resolved	Keeping aquatic invasive species out through the Clean, Drain, and Dry as well as the Don't Let it Loose campaigns
Determine if a water literacy program would inform and/or resolve the issue in a timely manner	"Store it, don't pour it" City of Edmonton wastewater campaign
Ensure the program considers key policies and initiatives	*Alberta Land Stewardship Act*
Check if anyone is providing programming about this issue. Scan what other jurisdictions are doing	Alberta Council for Environmental Education (ACEE) Communities of Practice
Determine the appropriate audience for the issue Research and/or consult with them about their needs and barriers to change	The City of Calgary's YardSmart Program identified the need for eco-scaping demonstration sites
Check capacity (financial, time and human) to be cost-effective	AWC annual operational planning
Collaborate with others where possible	ACEE Communities of Practice
Stage 2 — Design	
Set outcome(s) you want to achieve (i.e., What is your end product or what will be different as a result of your program?)	Low-flush toilet rebate programs
Identify specific, measurable, attainable, relevant and time-bound short-, medium- and long-term program goals, objectives, and how you will achieve them (i.e., strategies and timelines)	Backcast from event or end-goal date
Know your baseline and have a plan to measure outcomes (targets and milestones). Use the water literacy ladder to focus on what you want to achieve	RiverWatch conducts pre- and post-participation surveys
Develop a communications plan that identifies your audience, what they value and what is important or relevant to them (i.e., What are community specific issues, cultural considerations, learning styles?)	Incentives (e.g., toilet rebate programs). Address community needs (Lake Windermere project)

Program Stages	Examples
Identify user-friendly tools and experiential, meaningful delivery mechanisms for your audience. Use clear, audience-specific language and unbiased information	Cows and Fish Program of the Alberta Riparian Habitat Management Society — digital storytelling (From Street to Stream series)
Determine a suitable place to reach your audience. Go where they are and do not rely on them to come to you. Make interactions personal	Nature Alberta's Living by Water Homesite Consultations
Develop a budget and seek funding. Can your program survive without significant or consistent funding? Allocate time and resources in a work plan. Are governance, accountability and management structures in place?	Alberta Lake Management Society — seeks core funding from GoA and supplementary funding from other water groups. Find corporate sponsors for specific events
Undertake risk assessment and mitigation. Have you built in the flexibility to make corrections to your program if needed?	Adaptive management and continuous evaluation
Pilot your program with partners or a key sample audience	Strathcona County's Pond Party

Stage 3 — Implement

Set priorities; don't spread resources too thin	
Lead by example; communicate, communicate, communicate	North Saskatchewan Riverkeepers advertise events via Twitter and Facebook; "I Love My Lake" stickers and ambassadors
Set up processes to track, document, and share the program's development over time. Monitoring is important to program success	Quarterly or annual reporting of program and continuous evaluation
Manage adaptively. Practice continuous improvement	Evaluate each program each time

Stage 4 — Evaluate

How did the program improve knowledge of the issue and skills to address it? Measure program performance and cost-effectiveness. Were goals met? Will this process be done internally or externally?	Quantitative and/or qualitative
Determine how the results of the evaluation will be communicated to audience and stakeholders	Report to AWC board
Provide examples of and celebrate success throughout the program	AWC team celebration dinners

Five case studies of existing water literacy programs in Alberta demonstrate the use of this checklist in various aspects of program design.

CASE STUDY 1 — RIVERWATCH

RiverWatch helps science classes explore a 10km section of their local river during a raft float trip.[22] Along the way, students make shoreline stops to conduct water chemistry and biology tests. Back at school, the water quality data is used to answer the question, "How healthy is your river?"

Stage 1 — Research

Strike while the iron is hot: RiverWatch was sparked by a 1994 Alberta Education curriculum change.

Provide assistance by filling a need: Teacher surveys showed that resources were limited to textbook reading without experiential components.

Build on previous successes: Alberta Environment (now Alberta Environment and Parks) supported a field study called the Aquatic Invertebrate Monitoring (AIM) Program with high school teachers.

All stakeholders are project partners from the ground up: In 1994, the RiverWatch teachers used the AIM Program as a resource model and surveyed their colleagues for input, added a student-sized rafting adventure, field-tested the concept with their own students, and borrowed equipment and space through the Sam Livingston Fish Hatchery. They held a teacher in-service workshop, which became a popular curriculum resource built from the grassroots up for teachers, with teachers and by teachers.

22 See the website for more information http://www.riverwatch.ab.ca

Stage 2 — Design

Begin with sound teaching and learning theory: RiverWatch used the curriculum model for Alberta Education's Junior High Environmental and Outdoor Education Complementary Course. This model outlines three learning levels: foundations (awareness and environmental concepts), explorations (issues investigation and values) and empowerment (personal commitment to action).

Combine best theory with amazing client experience: The RiverWatch day begins with immersion into a new environment through river rafting, leads into first-hand investigations of water quality data, and finishes with a personal and practical realization of how citizens can contribute to wise water use.

Stage 3 — Implement

Real world, place-based science: The focus of a RiverWatch day is to answer, "How healthy is our river?" by comparing water quality data collected by students above and below a wastewater treatment plant.

Great instructor to student ratio: RiverWatch is a labour-intensive program. Three full-time staff and 36 seasonal staff ensure that each raft of 15–18 students is accompanied by a certified river guide and a school-based adult.

Grassroots sustainability: RiverWatch is funded 50% through student fees and 50% through corporate donations and federal grants. The program operates in each school year from September–October and May–June and has operational bases at the Edmonton and Calgary wastewater treatment plants. RiverWatch is a not-for-profit organization and a registered Canadian charity under the direction of a nine-member board of directors.

Stage 4 — Evaluate

Go big or go home: RiverWatch is a recipient of the Prime Minister's National Award for Teaching Excellence and is a widely used, in-depth environmental field study available to students.

Walk the talk: Student participants have scored higher on provincial achievement tests. An online survey of 5,000 students showed a scoring improvement of 24% for "I can rate the environmental health of my river" following the field study.

4.0 Assessing Water Literacy among Albertans

A theme the Water Conversation of 2013 revealed is that some Albertans wanted the GoA to provide more information on the topics at hand to help them make meaningful contributions to policy discussions.[23] Determining what Albertans know and do not know about water, public policy and stewardship activities could help practitioners improve their programs to increase the public's ability to contribute to important policy discussions. One of the objectives of this project was to develop a tool, delivery approach and assess a sample of Albertans' water literacy.

Feature Water Literacy Practitioner: Strathcona County

Strathcona County is a municipality that works cooperatively with urban and rural residents to protect the environment. With a number of programs from water to wastewater, water literacy programs are an important part of their daily education and outreach initiatives; these include the Yellow Fish Road, pond parties, backwater valve rebate and others. For more information, see: http://www.strathcona.ca/

Assessments could provide qualitative information to help practitioners determine how to improve programs through changes in content, methodologies, delivery materials or other areas. The intent of assessment is to support the gradual improvement of learning over time. An assessment tool should be designed to meet a particular purpose. Some reasons to assess include assisting in learning and documenting progress, developing or improving a learning program, facilitating transitions and demonstrating accountability. Improvement and follow-up is an integral part of any assessment.

23 Government of Alberta. 2014. *Our Water, Our Future: Summary of Discussions.* p 14. Available online: http://esrd.alberta.ca/water/water-conversation/documents/WaterFuture-SummaryDiscussions-2014.pdf. Accessed May 2016.

After surveying and developing an inventory of programs, water literacy levels of a sample of Albertans were assessed. Results from the assessment of a sample of Albertans appear in this section.

4.1 Topics Assessed

Water is a broad subject with many issues and concerns. The assessment could only sample Albertans in a few areas due to limited resources. Guided by the water literacy ladder, topics that aligned with the GoA's Water Conversation and other timely and relevant topics (e.g., *Alberta Wetland Policy*[24]), it was decided that the tool would assess the awareness, knowledge, attitudes, skills and actions levels for six water management topics:

- lake management
- wetland management
- watershed management
- water management (supply and allocation)
- sector water use
- drinking water, wastewater and groundwater

24 Government of Alberta. 2013. *Alberta Wetland Policy.* Available online: http://aep.alberta.ca/water/programs-and-services/wetlands/documents/AlbertaWetlandPolicy-Sep2013.pdf. Accessed May 2016.

4.2 Tool and Methodology

Although considerable information is available online about assessments in general, not much work has been done in Alberta to assess water literacy. Research conducted in the fields of health, social sciences and environmental studies in other jurisdictions was helpful in designing the methodology for this project. The challenges and information needs associated with each topic were considered and survey questions for each ladder level (i.e., awareness, knowledge, attitudes, skills and actions) were drafted. A consultant helped develop an assessment tool (a questionnaire), and later assessed a sample of Albertans.[25]

Feature Water Literacy Practitioner: Alberta Association of Municipal Districts and Counties

The Alberta Association of Municipal Districts and Counties (AAMDC) is an independent association of Alberta's 69 counties and municipal districts. The AAMDC helps rural communities to achieve a strong and effective local government. An important role of the AAMDC is to provide education on current issues and developments. Water is a key aspect of this in terms of land-use planning decisions and water bodies, the management of water systems that impact residents, business and industry, and severe weather events such as drought or flooding. For more information about the AAMDC see: http://www.aamdc.com/

The questionnaire was tested with two focus groups of Albertans (20 people total) in a face-to-face setting and then with an additional 20 Albertans via telephone. These pilots led to alterations in wording and number of questions. The final assessment tool was administered by telephone to a sample of 100 Albertans. In general, the sample was sufficient to provide a confidence interval (margin of error) of +/- 10%. In other words, there was 95% certainty that the

25 Feltham Research Services. 2016. *Water Literacy Assessment Tool and Public Water Literacy Survey in Alberta*, Final Report. Prepared for the Alberta Water Council. Available online: http://awchome.ca/Projects/WaterLiteracy/tabid/199/Default.aspx. Accessed June 2016.

true value of a response number would be within 10% of the number recorded. The data were analyzed using IBM SPSS Statistics and Microsoft Excel 2013.

The sample was generally representative of the Alberta population; 100 people ranged in age from 20 to 85, with 11% having children and two-thirds with post secondary education.

CASE STUDY 2 — CIRCUIT RIDER TRAINING PROGRAM

The Circuit Rider Training Program (CRTP) provides First Nation participants with hands-on training on how to operate, service and maintain local water and wastewater systems so that Indigenous communities have safe access to drinking water. It is a key component of the Government of Canada's First Nations Water and Wastewater Action Plan.[26] In Alberta, the First Nations Technical Services Advisory Group (TSAG) delivers the CRTP. This program addresses the water literacy ladder desired outcome associated with "action" by increasing the number of certified water and wastewater operators.

Stage 1: Research

The high number of boil-water advisories and the lack of certified operators showed a gap in capacity to manage drinking water and wastewater. The need for training and support for drinking and wastewater operators on reserve led to the development of the CRTP.

26 Government of Canada. *Circuit Rider Training Program*. Indigenous and Northern Affairs Canada. Available online: https://www.aadnc-aandc.gc.ca/eng/1313424571273/1313424692733. Accessed May 2016.

Stage 2: Design

First Nations designed the CRTP for First Nations, with the goal of providing training, support and troubleshooting to drinking water and wastewater treatment operators on reserves. The program has a clear target audience (operators on reserve), stable funding provided through Indigenous and Northern Affairs Canada and clear objectives (increase the number of certified water and wastewater operators in First Nation communities). On top of overall program targets, participants work with CRTP trainers to customize training programs with personal milestones to meet diverse learning needs.

Stage 3: Implement

Most of the CRTP is delivered in each participating community (approximately 40 First Nations), with additional regional training sessions. Each Circuit Rider Trainer develops work plans and targets for each of the operators he or she works with. The program is communicated through one-on-one meetings with First Nations band staff, community information sessions, booths at career fairs and during other TSAG programs (e.g., workshops, classroom presentations).

Stage 4: Evaluate

The CRTP measures the success of its program by the number of operators that complete their certification compared to the number of program entrants. It also measures success by assessing how operators met their professional development objectives annually. TSAG celebrates successes, such as achieving certification or an improvement in a community's water treatment or stewardship, through presentations at the TSAG annual conference and through bulletins. There is room for improvement however; TSAG is working to better integrate water awareness programs for First Nations' youth (e.g., field days, presentations, camp) with the CRTP to encourage careers in drinking water and wastewater treatment and technology.

4.3 Results

This pilot assessment revealed that Albertans have higher levels of awareness and knowledge in some areas than others. It also provided the sample population the opportunity to express their attitudes on the topics that were being assessed. Some individuals in the sample could not answer certain questions, as they did not know enough about the topic to have an opinion. Relative to the water literacy ladder, Albertans generally demonstrated more awareness and knowledge but a lower level of skills and understanding about action to take. In some cases, Albertans may have the skills to bring about change but this was not being translated into direct actions. The main findings, considerations for future programs and what improvements could be made to future reassessments for the six topics assessed in this project are summarized below.

Feature Water Literacy Practitioner: Trout Unlimited Canada

Trout Unlimited Canada (TUC) strives to conserve protect and restore Canada's freshwater ecosystems and their cold-water resources. With chapters across Canada, TUC has a number of conservation projects that promote water literacy (e.g., Alberta Fish Rescue, Quirk Creek Brook Trout Suppression, Drywood Creek and others). For more information, go to http://www.tucanada.org/index.asp?p=1

Lake Management

Main findings: Survey respondents have good awareness and knowledge about lakes, but they were split on who is responsible for lake management — all Albertans or the GoA. A few respondents thought municipal governments are responsible for lake management. While respondents were aware of actions they could take to protect or improve lake health, few carried out these actions. Most popular actions were washing vehicles at a carwash and reducing fertilizer and pesticide use.

Q6: Whether or not you own lakeshore property, which of the following activities to improve lake health have you done in the last 12 months? (Choose all that apply)

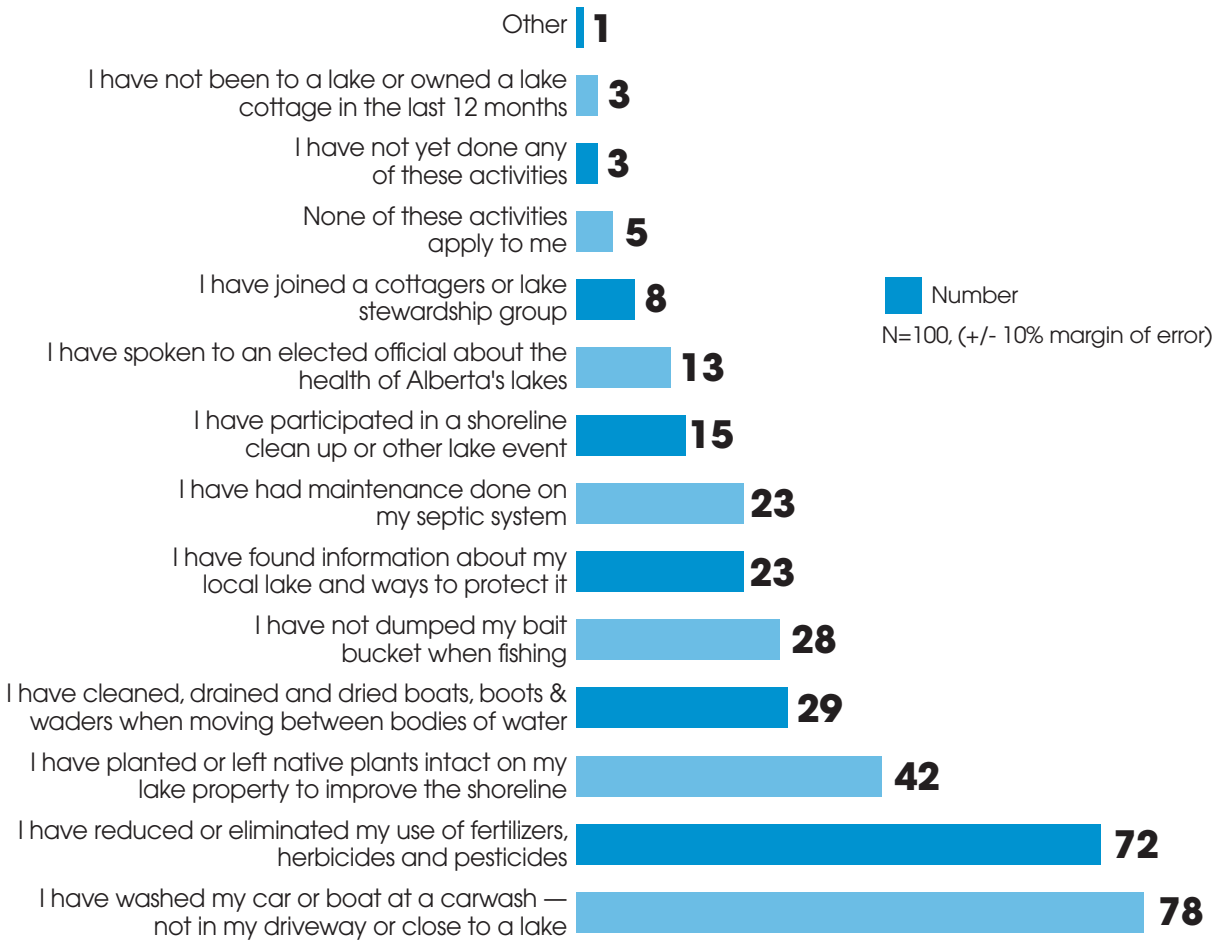

Figure 6: Activities to Improve Lake Health

Future Water Literacy Programs: Future literacy programs might focus on helping Albertans use skills and knowledge to take actions to protect or improve lake health.

Future Reassessments: Would want to see improvement in the number and type of actions being taken to protect lake health.

Wetland Management

Main findings: Albertans have good awareness and knowledge about wetlands. Most respondents knew that wetlands provide habitat for species and are an essential component of watersheds. Attitudes reflect a belief that wetlands are important. There is also good understanding of actions that influence wetlands, and that some actions require a permit. Only half of respondents had explored a wetland and very few had engaged in wetland conservation activities.

Q12: Which of the following wetlands activities have you done in the last 12 months?

Figure 7: Wetland Activities

Future Water Literacy Programs: Future programs might add more experiential components to get people out to wetlands and provide more skills so that Albertans know what actions they could take to protect wetlands.

Future Reassessments: Would want to see improvement in the awareness and knowledge about regulatory requirements required for agricultural, industrial or residential development particularly among rural Albertans.

CASE STUDY 3 — WORKING WELL PROGRAM

Private water well owners in Alberta are responsible for managing their water wells. The Working Well Program (WWP), delivered by AEP, aims to ensure safe and secure groundwater supplies for users in Alberta.

Stage 1 — Research

Working Well Program is a training workshop program, delivered collaboratively with local counties; it provides well owners with the skills and knowledge they need to care for wells. The program strives to foster a culture of stewardship; promote the role of water well owners in managing and taking care of their wells; and highlights the importance of water stewardship.

Stage 2 — Design

Program Objectives and Water Literacy Ladder Steps:

Awareness: Well owners recognize that management of private wells is their responsibility and they understand the potential impacts of human activities on groundwater.

Knowledge: Well owners have a basic understanding of groundwater science and well management. Attitudes: Well owners share their attitudes in regards to the impacts of local industrial activity and well maintenance on groundwater and drinking water.

Stage 3 — Implement

Skills: Well owners apply newly acquired knowledge and critical thinking skills to manage their water wells.

Action: Well owners adopt the behaviours and practices required for the ongoing maintenance of water wells and stewardship of groundwater resources.

Stage 4 — Evaluate

Place-Based and Experiential: The WWP responded to local concerns and the need for clear and accurate information about the impacts of coal-bed methane on groundwater. It provides hands-on and action-oriented training for well owners, who transfer new knowledge and skills to well management. The program started in a few Alberta communities and, based on its local success, was applied to municipalities across the province.

Collaborative: The WWP was initiated and is maintained through a collaborative effort among municipalities, the Alberta Water Well Drilling Association and some GoA departments.

Other Success Factors: The WWP uses a community-based social marketing approach (e.g., personal contact, prompts, evaluation, positive messaging, research and analysis).

Watershed Management

Main findings: Respondents believe watersheds are significant but have poor awareness of what a watershed is or the role of WPACs. Other than discussing watershed issues with community members, few respondents have been involved in a watershed management activity.

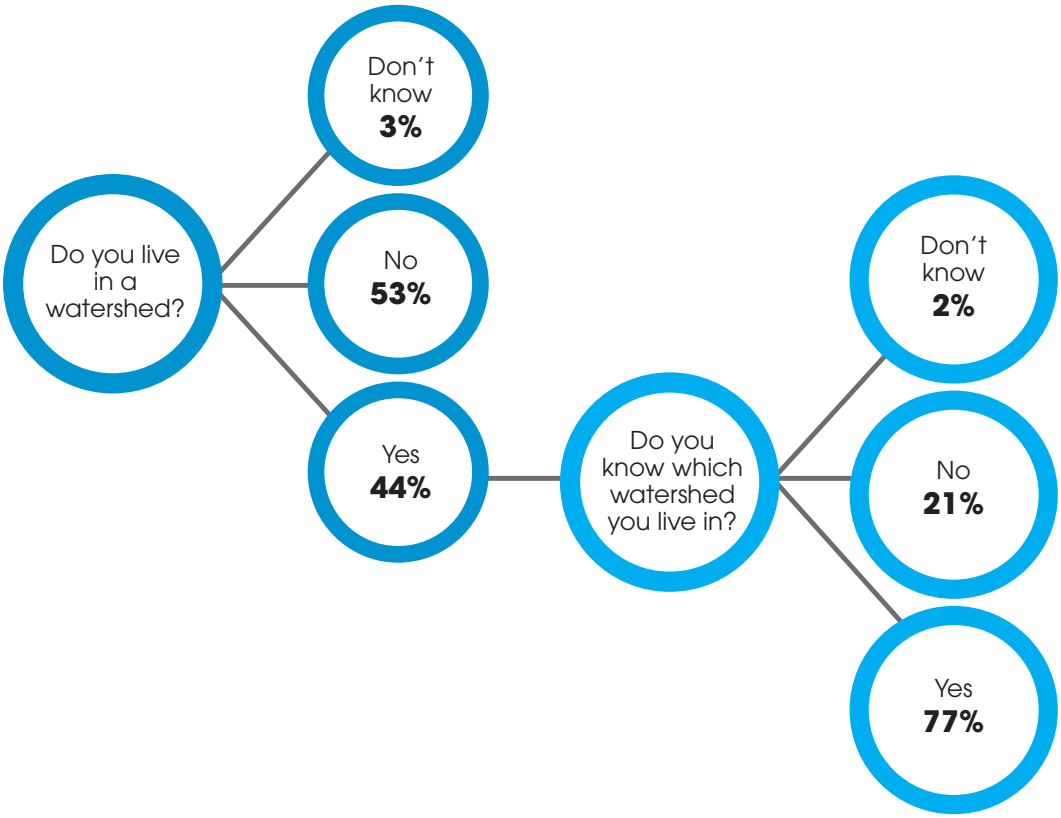

Figure 8: Watershed Knowledge — Do you live in a Watershed?

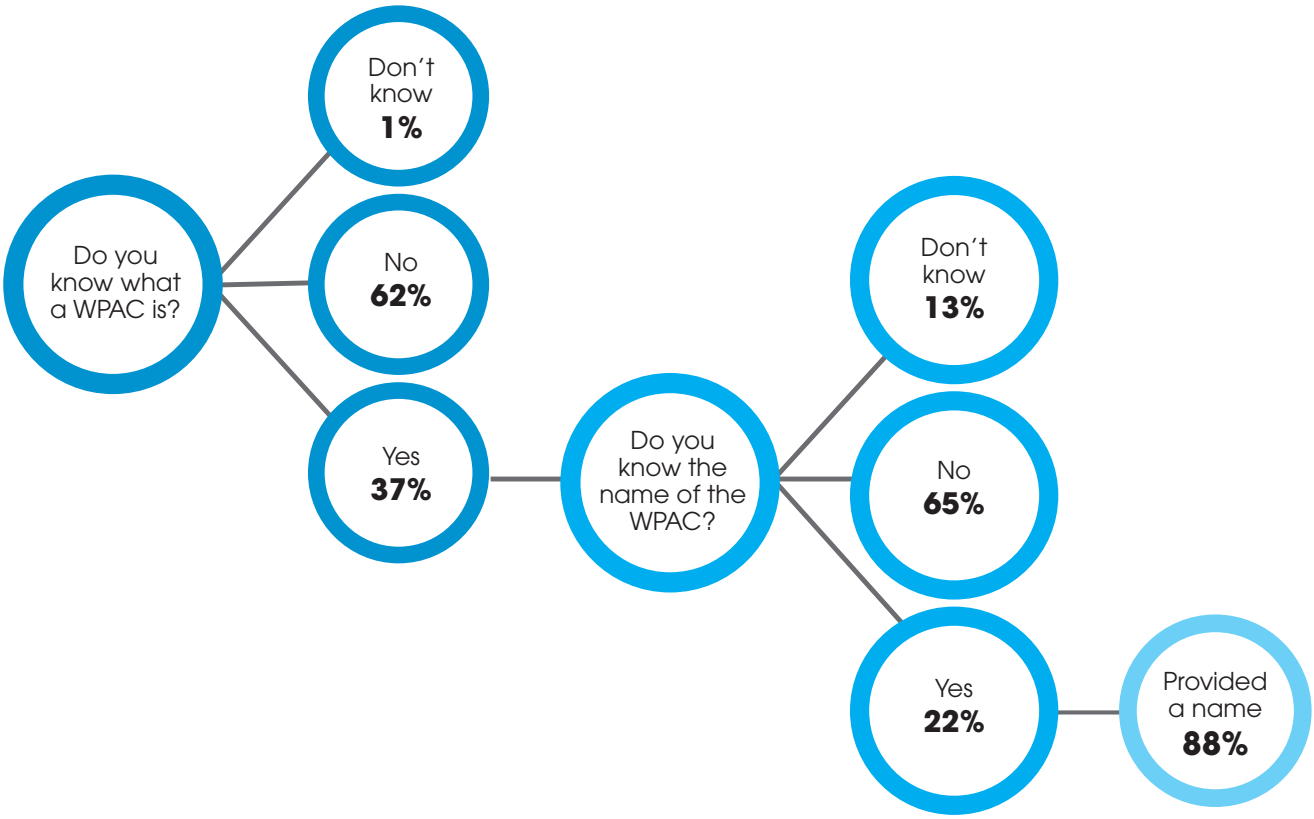

Figure 9: Knowledge about WPACs — Do you know what a WPAC is?

Future Water Literacy Programs: Future programs might start with raising awareness of what a watershed is and that everyone lives in a watershed, what a WPAC is and what people can do to contribute to watershed health.

Future Reassessments: Would want to see improvement in watershed awareness, knowledge, roles and responsibilities of WPACs and increased participation in watershed management activities.

Water Management (Supply and Allocation) System

Main findings: Respondents are aware that Alberta can be short of water at certain times in specific areas, and that water belongs to the Crown and most withdrawals must be licenced. Only a third of respondents indicated if they thought that the GoA allocates water fairly and effectively. Questions for this topic had a large neutral response, indicating that respondents do not have sufficient information to answer. Few respondents have engaged in an action related to this topic.

Q22: I believe the GoA manages and allocates our available water supply effectively and fairly to meet a variety of social, economic and ecological needs.

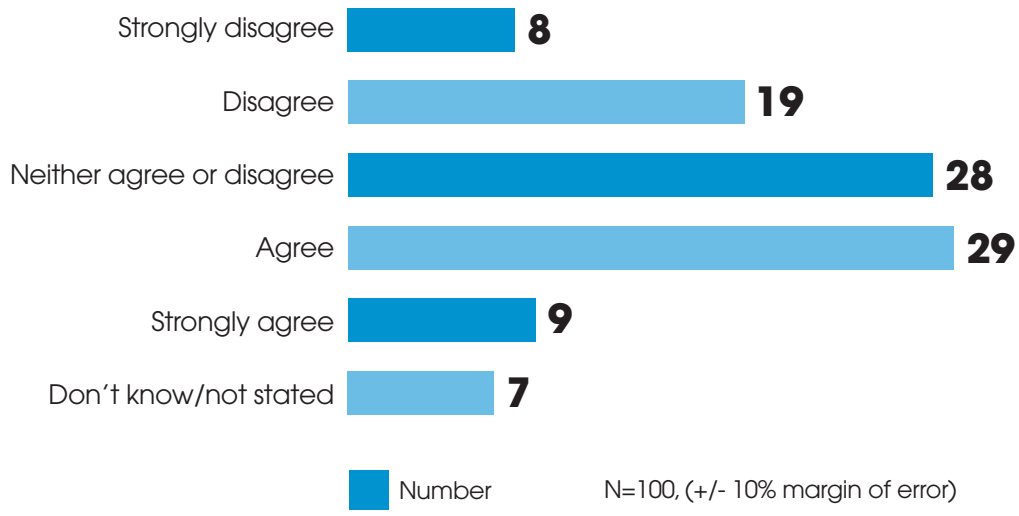

Figure 10: Attitudes about Alberta's Water Management System

Future Water Literacy Programs: Future programs would inform Albertans about how water is allocated, how much is actually used and what our water supply and demand is. In this survey, few respondents knew where they could go for more information and how they can get involved in activities related to this topic.

Future Reassessments: Would want to see improvement in awareness and knowledge about water allocation and water use, and actions that Albertans can take to help.

Sector Water Use

Main findings: Respondents have very poor knowledge about sector water use but strongly believe all sectors should conserve water. One question asked respondents who uses the most water in Alberta. Only 17% gave the correct answer, which was "irrigation". Almost half of respondents answered that it was "oil and gas".

Q26: Many sectors require water in different amounts for different purposes. Who or what sector do you believe uses the most water in Alberta?

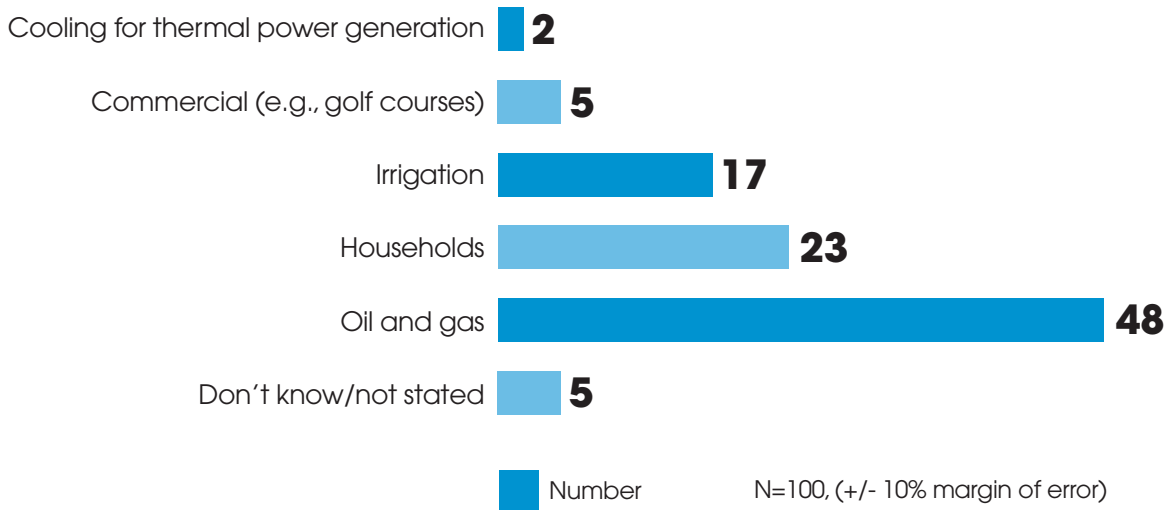

Figure 11: Sector Water Use Knowledge

Future Water Literacy Programs: Future programs might focus on informing about the volume of available water, volume of water used and what sectors are doing to conserve water.

Future Reassessments: Would want to see improvement in awareness and knowledge about sector water use.

CASE STUDY 4 — LAKEWATCH

LakeWatch is a water quality monitoring program offered to Albertans who are interested in collecting information about their lake or reservoir. This program provides an important source of data for lake and watershed stewardship groups, local government, provincial government, researchers, lake users and cottage owners. The program arose from a partnership between the GoA and the Alberta Lake Management Society (ALMS).

Stage 1 — Research

LakeWatch strives to accomplish four primary objectives: (1) act as a platform for educating lake users about the aquatic environment; (2) foster and enhance public involvement in lake management; (3) facilitate linkages between aquatic scientists and lake users; and (4) provide reliable water quality data at significant cost savings. ALMS has ensured that collected data are reliable through: (1) a partnership with AEP to train summer staff; (2) routine preparation, calibration, cleaning and servicing of equipment; (3) incorporating quality assurance and quality control protocols ; and (4) data verification and validation by technical experts. LakeWatch data have been used to describe the aquatic environment by the Cold Lake Beaver River Water Management Plan, Lac La Nonne and Moose Lake State of Watershed Report, the Pine Lake Restoration Program and AEP lake trend assessments. ALMS strives to make LakeWatch a fun and rewarding experience because they recognize that volunteers' time is valuable.

Stage 2 — Design

Each year ALMS receives requests to have different lakes sampled. Requests are prioritized based on the amount of historical data available for that lake, volunteer availability and urgency. ALMS selects ten lakes that meet priorities, ten lakes in the Lakeland Industry and Community Association boundaries, five lakes in provincial parks and a few additional lakes for a fee. ALMS staff also participates in lake education events.

Stage 3 — Implement

After receiving a welcome package, volunteers with boats take ALMS technicians to collect data following GoA protocols. ALMS technicians assist volunteers to test each lake five times during the summer, collecting important physical data such as water temperature, clarity, a suite of water chemistry parameters and invasive species. Once all the data for the lake are collected, a LakeWatch Report is produced, which summarizes data in an easy-to-understand manner. LakeWatch Reports can be used to educate users, and to guide water restoration and management efforts. Recently, lake tributary sampling was added to the program to assist in developing lake nutrient budgets.

Stage 4 — Evaluate

At the end of each sampling season, ALMS asks volunteers to complete a short online survey. This survey is a good method to obtain feedback on the LakeWatch program. They also have a volunteer-of-the-year recognition program. LakeWatch has been a highly successful program, collecting rigorous water quality data since 1996. ALMS has made 281 visits to monitor water quality at 107 Alberta lakes over multiple years.

Drinking Water, Wastewater and Groundwater

Main findings: Respondents have good awareness of where their drinking water comes from and where their wastewater goes. They feel confident that they could get information about drinking water sources and wastewater. Respondents were unsure about some groundwater facts (e.g., contamination).

Q28: From which of the following sources does your drinking water come? (choose all that apply)

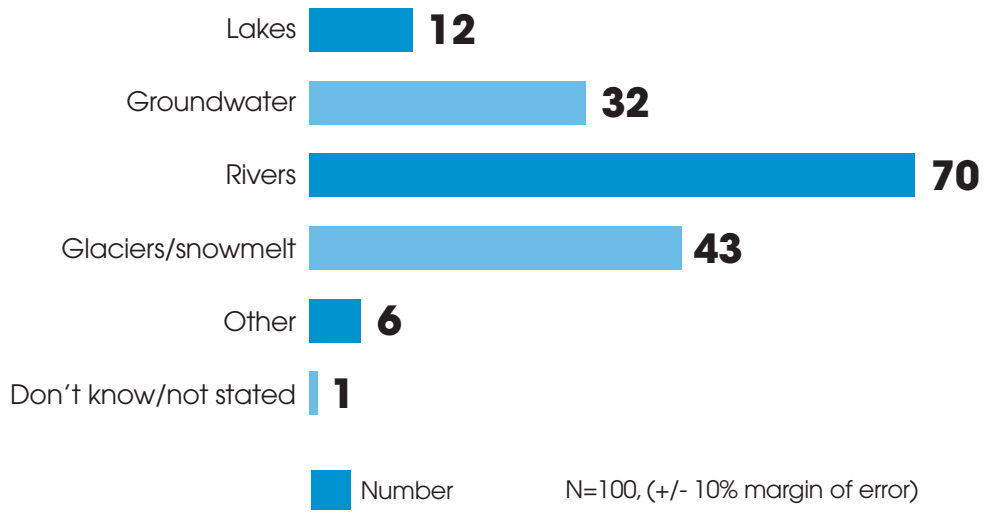

Figure 12: Drinking Water Awareness and Knowledge

Q29: I am aware of where/how my wastewater and stormwater are returned to surface water sources (such as a river)?

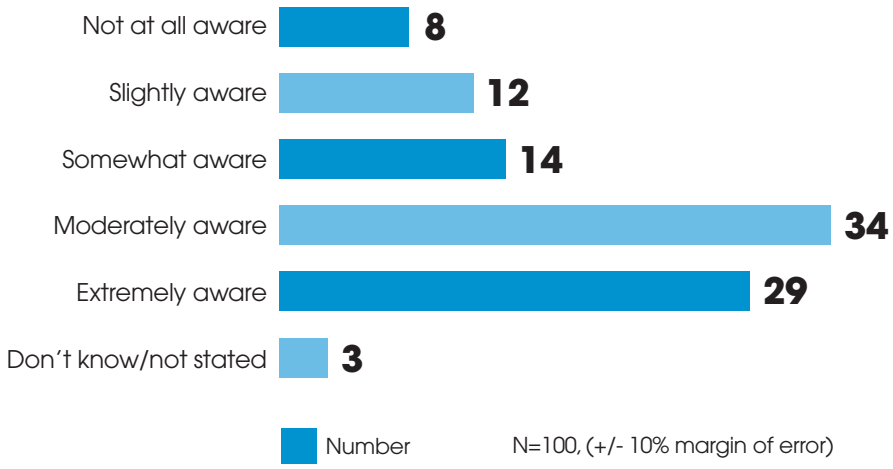

Figure 13: Wastewater Awareness and Knowledge

Q36: I believe the biggest contamination threat to Alberta's groundwater is (choose one):

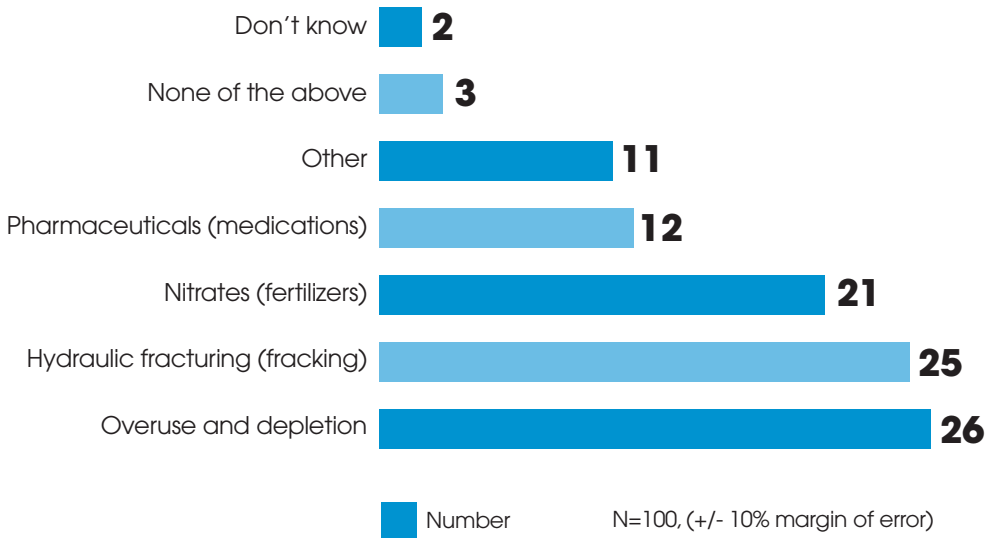

Figure 14: Groundwater Contamination Awareness and Knowledge

Future Water Literacy Programs: Future programs might focus on explaining groundwater resources, and the issues and cost associated with safe drinking water, wastewater treatment and developing appropriate infrastructure.

Future Reassessments: Would want to see improvement in skills towards calculating water use, finding information about drinking water, wastewater and groundwater and taking action to conserve water.

To review all results of the assessment see the consultant's report online at http://awchome.ca/Projects/WaterLiteracy/tabid/199/Default.aspx.

4.4 Learnings and Next Steps

To measure changes in water literacy levels among Albertans over time, a baseline should be established, followed by repeated assessments at periodic intervals. This would help determine what Albertans have learned, compare achievements to the agreed-upon program goals and identify ways to improve programs. It could also help determine success of a program in meeting learning needs, identify appropriate changes to learner goals based on progress, and establish the progress of learners for accountability purposes.

Feature Water Literacy Practitioner: Alberta Lake Management Society

The Alberta Lake Management Society is a not-for-profit organization that promotes understanding and comprehensive management of lakes and reservoirs, and their watersheds. Through a number of programs such as LakeWatch, Alberta Water Quality Awareness Day, Invasive Aquatic Plants and others, water literacy is a key component of their work. For more information, see: http://alms.ca/

A number of best practices were identified to guide practitioners as they design, deliver and evaluate a program. Such practices could also be applied when evaluating a program using the results of an assessment (see Section 3).

The consultant provided the following observations and guidance for using the tool and improving its accuracy in future assessments.

- Funding was provided by AEP to assess 100 individuals, who reflected a geographic cross-section of Albertans. However, breaking down the sample into smaller demographic groups (e.g., based on age or education) proved difficult. In general, the sample was sufficient to provide a confidence interval (margin of error) of +/- 10%.
- The sample focused on geographic distribution and recruited men and women equally, with differences linked to gender noted in the consultant's report. The age range included few respondents under the age of 39. To

reflect literacy levels of younger Albertans, it is recommended that this tool survey the 18 to 39 age group for future assessments.

- Participants may be recruited in various ways. Some researchers have found that advertisements in publications such as "The Coffee News" and newspapers get good responses. Recruiting at events via a dedicated information booth or advertising the survey as part of an existing booth has been effective. Discussing the survey and asking for participants on local radio and call-in shows has also been successful. All of these approaches could be used to recruit participants for future surveys.
- Although the full assessment tool used in this study is quite long, it was constructed to be administered in pieces; for example, a group interested in literacy related to lake management could ask only those questions plus demographic questions. In future, the tool could be administered one topic at a time.

The assessment tool created for this project is intended to be used for informational purposes. The tool is not exhaustive in the topics it covered and does not provide insights beyond specific questions. The results may not indicate an Albertan's water literacy level as a whole, given the small sample size and topics; rather they provide a snapshot at one point in time.

Depending on resources, capacity and priorities, practitioners could use this tool as a starting point to support other assessment activities. Building on the work described in this project, a practitioner could assess a single water topic or a number of water topics. In each case, the first step should be to create a baseline using one or more of the water topics selected in this project and then develop further questions for an in-depth assessment. A practitioner should strive to sample a wider geographic and demographic to lower the margin of error. The second step would entail reassessment at periodic intervals, using the same water topic(s) assessed in the baseline study. Future reassessments would determine if awareness and knowledge of Albertans on the topic(s) increased or decreased, if attitudes changed, if more skills were being adopted and if more actions were being taken.

With these findings, practitioners could improve their programs to address gaps. With better education and outreach programs, Albertans would have an opportunity to become better stewards and participate more effectively in consultation processes on the selected water topic(s). The tool could also be used to assess Albertans on entirely different water topics.

CASE STUDY 5 — LIVING BY WATER

Living by Water (LBW) a national initiative developed in 1997 by two British Columbian waterfront residents. This unique educational program is designed to help waterfront residents apply environmentally friendly practices on their property to maintain shoreline and water health. Since 1999, under the direction of Nature Alberta — a not-for-profit, registered charitable organization — LBW has been operating in Alberta to provide information to residents about the basics of shoreline living.

Stage 1 — Research

Cumulative negative effects due to all property and water-based activities help to accelerate the deterioration of the lake, whereas, the cumulative adoption of beneficial practices could go a long way to improve conditions at Alberta lakes. LBW encourages shoreline residents to respect the role shoreline habitats play in the enjoyment of their everyday lives. Users have a shared responsibility to recognize the potential impacts their activities have on aquatic systems both above and below the high water line.

Stage 2 — Design

While LBW staff participate in many educational activities, home site consultations are the core activity offered to interested shoreline residents. Through the free and confidential home site consultations, LBW informs residents about the ecology of their lake and the associated environmental concerns, and gives recommendations for how residents can reduce their impact on the lake.

Stage 3 — Implement

Throughout the summer cabin season, staff attend local lake events to recruit and sign up home site residents. A home site consultation is scheduled and the staff person shows up at the designated time. The staff person and the resident(s) then walk through a set evaluation including the yard, cabin, shoreline, septic system and other components on the property that could affect the lake ecosystem.

Stage 4 — Evaluate

To date, Nature Alberta has completed 768 consultations at 30 lakes throughout Alberta. In 2014, staff visited 112 households at Pigeon Lake, Sylvan Lake, Lesser Slave Lake, Island Lake, Wizard Lake, Crimson Lake, Lake Isle, Gull Lake, Hubbles Lake, Jackfish Lake, Lac Ste. Anne and Buffalo Lake. After each home site visit, residents are provided with a written report and additional information about issues identified during the visit and are asked to submit a satisfaction survey about the visit. LBW was recognized with an Emerald Award in 2014.

5.0 Key Findings and Recommendations

Based on the findings from this project, five recommendations were developed to improve water literacy in Alberta and inform the GoA's development of a provincial water literacy strategy.

Increase Collaboration among Water Literacy Practitioners

Key finding 1

Practitioners offer programs on a diversity of topics in various locations. However, a formal process does not exist to facilitate collaboration among practitioners and avoid duplication of efforts. A number of water portals and resources exist now (e.g., Alberta Water Portal,[27] Alberta Council for Environmental Education Resource Database[28]), and there is value in either enhancing these portals or creating one specifically to cultivate a water literacy community. A water literacy portal would enable networking, coordination and information sharing among practitioners. It could house accessible information about practitioners, programs, tools, resources, grants and events.

Recommendation 1

The Government of Alberta collaborate with partner organizations such as the Alberta Council for Environmental Education to improve the water literacy component of existing water portals, or develop a new interactive water literacy portal. These portals would promote water literacy tools, events, networking, collaboration and information sharing among water literacy practitioners and policy makers and should be in place by the end of 2017.

27 More information about the Alberta Water Portal is available online http://albertawater.com/. Accessed May 2016.

28 Alberta Council for Environmental Education. *Resource Database.* Available online at http://www.abcee.org/acee-resources-search. Accessed May 2016.

Provide Tools and Knowledge to Assess Program Success and Effectiveness

Key finding 2

Some practitioners did not measure the success and/or effectiveness of programs, as they did not know how or they lacked the skills or resources. Assessed Albertans demonstrated higher levels of awareness and knowledge but lower levels of skills and actions. Practitioners require more tools, guidance and resources to assess programs. Using the list of best practices (Section 3), train the trainer workshops and a guidebook with a supporting toolbox should be developed. Funders can require and encourage that program success and effectiveness be measured when they issue a grant.

Recommendation 2

The Government of Alberta work with partner organizations to build on existing work and develop new tools to assist water literacy practitioners in designing, delivering and evaluating the success and effectiveness of programs, by the end of 2018.

Better Align Topics, Audiences, Delivery Areas and Methods

Key finding 3

Water literacy programs cover a variety of topics, target audiences and delivery areas but gaps still exist in the concerns and issues addressed, and where and to whom the programs are delivered. The assessment revealed a low level of awareness and knowledge among Albertans on some basic water topics. For example, knowledge about the role of First Nations treaty rights, water allocation, and federal agreements in national parks and reserves was lacking and is fundamental for improving water literacy. Water literacy products and programs or a "Water 101 campaign" in the form of books, information kits, posters, websites and social media among other methods

could help build this foundation. The booklet Facts about Water in Alberta[29] produced by the GoA was an excellent start, and additional similar materials are needed. The gaps identified in this report require further examination.

Recommendation 3

Between now and the end of 2018, the Government of Alberta work with partner organizations such as Watershed Planning and Advisory Councils and others to:

a) improve the dissemination of existing water literacy products and programs

b) develop products and programs to inform Albertans on basic water topics to address gaps identified in this report

Strengthen Capacity among Water Literacy Practitioners

Key finding 4

The diversity, consistency and quantity of funding were common challenges encountered by not-for-profit practitioners. Funding constraints hinder design, delivery and evaluation of programs due to limited staff numbers, expertise and training opportunities. New types of resources, approaches and funding should be examined and implemented over time. This could be in the form of new grants, in-kind support, or other types of incentives to support program development and delivery by water literacy practitioners. Funding should support the recommendations in this report for improving water literacy in Alberta, particularly programs that address gaps in knowledge, topic areas and target audiences.

29 Government of Alberta. 2002. *Facts about Water in Alberta.* Available online: http://environment.gov.ab.ca/info/library/6364.pdf. Accessed May 2016.

Recommendation 4

The Government of Alberta and partner organizations annually assess their distribution of funding and resource support to ensure supported initiatives are improving water literacy in Alberta through effective program planning and evaluation.

Assess Water Literacy among Albertans

Key finding 5

Assessments can provide practitioners with information on what Albertans know about water and what topics they need to learn more about to make them better water stewards and participants in discussions about water use and management. A baseline of information can be created and then reassessments would determine if the awareness and knowledge of Albertans on the various topics have increased or decreased, if attitudes have changed, if more skills were adopted and if more actions were taken. Practitioners who conduct assessments should share findings, lessons learned and successes with others. These findings could be shared via the water portal (recommendation one) or at water literacy related events (e.g., workshops, meetings or symposiums). The GoA has committed to collecting, collating, assessing and annually sharing assessment data with AWC members and practitioners to track trends and improve program design, delivery and evaluation.

Recommendation 5

The Government of Alberta and partner organizations use the assessment tool described in this report through outreach and engagement activities to inform water literacy program design, delivery and evaluation.

6.0 Conclusion

Using the water literacy ladder as a guide, this project revealed that most of the identified programs in Alberta focus on cultivating awareness and knowledge of water topics in concentrated delivery areas. Programs focused less on fostering skills and collective action. Additionally, a number of essential topics and audiences were missing. The assessment of Albertans mirrored similar trends in other studies where respondents were more aware of and knowledgeable about some topics, but less equipped with the skills to take collective action; Albertans also shared their attitudes on the various topics assessed. If the goal is for Albertans to develop skills and take more action to protect and conserve water resources, practitioners need to design and deliver programs that focus on filling gaps in water topics, building skills and encouraging collective action. To improve water literacy efforts, practitioners should increase collaboration; develop and share tools and knowledge for program assessment; and better align topics, audiences, delivery areas and methods. Moreover, strengthening practitioner capacity and assessing water literacy among Albertans can enhance program planning, design and delivery efforts.

Appendix A: Water Literacy Project Team Terms of Reference

Approved by the Alberta Water Council on March 20, 2014. All sections amended on October 30, 2014 and March 19, 2015.

CONTEXT

- The Water Literacy initiative originated from a statement of opportunity (SoO) brought forward to the Council by the GoA, AEP. The Council identified this initiative as a potential Council project at the October 2013 board meeting and established a Working Group to further define the scope of a potential project.
- Water Literacy is an important component of the *Water for Life* strategy as it states that "Albertans will have access to the knowledge needed to achieve safe drinking water, healthy aquatic ecosystems, and reliable, quality water supplies for a sustainable economy."
- Water literacy is also the foundation for successful education and outreach efforts and for informed policy input to Government by the public. In the recently conducted GoA-led water conversation, Albertans identified the need to raise water literacy levels to allow them to contribute meaningfully to water management issues and to build capacity for water stewardship.
- AEP's Education and Outreach Section is developing a water literacy strategy to addresses key AEP water related outcomes through education and awareness. AEP is seeking advice on existing products, programs, assessments and research as well as gaps and opportunities for improving water literacy. The Council's multi-stakeholder membership can support gathering this advice from many stakeholders.

STRATEGIC INTENT (GOAL)

The purpose of this initiative is to enhance knowledge of, and provide recommendations for, improved water literacy in Alberta.

OBJECTIVES

- Improved understanding of existing organizations with water literacy programs, products, assessments or research in Alberta, and/or similar resources available to Albertans from other jurisdictions.
- Improved understanding of successful approaches or best practices to assessing and enhancing water literacy.
- Developed a tool, delivery approach, and assessed a sample of Albertans' water literacy
- Recommendations on improving water literacy in Alberta

KEY TASKS

The Project Team will:

- Build a work plan and operate according to its timelines and tasks.
- Provide regular updates to the Council
- Conduct a survey to inventory existing water literacy organizations and the programs, products, assessments and research they provide
- Compile a list of water literacy current approaches or best practices identified from the survey and elsewhere
- Engage a consultant to assist with:
  - Designing a valid water literacy assessment tool
  - Developing an approach to assess water literacy levels among Albertans geographically and demographically
  - Assessing a sample of Albertans on water literacy
- Develop a report and recommendations to Council on opportunities and gaps for improving water literacy in Alberta.

Timelines and Deliverables

■ Revised ToR	October 2014
■ Revised ToR and update on survey findings and successful approaches	March 2015
■ Update on assessment work	June 2015
■ Draft recommendations	October 2015
■ Final report and recommendations	March 2016

POTENTIAL MEMBERSHIP

Industry:

- Irrigation
- Oil and Gas
- Power Generation
- Mining

Government:

- Large Urban
- Small Urban
- Rural
- First Nations
- Metis

Non-Governmental Organizations:

- Environmental
- Lake Environment Conservation
- Watershed Planning and Advisory Councils
- Technical Services Advisory Group

Government of Alberta and Provincial Authorities:

- Alberta Environment and Parks
- Alberta Agriculture and Forestry
- Alberta Energy
- Alberta Health
- Alberta Municipal Affairs

The Project Team will operate in a manner that is consistent with the rules, policies and procedures adopted by the Alberta Water Council, including the use of consensus to make decisions in a multi-stakeholder process.

BUDGET

The Working Group estimates a total budget of $85,000, broken down as follows:

Core Funding Costs (covered by Alberta Water Council):

Stakeholder support	$	42,000
Hosting	$	5,500
Communications Support	$	7,500
Project Funding Costs (covered by stakeholders)	$	30,000

Appendix B: Team Members and Acknowledgements

The Alberta Water Council acknowledges the contributions of the following working group and project team members who volunteered their time and expertise on this project, as well as the organizations they are affiliated with:

Members

Al Kemmere	Alberta Association of Municipal Districts and Counties
Amanda Doyle	(First Nations) Technical Services Advisory Group
Arin MacFarlene-Dyer	Alberta Lake Management Society
Christina Pickles	Alberta Council for Environmental Education
Dan Moore	Alberta Newsprint Company
Deanna Cottrell	Shell Canada
Harpreet Sandhu	City of Calgary
Janice Dewar	City of Edmonton
Janine Higgins	Alberta Environment and Parks
Jay White	Alberta Lake Management Society
Jennifer Makar	City of Calgary
Kim McLeod	Alberta Environment and Parks
Kathy Worobec	Alberta Council for Environmental Education
Lynn Robb	Trout Unlimited Canada
Michelle Muller	City of Calgary
Naomi Achus	Alberta Health
Ron McMullin	Alberta Irrigation Projects Association
Sarah Skinner	Battle River Watershed Alliance
Sharina Kennedy	Alberta Environment and Parks
Sharon McKinnon	Crop Sector Working Group

Susanna Bruneau	Battle River Watershed Alliance
Sylvia Trosch	City of Calgary
Tasha Blumenthal	Alberta Association of Municipal Districts and Counties
Ted Harms	Alberta Agriculture and Forestry
Vanessa Higgins	Strathcona County
Petra Rowell	Alberta Water Council
Anuja Ramgoolam	Alberta Water Council

This work would not have been possible without the financial support of Alberta Environment and Parks, who provided a grant to cover the costs of hiring a consultant to assist the team in developing and delivering the water literacy assessment tool.

The AWC would also like to thank the many volunteers who took the time to fill out the electronic survey that informed this project.

Appendix C: List of Alberta Watershed Planning and Advisory Councils

1. Athabasca Watershed Council
   http://www.awc-wpac.ca
2. Battle River Watershed Alliance
   http://www.battleriverwatershed.ca
3. Beaver River Watershed Alliance
   http://beaverriverwatershed.ca
4. Bow River Basin Council
   http://brbc.ab.ca
5. Lesser Slave Watershed Council
   http://lesserslavewatershedcouncil.ca
6. Mighty Peace Watershed Alliance
   http://www.mightypeacewatershedalliance.org
7. Milk River Watershed Council Canada
   http://www.mrwcc.ca
8. North Saskatchewan Watershed Alliance
   https://www.nswa.ab.ca
9. Oldman Watershed Council
   http://oldmanwatershed.ca
10. Red Deer River Watershed Alliance
    http://www.rdrwa.ca
11. South East Alberta Watershed Alliance
    http://seawa.ca

www.awchome.ca