

# Clean, Safe, and Reliable Drinking Water



An Update on  
Drinking Water  
Protection in BC and  
the *Action Plan for  
Safe Drinking Water  
in British Columbia*



Office of the  
Provincial Health Officer

Provincial Health Officer's Drinking  
Water Report: 2012/13-2016/17

## Front cover captions:

**(Left)**

**Seymour-Capilano filtration plant  
in North Vancouver.**

*Photo credit: Metro Vancouver.*

**(Middle)**

**Comox Lake on north Vancouver Island.**

*Photo credit: Zoe Norcross-Nu'u, Comox Valley  
Regional District.*

**(Right)**

**Kamloops Centre for Water Quality, Primary  
mixing floor, aeration, and clean water piping.**

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Ministry of Health  
Victoria, BC

June 2019

The Honourable Adrian Dix  
Minister of Health

Dear Minister:

I have the honour of submitting the Provincial Health Officer's report, *Clean, Safe, and Reliable Drinking Water: An Update on Drinking Water Protection in BC and the Action Plan for Safe Drinking water in British Columbia*, for the years 2012/2013 to 2016/2017.

Sincerely,

A handwritten signature in black ink, appearing to read "Bonnie Henry". The signature is written in a cursive, flowing style.

Bonnie Henry  
MD, MPH, FRCPC  
Provincial Health Officer





# Table of Contents

<b>List of Figures and Tables</b> .....	iv
<b>Acknowledgements</b> .....	viii
<b>Executive Summary</b> .....	x
<b>PART 1: Drinking Water–The BC Framework</b> .....	1
<b>Chapter 1: Introduction – Clean, Safe, Reliable Drinking Water</b> .....	2
1.1 Role and Mandate of the Provincial Health Officer .....	2
1.2 What is a Water Supply System? .....	3
1.3 The <i>Action Plan for Safe Drinking Water in British Columbia</i> .....	4
1.4 The Multi-barrier Approach to Drinking Water .....	7
1.5 Water System Data – New Indicator Project .....	8
1.6 Organization of Report .....	9
1.7 Conclusion .....	9
<b>Chapter 2: Roles and Responsibilities in Drinking Water Protection</b> .....	12
2.1 Federal, Provincial Government, and Other Agencies .....	12
2.2 Water System Suppliers and Operators .....	17
2.3 First Nations Water Systems .....	19
2.4 Conclusion .....	21
<b>Chapter 3: Types of Water Systems</b> .....	24
3.1 Types of Water Systems and New Water System Categories .....	25
3.2 Governance Opportunities and Challenges Faced by Specific Types of Water Systems .....	29
3.2.1 Municipalities and Regional Districts .....	29
3.2.2 Improvement Districts .....	29
3.2.3 Private Water Utilities .....	32
3.2.4 Water Users’ Communities .....	35
3.2.5 Independents and Good Neighbour Systems .....	38
3.2.6 Stand-alone Facility Water Systems .....	39
3.3 Water Systems in BC First Nations Communities .....	39
3.4 Conclusion .....	40
<b>PART 2: The Multi-barrier Approach–Key Elements</b> .....	45
<b>Chapter 4: Source Water Protection</b> .....	46
4.1 Legislation and Policy Frameworks .....	46
4.1.1 The <i>Drinking Water Protection Act</i> .....	47
4.1.2 The <i>Forest and Range Practices Act</i> .....	50
4.1.3 The <i>Environmental Management Act</i> .....	52
4.1.4 The <i>Water Sustainability Act</i> .....	56
4.1.5 Other Regulatory Updates to Protect Water Quality .....	59

<b>4.2 Guidelines, Objectives, and Best Practices</b> .....	60
4.2.1 Guidelines .....	60
4.2.2 Objectives .....	62
4.2.3 Policy Guidance and Best Practices .....	62
<b>4.3 Source Water Monitoring</b> .....	64
4.3.1 Ambient Water Quality and Quantity Monitoring .....	64
4.3.2 Forest and Range Evaluation Program .....	65
<b>4.4 Partnerships and Inter-agency Coordination</b> .....	67
4.4.1 Regional Drinking Water Teams .....	67
4.4.2 Drinking Water Leadership Council .....	68
4.4.3 Inter-Ministry Groundwater Technical Team .....	68
4.4.4 Water Policy and Legislation Committee .....	68
4.4.5 <i>Water Act</i> Modernization Cross-government Directors Committee .....	68
4.4.6 Inter-ministry Agriculture-Environment-Health ADMs' Committee .....	69
4.4.7 Northeast Water Strategy .....	69
4.4.8 Inter-agency Drought Working Groups .....	69
4.4.9 Ad hoc Water Quality Issues Committees .....	71
4.4.10 Transboundary Watershed Task Groups .....	73
<b>4.5 Research, Science, Technology, and Information Management Systems</b> .....	74
4.5.1 Research .....	74
4.5.2 Information Management and Information Technology .....	76
<b>4.6 Public Engagement and Education</b> .....	79
<b>4.7 Conclusion</b> .....	82
<b>Chapter 5: Drinking Water Treatment and Distribution</b> .....	90
<b>5.1 Treatment Facility Performance Standards and Design</b> .....	90
5.1.1 Treatment Performance Standards .....	90
5.1.2 Facility Treatment and Distribution Design Standards and Guidelines .....	93
<b>5.2 Distribution System Design and Integrity</b> .....	96
5.2.1 Cross-connection Control .....	97
5.2.2 Secondary Disinfection .....	98
5.2.3 Distribution System Maintenance Plans and Procedures .....	99
5.2.4 Corrosion Control .....	100
5.2.5 Lead in Drinking Water .....	100
<b>5.3 Conclusion</b> .....	108
<b>PART 3: Total Quality Management</b> .....	113
<b>Chapter 6: Operations and Management</b> .....	114
<b>6.1 Good Operations</b> .....	114
6.1.1 Operating Permits .....	114
6.1.2 Facility Classification and Operator Certification .....	115
6.1.3 Operator Recruitment and Training .....	122
6.1.4 Standard Operating Procedures .....	124
<b>6.2 Good Management</b> .....	125
6.2.1 Asset Management and Financial Planning .....	125
6.2.2 Activities to Promote and Support Good Asset and Financial Management .....	126
6.2.3 Full-cost Accounting .....	129
6.2.4 Funding Programs .....	130
<b>6.3 Conclusion</b> .....	131
<b>Chapter 7: Monitoring and Reporting</b> .....	136
<b>7.1 Source Water Quality Monitoring</b> .....	136
<b>7.2 Performance Monitoring</b> .....	136
7.2.1 Secondary Disinfectant Residual Monitoring .....	136
<b>7.3 Water Quality Compliance Monitoring</b> .....	137
7.3.1 Bacteriological Monitoring .....	137
7.3.2 Chemical/Radiological Water Quality Testing .....	138

<b>7.4 Approved Laboratory Testing</b> .....	139
7.4.1 Laboratory Approvals and Audits .....	139
7.4.2 Laboratory Testing of Drinking Water Samples.....	141
<b>7.5 Drinking Water Quality Monitoring in First Nations Communities</b> .....	144
<b>7.6 Annual Water Supply System Reports</b> .....	145
<b>7.7 Public Notification of Drinking Water Quality Concerns</b> .....	145
7.7.1 Drinking Water Advisories in BC First Nations Communities.....	151
<b>7.8 Waterborne Disease Surveillance</b> .....	152
<b>7.9 Conclusion</b> .....	154
<b>Chapter 8: Abatement and Enforcement</b> .....	158
<b>8.1 Drinking Water Program Resources</b> .....	158
<b>8.2 Drinking Water Inspections and Investigations</b> .....	160
8.2.1 Drinking Water System Inspections .....	160
8.2.2 Complaints and Investigations.....	165
<b>8.3 Enforcement and Reviews</b> .....	165
8.2.3 Enforcement Activities.....	165
8.2.4 Reviews and Reconsiderations .....	166
<b>8.4 Conclusion</b> .....	167
<b>PART 4: Small Water Systems in BC</b> .....	171
<b>Chapter 9: Small Water Systems in BC</b> .....	172
<b>9.1 Supporting Sustainable Small Water Systems in BC</b> .....	172
9.1.1 Flexible Options for Small Water Systems .....	172
9.1.2 Capacity Building .....	176
9.1.3 Inter-agency Collaboration .....	180
9.1.4 Sustainable Small Water System Development .....	181
<b>9.2 Bulk Water Delivery</b> .....	184
9.2.1 Bulk Water Haulers in BC.....	184
<b>9.3 Conclusion</b> .....	187
<b>PART 5: Discussion and Recommendations</b> .....	193
<b>Chapter 10: Discussion and Recommendations</b> .....	194
<b>10.1 Summary of Progress on the Action Plan for Safe Drinking Water in British Columbia</b> ....	194
10.1.1 Areas of Progress .....	194
10.1.2 Areas of Challenge.....	195
<b>10.2 Recommendations: Setting Strategic Priorities in Drinking Water Protection</b> .....	195
10.2.1 Governance of Drinking Water Protection .....	196
10.2.2 Legislative and Policy Frameworks to Protect Drinking Water .....	196
10.2.3 Evaluation and Accountability of Program Activities .....	197
10.2.4 Small Water System Governance and Sustainability .....	198
10.2.5 Elements of the Multi-barrier Approach – Specific Recommendations .....	199
<b>10.3 Conclusion</b> .....	201
<b>Appendix A: Glossary</b> .....	202
<b>Appendix B: Drinking Water Protection Program Committees</b> .....	210
<b>Appendix C: Training Programs for Small Water System Operators (2012/13-2016/17)</b> .....	212
<b>Appendix D: Update on the 2015 Recommendations on the Action Plan for Safe Drinking Water in British Columbia</b> .....	218



# List of Figures and Tables

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## Chapter One: Introduction – Clean, Safe, Reliable Drinking Water

Figure 1.1	Structure of Drinking Water Reporting .....	3
Figure 1.2	Principles for Drinking Water Protection .....	4
Figure 1.3	The Multi-Barrier Approach to Safe Drinking Water .....	7
Table 1.1	New Drinking Water Indicators of the Multi-barrier Approach .....	8

## Chapter Two: Roles and Responsibilities in Drinking Water Protection

Table 2.1	Legislation That Supports Drinking Water Protection and Agency Responsible .....	12
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## Chapter Three: Types of Water Systems

Figure 3.1	Number of Improvement Districts, by Number of Connections, BC, 2017 .....	31
Figure 3.2	Number of Private Water Utilities, by Number of Authorized Lots Served, BC, March 2017 .....	33
Figure 3.3	Location of Private Water Utilities, October 2017 .....	34
Figure 3.4	Location of Water Users' Communities in BC, October 2017 .....	36
Table 3.1	The Number of Small and Large Water Systems, by Health Authority, as of March 31 <sup>st</sup> , 2013 to 2017 .....	24
Table 3.2	Water System Categories Based on the Size of the Population Served .....	25
Table 3.3	Water System Categories Based on the Source Type that Serves the System .....	25
Table 3.4	Water System Categories Based on the Type of Community Water System.....	26
Table 3.5	Water System Categories Based on Type of Stand-alone Facility Water System .....	28
Table 3.6	Number of Improvement Districts, by Health Authority, BC, 2017.....	30
Table 3.7	Categories of First Nations Drinking Water Systems, BC.....	39

## Chapter Four: Source Water Protection

Figure 4.1	Primary Legislation for Source Water Protection in BC .....	47
Figure 4.2	<i>Water Sustainability Act</i> Regulations At-a-Glance .....	58
Figure 4.3	Water Quality Impact Rating, Sampled Sites, BC, 2012-2016.....	65
Figure 4.4	Provincial Inter-agency Drought Response Plan and Working Groups, 2017 .....	70
Figure 4.5	Status of Aquifer Mapping in BC.....	77
Table 4.1	Key Compliance Tools Under the BC <i>Environmental Management Act</i> .....	53
Table 4.2	Key Compliance Tools Under the <i>Water Sustainability Act</i> .....	57

Table 4.3	Guidelines and Guidance Documents Released 2012-2016 .....	60
Table 4.4	Status of Regional Drinking Water Teams .....	66
Table 4.5	Resource Practices Branch Funded Research Projects Undertaken by the University of British Columbia – Okanagan, 2015 to 2017 .....	74
Table 4.6	Ministry of Agriculture Source Water Protection Tools .....	79
Table 4.7	Public Engagement and Education Tools .....	80

## Chapter Five: Drinking Water Treatment and Distribution

Table 5.1	Drinking Water Treatment Objectives (Microbiological) for Surface Water .....	91
Table 5.2	Drinking Water Treatment Objectives (Microbiological) for GARP-Viruses .....	91
Table 5.3	Test Results, Lead in Drinking Water, Public School Facilities, by School District, BC, April 2016 to March 2017 .....	104
Table 5.4	Regional Health Authority Plans and Activities to Address Lead in Drinking Water in Child Care Facilities, 2017 .....	106

## Chapter Six: Operations and Management

Figure 6.1	Number of New Classifications or Reclassifications issued per year, BC, 2012 to 2016 .....	117
Figure 6.2	Operator Certification Exams Taken, BC, 2012 to 2016 .....	119
Figure 6.3	Size of the Water and Wastewater Workforce, BC, 2015.....	122
Figure 6.4	Water and Wastewater Workforce, Age Distribution, BC, 2015 .....	122
Figure 6.5	Asset Management for Sustainable Service Delivery: A BC Framework.....	127
Table 6.1	Number of Water Systems with Operating Permits, without Operating Permits, and with Conditions on Operating Permits, by Health Authority, BC, 2013/14.....	115
Table 6.2	Number of Water Treatment and Water Distribution Facilities, by Level of Classification, BC, 2013 to 2017.....	116
Table 6.3	Number of Certified Water Distribution and Water Treatment Operators by Certification Level, BC, 2013 to 2017 Calendar Year.....	118
Table 6.4	Number and Percentage of Water Systems with an Accepted Emergency Response and Contingency Plan, by Health Authority, BC, 2012/13 to 2016/17 .....	124
Table 6.5	Activities to Promote and Support Good Asset and Financial Management .....	127
Table 6.6	Funded Drinking Water Projects, BC, 2014/15 to 2016/17 .....	130

## Chapter Seven: Monitoring and Reporting

Figure 7.1	Number of Approved Laboratories, by Health Region, 2017 .....	140
Figure 7.2	Number of Drinking Water Samples Tested at BC Centre for Disease Control Public Health Laboratory, by Month, 2014/15 to 2016/17 .....	143
Figure 7.3	Percentage of Drinking Water Samples Tested at BC Centre for Disease Control Public Health Laboratory that Were Positive for <i>E. Coli</i> , by Month, 2014/15 to 2016/17 .....	143
Figure 7.4	Percentage of Wasted Drinking Water Samples Tested at BC Centre for Disease Control Public Health Laboratory, by Month, 2014/15 to 2016/2017 .....	144
Figure 7.5	Number of Drinking Water Advisories Issued and Resolved within each fiscal year, BC, 2012/13 to 2016/17 .....	148
Figure 7.6	Water Systems on Boil Water Notice, 2007 Cohort, Interior Health, 2007 to 2015 .....	151
Figure 7.7	Annual Enteric Disease Rates, BC, 2007 to 2016 .....	153

Table 7.1	Number and Percentage of Water Systems Meeting Sampling Frequency Requirement 90% of the Time, BC, 2012/13 to 2016/17 .....	138
Table 7.2	Number of Water Samples Submitted, and Number and Percentage of Wasted Samples and Positive <i>E. coli</i> Reports, BC, 2012/13 to 2016/17 .....	142
Table 7.3	Number of Drinking Water Advisories in Effect as of March 31, by Advisory Type and Health Authority, BC, 2013 to 2017 .....	147
Table 7.4	Reported Cases of Enteric Disease, BC, 2007 to 2016 .....	152

## Chapter Eight: Abatement and Enforcement

Figure 8.1	Number of Full-time Equivalent Positions Working Within Health Authority Drinking Water Programs Compared to the Number of Permitted Water Systems, 2004/05 to 2016/17.....	160
Table 8.1	Number of Full-time Equivalent (FTE) Staff Appointed or Delegated the Duties of a Drinking Water Officer under the <i>Drinking Water Protection Act</i> , by Health Authority and Position, BC, on March 31, 2017 .....	159
Table 8.2	Drinking Water Inspection Frequency Targets, Regional Health Authorities .....	161
Table 8.3	Percentage of Drinking Water Systems Inspected and Meeting Inspection Frequency Targets, by Health Authority, BC, 2014/15 to 2016/17 .....	162
Table 8.4	Percent of Water Systems that Met Inspection Targets, by Risk Category, 2012/13 to 2013/14.....	164
Table 8.5	Percent of Water Systems Receiving an Inspection, by the Number of Connections, Vancouver Coastal Health Authority, 2012/13 to 2013/14.....	164
Table 8.6	Number of Enforcement Actions, by Health Authority, 2014/15 to 2016/17 .....	166
Table 8.7	Number of Requests for a Review by the Provincial Health Officer under Section 39.1 of the <i>Drinking Water Protection Act</i> , 2014/15 to 2016/17 .....	167

## Chapter Nine: Small Water Systems in BC

Figure 9.1	Bulk Water Haulers, Northern BC .....	186
Table 9.1	Exemptions for Non-potable Water Systems, by Health Authority, March 31, 2016, and March 31, 2017.....	173
Table 9.2	Small Water Systems Classification and Operators Certified by the Environmental Operators Certification Program (EOCP), BC, 2013 to 2017 .....	175
Table 9.3	Resources Provided by the Sustainable Infrastructure Society.....	177
Table 9.4	Guides and Online Tools for Small Water Systems.....	179
Table 9.5	Progress on the Deliverables of the 2014/15 ADM Committee on Small Water Systems ....	180
Table 9.6	Actions to Prevent the Proliferation of Unsustainable Water Systems.....	182
Table 9.7	Number of Bulk Water Haulers and Private Bulk Water Delivery Fill Stations, by Health Authority, BC, 2015/16 to 2016/17 .....	185



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# Executive Summary

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This report, produced by the Office of the Provincial Health Officer (PHO), serves as a transitional report and covers fiscal years 2012/13 through 2016/17. It provides an update on progress towards the *Action Plan for Safe Drinking Water in British Columbia* and introduces new indicators and a reporting structure for drinking water in BC that is consistent with a multi-barrier approach. The multi-barrier approach is a system of procedures, processes, and tools that collectively prevents or reduces the risk of contamination of drinking water from source to tap to reduce risks to human health.

Part 1 of this report introduces the new indicators and structure of this report, outlines the roles and responsibilities of the many agencies involved in drinking water protection, and describes the different types of water supply systems in BC. Part 1 also introduces some of the specific governance challenges facing local governments, improvement districts, utilities, water users' communities, and independent water systems. Part 2 centres on the three core elements of the multi-barrier approach: source protection, drinking water treatment, and drinking water distribution system integrity. These three core elements must be managed as a whole through an integrated system of total quality management, as no single element can guarantee clean, safe, and reliable drinking water on its own. Part 3 of this report covers the integrated system of total quality management, including good operations, proper management, and effective monitoring and reporting, which in turn relies on legislative and policy frameworks, guidelines, standards and objectives, research, science, and technology, public involvement, and awareness. This multi-barrier approach framework also depends on well-resourced and strategic enforcement and abatement

programs and policies. Part 4 describes the specific challenges facing small water systems and the initiatives to support them, and Part 5 offers recommendations to improve drinking water protection and oversight.

Information on drinking water and source supplies in BC remains decentralized, inconsistent, and difficult to access, which limits our capacity to report on the state of drinking water supplies in BC. The ability of regional health authorities to extract information from their data systems that is meaningful for measuring progress towards implementing the multi-barrier approach and providing safe drinking water continues to be limited. Recognizing these data limitations, the Office of the PHO initiated a project in 2014, in partnership with the health authorities and the Ministry of Health, to revise the way water systems are categorized and to create a new suite of indicators to better track progress in the implementation of the multi-barrier approach. This report recommends that regional health authorities complete data system modifications and data entry using the new categories and indicators introduced in this report within five years of its release.

Drinking water protection is complex and involves many different actors at the federal, provincial, and local level. Water is used for diverse purposes, and a variety of laws and rules govern its use, protection, conservation, and sustainability. While the *Drinking Water Protection Act* is the principal statute concerning drinking water protection in BC, many other statutes deal with matters of relevance to drinking water protection, including resource extraction, land use, and environmental practices. Many of these statutes, such as the *Forest and Range Practices*



*Act, Environmental Management Act, and the Water Sustainability Act, contain their own provision for drinking water protection, most particularly source water protection. The role of drinking water officers under the Drinking Water Protection Act complements the roles of statutory officials under these other statutes, and this act contains numerous provisions to balance respect for other statutory mandates while at the same time ensuring that protection of drinking water is achieved.*

A large number of water systems are regulated in BC under the *Drinking Water Protection Act*. As of March 31, 2017, there were 4,825 recorded water systems across the province, 91 per cent of which are small water systems (i.e., water supplies that serve less than 500 people in a 24-hour period). While most water systems in the province are small, the majority of the population in the province is served by a small number of larger, local government water systems known to provide clean, safe, and reliable drinking water.

Seventeen years have passed since the provincial government developed and released the 2002 *Action Plan for Safe Drinking Water in British Columbia* (the Action Plan). Important progress has been made on many of the solutions offered in the Action Plan. The Action Plan noted that strong, effective legislation was central to the goals of clean, safe, and reliable drinking water. The provincial government has since implemented a legislative framework for protecting drinking water that is supported by guidelines, objectives, best management practices, and policies. Since the Action Plan was established, the *Drinking Water Protection Act* and the *Water Sustainability Act* have been introduced.

Another area where progress has been made is in monitoring requirements. Basic monitoring requirements for microbiological indicators have been established in the *Drinking Water Protection Regulation*, and the monitoring that the environmental protection and resource ministries are responsible for continues to grow. Considerable work continues to be done to improve facility classification and compliance with training and certification requirements for drinking water operators. Treatment objectives for surface and groundwater systems are in

place and many water system and source assessment guidance documents have been developed. Project-focused, inter-agency work continues to happen, albeit in a limited way. The reporting and transparency of government actions and of enforcement and abatement programs have improved. Government and health agencies continue to invest in outreach and education for water system owners, operators, and users, particularly for small water systems with limited capacity. Considerable efforts have been made to promote asset management and financial planning, and funding programs for infrastructure and planning are in place, although much of the funding is available only to select systems.

While there has been much progress on many of the Action Plan solutions, challenges remain. One area of continued challenge is inter-agency coordination of resources to protect drinking water. The Action Plan called for coordination of resources to ensure clear lines of responsibility within government for various aspects of drinking water protection, source protection, land use planning, and infrastructure. The inter-agency groups tasked with facilitating this coordination and implementing the Action Plan (i.e., the Assistant Deputy Ministers' Committee on Water and the regional drinking water teams) have disbanded, and as a result there is no current inter-agency committee with this specific mandate. The signatory ministries to the Action Plan and the 2006 Memorandum of Understanding regarding inter-agency accountability and coordination on drinking water protection have also changed, along with shifts in portfolios, program responsibilities, and strategic priorities. While inter-agency committees have formed to create forums for advice on policy development within ministries, coordination of actions and resources among ministries remains a challenge given the jurisdictional complexity.

While several legislative and assessment tools to protect drinking water are now available, the processes required for their implementation has limited their use. For example, very few comprehensive source-to-tap assessments of water supplies have been completed due to the complexity and resources required to carry them out. While simpler tools have been created to address this problem, uptake of these tools is

unknown. Other source protection tools such as drinking water protection plans also remain untested due to the conditions that must be met for their application, thus limiting their use as a legislative tool. Statutory decision makers under the *Environmental Management Act* have tools to protect source waters, such as water quality guidelines and water quality objectives, but these guidelines and objectives are only enforceable where statutory decisions are required. The new *Water Sustainability Act* has introduced new tools described in this report to protect source supplies for drinking water, but many of these tools remain untested.

Most watersheds in BC are multi-use, but only 466 have been designated as community watersheds with the associated forestry and range management protections under the *Forest and Range Practices Act*. Drinking water officers work with water suppliers to develop source protection plans, but it remains unknown how many suppliers have formalized, accepted plans in place. While there are many examples of successful partnerships to identify hazards and develop a plan to respond to them, these plans do not necessarily have the framework to support and enforce them. Source protection plans are not legally binding, and water suppliers often do not have control over land use decisions within their watersheds. This type of situation can threaten the effectiveness of such plans when conflicts arise and not all stakeholders support the provisions in the plan.

Despite the high number of drinking water advisories in BC, the number of documented disease outbreaks and confirmed cases of illness associated with drinking water supplies remains low for a variety of reasons. Although there has not been a documented waterborne outbreak in BC in recent history, the public health risk from pathogens associated with consuming inadequately treated or poorly protected water remains a threat for many, making investments in source protection and drinking water infrastructure a necessary priority to protect public health.

Resources at the health authority and provincial level for abatement and enforcement programs to protect drinking water and source water remain stretched; this creates challenges in fulfilling the mandate to protect drinking water. Since the proclamation of the *Drinking Water*

*Protection Act* in 2003, the number of regulated drinking water systems has increased by 868.<sup>a,1</sup> Over this same period, the number of full-time equivalent (FTE) environmental health officers carrying out the functions of a drinking water officer has decreased from 60 FTEs to 50 despite the growing complexity of drinking water and governance challenges. This leaves, on average, 144 water systems that must be monitored and inspected per environmental health officer FTE. Similarly, there are, on average, 650 water systems per public health engineer in the province. Given the importance of clean, safe, and reliable drinking water and the increasing complexity and demands on drinking water protection programs across the province, a review of the program resources, legislative tools, guidance, and training to fulfill this mandate is necessary.

Efforts have been made to address small water system capacity through flexibility in regulations, training programs, and the development of user-friendly resources. However, many challenges for small water systems remain, largely due to resource and governance constraints. Transportation issues and access to approved laboratories continue to be a challenge in many rural and remote areas of the province. Regulatory backstops to prevent the proliferation of unsustainable small systems at the land development stage have not yet been developed, and in many areas of the province there is no strategy to incorporate failing water systems within a jurisdiction. While the number of drinking water advisories for BC remains high (603 as of March 31, 2017), slow and steady progress is being made to remove long-standing advisories. The majority of long-term advisories occur among small water systems, which often lack the resources, capacity, or willingness to invest in their aging infrastructure, or to install or operate the treatment necessary to provide potable water. Future reports will be able to explore in more detail the reasons behind advisories, their respective lengths, and the types of systems experiencing them.

This report offers 32 recommendations to further advance the protection of drinking water across BC. Recommendations 1 through 3, which are priority recommendations for the provincial government, pertain to the overall governance of drinking water. Recommendations

<sup>a</sup> On December 31, 2003, there were 3,957 recorded water systems (excluding First Nations systems) in BC.

4 through 7 suggest actions to improve the legislative and policy frameworks to protect drinking water. Recommendation 8 seeks to improve available data to strengthen program oversight and evaluation. Recommendations 9 through 12 suggest options for a strengthened strategic approach to address small water system challenges and governance challenges for both small and large water systems. Finally, recommendations 13 through 32 present actions to address specific areas of challenge identified with the multi-barrier approach to drinking water protection highlighted within this report.

## Recommendations

### Recommendation 1: Governance of Drinking Water Protection

Review the existing governance structure of drinking water protection to ensure clear lines of responsibility and accountability are defined.

### Recommendation 2: Action Plan and Memorandum of Understanding

Revisit and update the *Action Plan for Safe Drinking Water in British Columbia* and the 2006 Memorandum of Understanding regarding inter-agency accountability and coordination on drinking water protection, and recommit to modernized principles and actions across government.

### Recommendation 3: Inter-agency Collaboration and Coordination

Identify a new framework for inter-agency collaboration and coordination that aligns with current structures and issues.

*Leads (Recommendations 1–3):* Ministry of Health and Ministry of Environment and Climate Change Strategy, with shared accountability and input from other ministries and agencies with responsibilities in drinking water protection. This would include but is not limited to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development; Ministry of Agriculture; Ministry of Energy, Mines and Petroleum Resources; BC Oil and Gas Commission; Ministry of Municipal Affairs and Housing; regional health authorities; and the First Nations Health Authority.

### Recommendation 4: Legislative Framework Review

Evaluate the available legislative tools to protect sources of drinking water under the *Drinking Water Protection Act* and other acts to identify any gaps, areas of overlap or conflict, and triggers for enforcement action. Establish improved processes for coordinating actions taken to compel compliance to protect drinking water. The evaluation should include a review of the tools available under the *Drinking Water Protection Act*, *Public Health Act*, *Water Sustainability Act*, *Environmental Management Act*, and *Forest and Range Practices Act*.

*Leads:* Ministry of Health, Ministry of Environment and Climate Change Strategy, and Ministry of Forests, Lands, Natural Resource Operations and Rural Development, in consultation with the regional health authorities and other agencies with responsibilities for protecting sources of drinking water.

### Recommendation 5: Drinking Water Protection Plans

Review the objectives and effectiveness of drinking water protection plans under the *Drinking Water Protection Act* as a source protection tool, to determine if changes to the Act could enable more collaborative and proactive source protection that would be legally binding.

*Leads:* Ministry of Health and the Office of the Provincial Health Officer, in consultation with the regional health authorities.

### Recommendations 6: Regulatory Conflict with the Water Sustainability Act

Collaborate on policy options to address regulatory conflicts between the *Drinking Water Protection Act* and the *Water Sustainability Act* regarding protecting sensitive aquatic environments under the *Water Sustainability Act* through the construction of joint intake waterworks and preventing the creation of new small water systems under the *Drinking Water Protection Act*.

*Leads:* Ministry of Environment and Climate Change Strategy and Ministry of Health, in consultation with the regional health authorities and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

### **Recommendation 7: Public Assent Processes and the Community Charter**

Review the waiver of public assent for borrowing processes related to the installation of treatment works for local government drinking water systems under the Municipal Liabilities Regulation in the *Community Charter*. Identify an alternate strategy to remove barriers to borrowing for necessary infrastructure improvements while also providing a streamlined opportunity for public assent. As part of this review, consider the liquid/solid waste management plans under the *Environmental Management Act* as a model.

*Leads: Ministry of Municipal Affairs and Housing and the Ministry of Health.*

### **Recommendation 8: Information Management and Information Technology**

#### **8a. Requirements for Reporting by the Office of the Provincial Health Officer**

Continue to adapt health authority data systems to align with the new indicators and water system categories developed collaboratively by the Office of the Provincial Health Officer, the regional health authorities, and the Ministry of Health, and be able to report out on such data within five years of the publication of this report.

*Lead: Regional health authorities, in consultation with the Office of the Provincial Health Officer and the Ministry of Health.*

#### **8b. Provincial Information Management and Information Technology Strategy**

Develop a provincial strategy to ensure data collected are relevant, reliable, consistent and accessible and which builds on the indicators and water system categories developed collaboratively by the Office of the Provincial Health Officer, the regional health authorities, and the Ministry of Health.

*Leads: Ministry of Health and the regional health authorities, in consultation with the Office of the Provincial Health Officer.*

### **Recommendation 9: Small Water System Strategy**

Recommit to an oversight body to develop a small water system strategy to (1) prevent the development of new unsustainable small water systems during subdivision development;

(2) promote amalgamation and acquisition of small water systems; and (3) build capacity and sustainability of existing small water systems.

*Leads: Ministry of Health, with shared accountability from the Ministry of Municipal Affairs and Housing, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, and the Ministry of Transportation and Infrastructure.*

### **Recommendation 10: Amalgamation, Acquisition, and Conversion**

**10a.** Develop and resource a strategic approach to encourage and facilitate the conversion of improvement districts, using established best practices.

**10b.** Develop best practices and guidance for local government for the development and implementation of an acquisition and amalgamation plan for small water systems.

**10c.** Identify resources required to develop dedicated funding to a) assist and provide incentive to local governments in the amalgamation or acquisition of small water systems; and b) support the conversion of improvement districts.

*Lead: Ministry of Municipal Affairs and Housing.*

### **Recommendation 11: Utilities and the Escheat Act**

Identify a strategy to ensure that customers of private water utilities that have fallen into escheat are provided with well-managed, safe, and reliable drinking water as quickly as possible.

*Lead: Ministry of Forests, Lands, Natural Resource Operations and Rural Development, in consultation with the Ministry of Municipal Affairs and Housing, the Ministry of Health, and the regional health authorities.*

### **Recommendation 12: Water Users' Communities**

Identify opportunities for greater collaboration on the approval and oversight of water users' communities, in order to improve capacity, accountability, and sustainability.

*Lead: Ministry of Forests, Lands, Natural Resource Operations and Rural Development, in consultation with the Ministry of Health and the regional health authorities.*

### **Recommendation 13: Source and System Assessment**

Develop a work plan to ensure that all water suppliers have a source and system assessment on record that identifies potential risks and vulnerabilities; this assessment can then be used to develop a response plan for source and system protection.

*Lead: Regional health authorities.*

### **Recommendation 14: Treatment Objectives**

Develop a process to uniformly review water systems to identify which systems do not meet the BC surface or groundwater treatment objectives. This review will inform the development of financial plans and compliance processes to meet the treatment objectives, and will help identify where resources are best directed to achieve identified target dates for improvements.

*Leads: Ministry of Health, Ministry of Municipal Affairs and Housing, and the regional health authorities.*

### **Recommendation 15: Design and Performance Standards**

Develop provincial guidance for a) the assignment of log-reduction credits for the evaluation of treatment processes against treatment objectives; and b) the design of waterworks.

*Lead: Ministry of Health, in consultation with the regional health authorities.*

### **Recommendation 16: Distribution System Integrity and Maintenance**

Develop provincial guidance for drinking water officers for the review and assessment of distribution integrity, management, and maintenance that considers the varying sizes, capacities, and complexities of water systems.

*Lead: Ministry of Health, in consultation with the regional health authorities.*

### **Recommendation 17: Secondary Disinfection**

Systematically review all water systems to identify which systems do not provide secondary disinfection, and of those, which systems will require secondary disinfection as per the *British Columbia Guidelines (Microbiological) on Maintaining Water Quality in Distribution Systems*. Continue

to promote secondary disinfection for all drinking water systems as best practice.

*Lead: Regional health authorities.*

### **Recommendation 18: Cross-connection Control**

Ensure water supply systems have appropriate plans/procedures in place to proactively identify and address cross-connections. Encourage all local government water purveyors to have an enforceable cross-connection control program.

*Lead: Regional health authorities.*

### **Recommendation 19: Lead in Drinking Water**

**19a. (Schools):** Establish a consistent sampling and reporting protocol for lead in drinking water for schools to follow. Continue to develop plans to implement measures to effectively reduce lead in school drinking water.

*Leads: Ministry of Health, Ministry of Education, and the regional health authorities.*

**19b. (Child Care Facilities):** Develop plans to promote screening for, and implement measures to effectively reduce levels of, lead in the drinking water of child care facilities, recognizing that children under the age of six are the most vulnerable to the harmful effects of lead.

*Leads: Ministry of Health and the regional health authorities, in consultation with First Nations Health Authority and the Ministry of Children and Family Development.*

### **Recommendation 20: Bulk Water Haulers**

Develop provincial guidelines for bulk water haulers to reflect current regulatory requirements and best practices.

*Lead: Ministry of Health, in consultation with the regional health authorities.*

### **Recommendation 21: Operator Certification**

Ensure that a satisfactory information exchange is occurring between the regional health authorities and the Environmental Operators Certification Program to identify water suppliers who are out-of-compliance with operator certification requirements.

*Lead: Ministry of Health, in collaboration with the regional health authorities and the Environmental Operators Certification Program.*

### **Recommendation 22: Operator Training**

Develop a minimum recommended standard of training and competencies for a small water system operator and a bulk water hauler. Standards for small water systems should take into account the varying sizes, levels of complexity, water sources, and governance structures of these small systems.

*Leads: Ministry of Health and the regional health authorities.*

### **Recommendation 23: Emergency Response**

Ensure all water systems have an appropriate emergency response and contingency plan and have the necessary training and capacity to implement it when needed.

*Lead: Regional health authorities.*

### **Recommendation 24: Asset Management and Financial Planning**

Review training needs and develop guidance for drinking water officers on the required elements of an asset management plan and financial plans for different types of water systems.

*Leads: Ministry of Health and Ministry of Municipal Affairs and Housing, in consultation with the regional health authorities and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.*

### **Recommendation 25: Water Chemistry Data**

Develop and resource an action plan and strategy to make water chemistry data for water supply systems from private laboratories available online for reporting and evaluation purposes.

*Leads: Ministry of Health and the regional health authorities.*

### **Recommendation 26: Water Quality Data Sharing**

Identify effective ways to share water quality monitoring data across agencies with responsibilities in source water protection.

*Leads: Ministry of Environment and Climate Change Strategy, in collaboration with the Ministry of Health, the regional health authorities, and the First Nations Health Authority.*

### **Recommendation 27: Access to Approved Laboratories**

Develop a strategic approach to support improved access to water testing in remote and rural areas. This includes exploring Level C laboratories and point-of-use testing for microbiological indicators.

*Leads: BC Centre for Disease Control Public Health Laboratory and the Enhanced Water Quality Assurance Program, with support from the Ministry of Health.*

### **Recommendation 28: Boil Water Notices**

Continue efforts to identify water systems that are on chronic, long-term boil water notices for reasons such as inadequate infrastructure and management, in order to inform a strategic long-term action plan to support improvements to these systems.

*Lead: Regional health authorities.*

### **Recommendation 29: Drinking Water Program Resource Requirements**

Review the resources needed by the Ministry of Health, Office of the Provincial Health Officer and the regional health authorities to effectively fulfil their roles under the *Drinking Water Protection Act*.

*Leads: Ministry of Health, Office of the Provincial Health Officer, and the regional health authorities.*

### **Recommendation 30: Training Needs of Persons Acting as Drinking Water Officers**

Review the training needs of individuals who are acting as drinking water officers in BC, to allow them to carry out program responsibilities under the Act and to effectively support water suppliers to achieve clean, safe, and reliable drinking water through the multi-barrier approach.

*Leads: Ministry of Health, Office of the Provincial Health Officer, and the regional health authorities.*

### **Recommendation 31: Investigating Threats to Drinking Water**

Develop guidance for investigating threats to drinking water under Section 29 of the *Drinking Water Protection Act*. These guidelines should clarify the scope of Section 29 investigations where assessments are required outside of the capacity of the health authority.

*Lead: Ministry of Health, in consultation with the regional health authorities and the Office of the Provincial Health Officer.*

### **Recommendation 32: Tracking of Activities under the Drinking Water Protection Act**

Develop a consistent and reliable method for tracking drinking water program activities under the *Drinking Water Protection Act*, including inspections, investigations, enforcement actions, reconsideration of decisions, and drinking water officer engagement and interactions with water suppliers, operators, local governments, and the public.

*Lead: Regional health authorities, in consultation with the Office of the Provincial Health Officer.*

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### **References**

<sup>1</sup> BC Office of the Provincial Health Officer. Progress on the action plan for safe drinking water in British Columbia. Victoria, BC: BC Office of the Provincial Health Officer; 2007 Feb [cited 2019 Jan 04]. Available from: <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/waterreport.pdf>.



# PART 1

## Drinking Water– The BC Framework



# 1 Introduction – Clean, Safe, Reliable Drinking Water

Ensuring that the public has access to clean, safe, and reliable **drinking water**<sup>a</sup> is imperative for public health. Protecting this resource is no small task and involves inter-agency coordination across different levels of government, ministries, communities, and non-government organizations. Drinking water in British Columbia comes from numerous **groundwater** and **surface water** sources, each with their own unique considerations for **source protection**, **treatment**, and **distribution**. In addition, water systems vary in size, type, ownership, and governance. Urban areas most often have large systems, while British Columbians in other parts of BC receive water from **small water systems**. The role of drinking water programs within BC is to ensure that the quality of drinking water is maintained for all British Columbians. This chapter provides an overview of drinking water reporting in BC, including a discussion of how reporting was done in the past by the Provincial Health Officer (PHO) and the new framework and indicators that will guide future reporting. In addition, this chapter will discuss how water systems are defined.

## 1.1 Role and Mandate of the Provincial Health Officer

The PHO is the senior public health official for BC, and is responsible for monitoring the health of the population of BC and providing independent advice to the ministers and public officials on public health issues. The *Public Health Act* outlines most of the responsibilities of the PHO. The PHO also holds oversight and accountability under the *Drinking Water Protection Act* (DWPA) for drinking water protection. Duties of the PHO under the DWPA include monitoring compliance of drinking water officers by way of guidelines and directives; preparing and delivering an

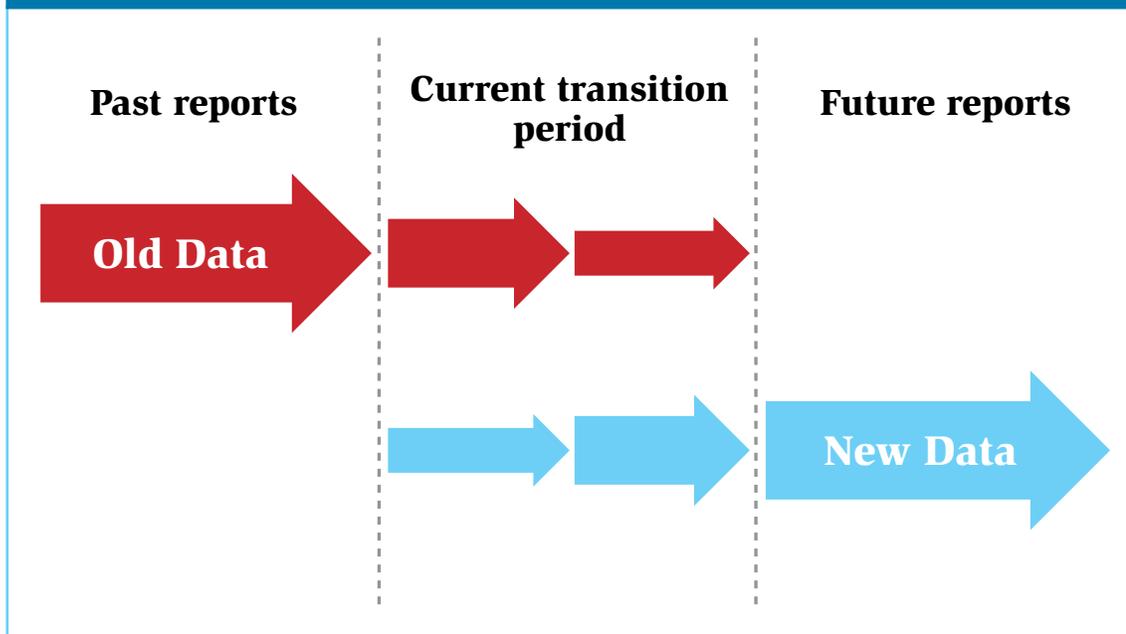
annual report to the Health Minister regarding activities under the Act; report on issues that threaten public health by negatively impacting drinking water; making recommendations to the Minister of Health with regard to drinking water protection plans; and reviewing decisions of **drinking water officers**. The PHO also provides recommendations for improvement in the protection of drinking water in BC.

Under Section 4.1 of the DWPA, the PHO must prepare a report respecting the activities under the Act for the past year. The PHO also reports on the *Action Plan for Safe Drinking Water in British Columbia* (the Action Plan). The PHO historically combined these reports and included annual activities under the DWPA within the report entitled *Progress on the Action Plan for Safe Drinking Water in British Columbia*. This report—*Clean, Safe, Reliable Drinking Water in BC: An Update on Drinking Water Protection and on the Action Plan for Safe Drinking Water in British Columbia*—describes activities under the DWPA for fiscal years 2012/13 through 2016/17 and serves as a transitional report to a new framework for reporting on drinking water in BC (See Figure 1.1). It still provides an update on progress towards the Action Plan, but also introduces new indicators and a reporting structure that is consistent with a **multi-barrier approach**. For the purpose of this transitional report, the eight principles identified in the Action Plan are tracked within each relevant element of the multi-barrier approach.

These changes to the reporting framework stemmed from an understanding that the existing indicators do not best reflect the current progress and objectives of the provincial drinking water program administered by the regional health authorities under the DWPA. A process was undertaken in collaboration

<sup>a</sup> Bolded text throughout this report indicate glossary terms, which are defined in Appendix A.

**Figure 1.1: Structure of Drinking Water Reporting**



with **regional health authorities** to develop new indicators. While these new indicators will better reflect the objectives of the provincial drinking water program, they do not yet align with currently available data from the regional health authorities. More work will need to be done on data collection and management in order to report on the new indicators in a more comprehensive way in the future.

## 1.2 What is a Water Supply System?

In BC any **water supply system** other than a single-family residence is regulated as a **drinking water supply system** under the DWPA. Therefore, any residential water supply with two or more **connections**, or any commercial, recreational, or industrial water supply where water is provided or offered for domestic purposes qualifies as a public water supply and requires a permit to operate issued by the local drinking water officer. The only type of water system that does not require a permit under the DWPA is a water supply system serving a single-family residence.<sup>b</sup> These unregulated systems (commonly referred to as “**private water systems**”) are not inspected or monitored by the regional health authorities and therefore are not included within the

data sets of this report. Across BC there are over 4,800 water supply systems regulated by the province. Most of these systems (over 90 per cent) are small water systems, serving 500 people or less in a 24-hour period.



A private water system consisting of a dug well with a hand-pump serving a single-family residence in BC.

*Photo credit: Mike Simpson, BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development.*

<sup>b</sup> Additionally, the DWPA does not apply to on-reserve First Nations water supply systems, as these systems fall under federal jurisdiction. Data on these systems, provided by the First Nations Health Authority, are included in this report.

### 1.3 The Action Plan for Safe Drinking Water in British Columbia

Seventeen years have passed since the provincial government developed and released the Action Plan in 2002.<sup>1</sup> The Action Plan outlined the need for stronger protection to meet the provincial government’s commitment to ensure safe, reliable, and accessible drinking water for all British Columbians. The solution described within the Action Plan included principles for drinking water protection as a platform for action (Figure 1.2); strong, effective legislation; and clear responsibility within government.

Since 2002, there have been a number of other government commitments and plans related to drinking water and water quality. In 2006, ministries with responsibilities for drinking water protection under the Action Plan entered into a Memorandum of Understanding (MOU) regarding inter-agency accountability and coordination on drinking water protection. This MOU re-affirmed the Action Plan and

outlined roles and responsibilities. At the same time, the province also moved forward with a Water Action Plan for BC and made a high-level commitment to “Lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management, bar none.”<sup>2</sup> As a result of this commitment, the BC government, in its 2006/07–2008/09 Strategic Plan, identified as a priority action the need to have a water strategy to ensure superior water quality and sustainable water development.<sup>2</sup> To meet this goal with respect to water quality, the Ministry of Environment<sup>c</sup> then led a cross-government strategy that resulted in the 2008 release of *Living Water Smart: British Columbia’s Water Plan*, described in the text box below, which outlined government’s commitment to change the way that water is governed and managed in BC. In 2009, the Ministry of Environment launched the *Water Act* Modernization project to update the historic *Water Act* and related water management policies, which led to the implementation of the *Water Sustainability Act* in 2016.<sup>3</sup>

#### Living Water Smart: British Columbia’s Water Plan

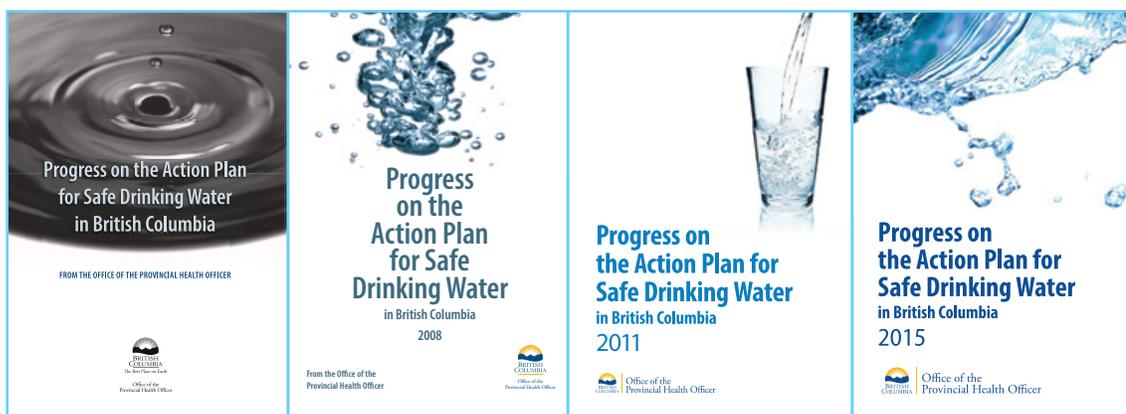
Living Water Smart provides the BC Government’s vision for sustainable water stewardship and sets direction for changes to water management and water use. Delivery of this plan involves several ministries and a range of stakeholders. The Ministry of Environment and Climate Change Strategy is responsible for overall coordination and reporting on Living Water Smart and is leading action on a number of specific commitments in the plan.<sup>4</sup>

#### Figure 1.2: Principles for Drinking Water Protection

1. The safety of drinking water is a public health issue.
2. Source water protection is a critical part of drinking water protection.
3. Providing safe drinking water requires an integrated approach.
4. All water systems need to be thoroughly assessed to determine risk.
5. Proper treatment and water distribution system integrity are important to protect human health.
6. Tap water must meet acceptable safety standards and be monitored.
7. Small systems require a flexible system with safeguards.
8. Safe drinking water should be affordable, with users paying appropriate costs.

Source: BC Ministry of Health Planning, BC Ministry of Health Services. Action plan for safe drinking water in British Columbia; 2002.<sup>1</sup>

<sup>c</sup> Now the Ministry of Environment and Climate Change Strategy.



Since the release of the Action Plan, the PHO has tracked progress on each of the Plan’s eight key principles through reports released in 2006<sup>5</sup>, 2008<sup>6</sup>, 2011<sup>7</sup>, and 2015.<sup>8</sup>

Many of the “solutions” offered in the Action Plan have been achieved. Where the Province has had success over the past 17 years is in implementing a broad legislative framework supported by guidelines and assessment tools for protecting drinking water, and in developing a strategic plan for water stewardship through Living Water Smart. The Action Plan called for an improved DWPA, new groundwater protection legislation, and regulations to protect public health and safety. The improved DWPA and its regulation came into force in 2003. The *Water Sustainability Act* and the new Groundwater Protection Regulation—which modernized the former *Water Act* and provides greater protection of groundwater resources—both came into force in 2016. New committees have formed (i.e., Drinking Water Leadership Council and Environmental Health Policy Advisory Committee) to provide expert advice on policy and legislative development for drinking water protection. Further, the Ministry of Health has improved drinking water treatment and distribution standards, based on advice from the Drinking Water Leadership Council, guidance from the Guidelines for Canadian Drinking Water Quality, and industry best practices. Basic routine monitoring requirements for drinking water quality have been established under regulation and drinking water officers can supplement those requirements with an order or permit requirements under the DWPA. Training and certification requirements for water system **operators** have been improved. Together these

achievements address most of the actions called for in the Action Plan but challenges remain.

The major action identified in the Action Plan that continues to be a challenge to implement is the need for inter-agency coordination of resources to protect drinking water. The Action Plan called for coordination of resources to ensure clear lines of responsibility within government for various aspects of drinking water protection, source protection, land use planning, and infrastructure. The inter-agency group tasked with facilitating this coordination and implementing the Action Plan—the Assistant Deputy Ministers’ Committee on Water—disbanded in 2010, and as a result there is no inter-agency committee remaining with this mandate. However, several inter-agency committees do exist, and collaboration and consultation on policy, guideline, and legislation development occurs across agencies. Furthermore, the formation of the Ministry of Forests, Lands, and Natural Resource Operations<sup>d</sup> in 2011 combined several different resource ministries into one in an effort to ensure a comprehensive approach to land use and natural resources operations that affect water. This new ministry reduced the need for inter-agency coordination between resource ministries, but the need to coordinate with health partners for accountability to the Action Plan remains.

<sup>d</sup> Now called the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.



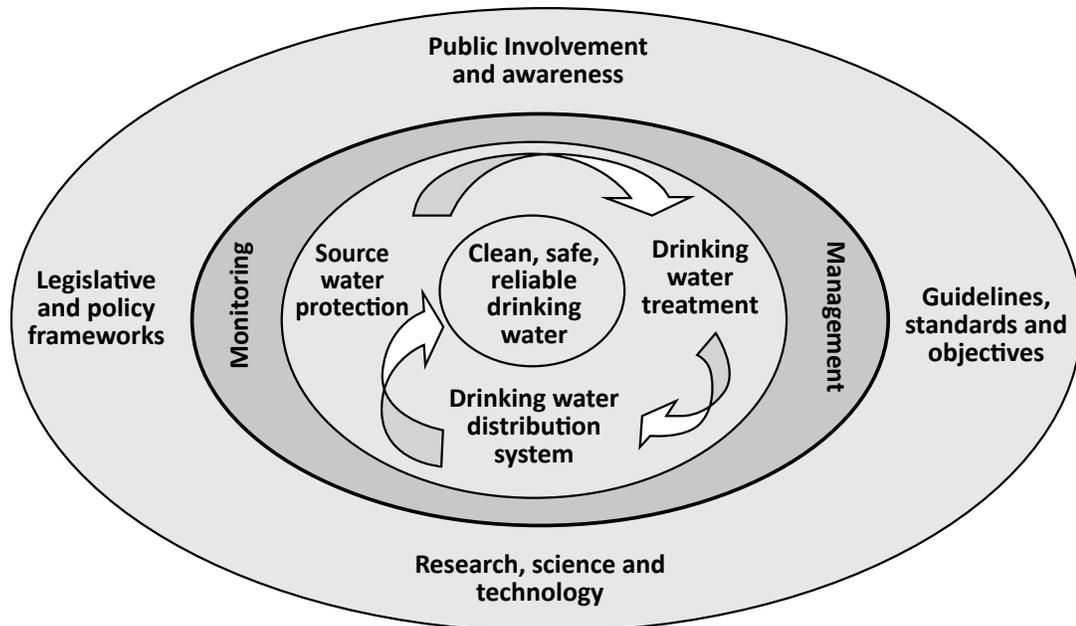
Seymour falls dam in North Vancouver, BC. One of three reservoirs in the protected watersheds for Metro Vancouver.  
Photo credit: Metro Vancouver.

The resources needed to improve drinking water protection were also outlined in the Action Plan. These resources included new drinking water officer positions, a province-wide source-to-tap assessment, increased inspection and monitoring, new reporting requirements, local coordination and cooperation, and financing new infrastructure. Since 2002, a number of new drinking water officers' positions were created; however the gap between the number of drinking water officers and the number of water systems in BC continues to widen. Several source-to-tap assessment tools now exist; but very few water supply systems have undergone a comprehensive source-to-tap assessment due to the complexity and resources required. Health authority efforts to increase inspection and monitoring of water supply systems and to increase drinking water officer engagement with water supply system operators, owners, and users continue; however, the large number of very small water systems in rural and remote areas of the province creates challenges. While clear reporting requirements have been implemented under the DWPA and public access to information about individual water supplies continues to improve, information management system

challenges remain. Provincial funding programs to finance new infrastructure improvements and planning continues in support of the Action Plan, although financing for infrastructure projects are limited to municipal and regional district water suppliers. Financial management and affordability continues to be a challenge for small water systems and for water supplies not operated by a local government, despite significant capacity-building efforts by the province, regional health authorities, and other supporting agencies.

Significant time has passed since the release of the Action Plan and since that time the multi-barrier approach has been adopted as best practice in most jurisdictions, including BC. Several regulatory developments and contextual changes that have also occurred since the release of the Action Plan and many of its proposed actions have become dated. In light of this, the PHO is now following the multi-barrier approach as a framework for reporting on improvements to drinking water programs in BC. The new indicator project, discussed later in this chapter, aims to provide the necessary data to evaluate progress towards the implementation of the multi-barrier approach.

**Figure 1.3: The Multi-Barrier Approach to Safe Drinking Water**



Source: Canadian Council of Ministers of the Environment. From source to tap: the multi-barrier approach to safe drinking water; 2002.<sup>10</sup>

## 1.4 The Multi-barrier Approach to Drinking Water

Around the same time the Action Plan was released in BC, the Federal-Provincial-Territorial Committee on Drinking Water released their position paper: *From Source to Tap: The Multi-barrier Approach to Safe Drinking Water* (2002).<sup>9</sup> Since that time, the multi-barrier approach has become the recognized best practice of most jurisdictions, including BC, to ensure clean, safe and reliable drinking water from source to tap. The principles of the Action Plan support and align with this approach. Future progress reports from the PHO will use this framework as the reporting structure.

The multi-barrier approach is a system of procedures, processes, and tools that collectively prevent or reduce the contamination of drinking water from source-to-tap in order to reduce risks to human health (See Figure 1.3). The inner circle of Figure 1.3 shows the desired outcome of this approach: clean, safe, reliable drinking water. The inner ring

identifies the three core elements of this approach to ensure safe drinking water from source to tap: source protection, drinking water treatment, and drinking water distribution system integrity. These core elements must be managed as a whole—as multiple layers of protection, or a multi-barrier approach—as no single element alone can guarantee clean, safe, reliable drinking water.

Monitoring and management, the middle ring of Figure 1.3, refers to the integrated system of total quality management necessary to support the three core elements. This system includes monitoring, reporting, good operations and management, and abatement and enforcement programs (more detail on total quality management can be found in Part 3 of this report). The outer ring of Figure 1.3 refers to those elements that support the system of total quality management, including legislative and policy frameworks; guidelines, standards, and objectives; the development of research, science, and technology; and public involvement and awareness.

## 1.5 Water System Data – New Indicator Project

The ability of regional health authorities to extract meaningful information from health protection program data systems in order to measure progress towards implementing the key elements of the multi-barrier approach continues to be limited. This challenge has been highlighted in all previous PHO drinking water reports. Previous attempts to develop a provincial drinking water information management and data system failed.

Recognizing these limitations, the PHO initiated a project in 2014 in partnership with the regional health authorities and the Ministry of Health to revise the way in which water

systems are categorized and to create a new suite of indicators to better track progress on the implementation of the multi-barrier approach. In 2015, the project team developed a draft that included new water system categories, new drinking water system indicators that align with the multi-barrier approach, and data on resources and actions to reflect the abatement and enforcement activities under the DWPA.

The categories, described in more detail in Chapter 3, identify and quantify the different types of water suppliers, the size of the water system, and the types of source water supplies used. The indicators (Table 1.1) track the progress of water suppliers and the drinking water protection programs within the regional health authorities

**Table 1.1: New Drinking Water Indicators of the Multi-barrier Approach**

Multi-barrier Approach Element		Indicators
Core Elements	Source Protection	<ul style="list-style-type: none"> <li>• Source assessment complete</li> <li>• Source assessment response plans in place</li> </ul>
	Treatment	<ul style="list-style-type: none"> <li>• BC treatment objectives achieved</li> <li>• Other treatment requirements (where required) to meet potability standards for chemical or physical parameters in place</li> </ul>
	Distribution System Integrity	<ul style="list-style-type: none"> <li>• Cross connection control program/devices in place</li> <li>• Secondary disinfection and residual monitoring (where required)</li> <li>• Leak and pressure detection plan/schedule in place</li> <li>• Maintenance plans/schedule in place</li> <li>• Corrosion control program in place (where required)</li> </ul>
Integrated System of Total Quality Management	Monitoring	<ul style="list-style-type: none"> <li>• Sampling frequency requirements met (bacteriological and chemical)</li> </ul>
	Reporting	<ul style="list-style-type: none"> <li>• Annual reporting requirement met</li> </ul>
	Operations	<ul style="list-style-type: none"> <li>• Current emergency response and contingency plans in place</li> <li>• Operator certified to the level of classification for the treatment and/or distribution system*</li> <li>• Operator has appropriate knowledge and training for the complexity of the system they operate**</li> </ul>
	Management	<ul style="list-style-type: none"> <li>• Asset management plan complete</li> <li>• Long-term financial plan complete (community systems only)</li> </ul>

Notes: \*This indicator applies only to large water systems: >500 people served in 24-hour period.  
 \*\*This indicator applies only to small water systems: ≤500 people served in 24-hour period.

in implementing the three core elements of the multi-barrier approach (source protection, robust treatment, and ensuring distribution integrity). They also track the implementation of the total quality management of the multi-barrier approach (monitoring, reporting, good operations and management, and enforcement and abatement programs). The new categories and indicators will allow future PHO reports to evaluate how different types and sizes of water systems differ in meeting the desired outcomes and identify where problems are occurring and more work is needed.

In 2016, the proposed categories and indicators were piloted with Interior Health using their data system, Hedgehog.net. Staff at Interior Health worked with their data system to enhance its capacity to capture the new indicators while also using the new water system categories. In late 2016, Fraser Health began an exploratory pilot project to modify their data system, Health Space, to capture the necessary information. Health Space is also used by Vancouver Coastal Health, Island Health, and Northern Health. Both pilot projects have demonstrated that the existing databases can be modified to capture the required information. The remaining challenges for implementation will be data entry, and training and guidance of **environmental health officers** and administrative support staff in accurate data collection and categorization. Additional resources will be required to implement the data system changes, data collection and categorization training, and data entry. The goal of this work is for the regional health authorities to complete data system modifications and data entry within five years of publication of this report.

## 1.6 Organization of Report

This report is organized in five parts with 10 chapters in total. The report's structure aligns with the elements of the multi-barrier approach.

- Part 1 (Chapters 1-3) – Chapter 2 outlines the roles and responsibilities in drinking water protection, while Chapter 3 describes the different types of water supply systems in BC and introduces some of their specific governance challenges.
- Part 2 (Chapters 4-5) – This section discusses the three core elements of the multi-barrier approach. Chapter 4 discusses source water protection, while Chapter 5 explores drinking water treatment and distribution, including infrastructure design and performance.
- Part 3 (Chapters 6-8) – This section discusses the total quality management dimension of the multi-barrier approach. Chapter 6 focuses on good operations and management; Chapter 7 addresses monitoring and reporting; and Chapter 8 discusses abatement and enforcement programs.
- Part 4 (Chapter 9) – This section explores important factors in drinking water protection for small water systems.
- Part 5 (Chapter 10) – This section summarizes the discussions and recommendations put forward in this report.

While water systems serving First Nations communities are not under provincial jurisdiction, information on drinking water in First Nations communities has been included in the chapters of this report. First Nations leadership work in partnership with Indigenous Services Canada and the First Nations Health Authority to provide safe and sustainable drinking water supplies in First Nations communities, following federal guidelines and provincial guidelines and regulations as best practice.

## 1.7 Conclusion

This chapter has provided contextual information for drinking water protection and presented the new approach for drinking water monitoring and reporting in BC. Significant time has passed since the release of the Action Plan, and regulatory and contextual realities for drinking water protection in BC have changed. Many of the actions called for in the Action Plan have been achieved or are ongoing; however, some remain a challenge. The eight principles in the Action Plan will continue to inform reporting; however, this and future reports will follow the multi-barrier approach and will use the new indicators that have been developed. Since data are currently not available for several of these indicators, this report will serve as a transition to the new reporting structure. The next chapter will outline the roles and responsibilities in drinking water protection and water systems in BC.

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# 2 Roles and Responsibilities in Drinking Water Protection

This chapter provides an overview of the roles and responsibilities in drinking water protection. Drinking water protection is complex and involves federal, provincial, and local governments, health authorities, and other agencies.

## 2.1 Federal, Provincial Government, and Other Agencies

In Canada, the constitutional division of powers between the provinces, territories, and federal government guides the regulatory oversight for drinking water. Health Canada derives microbiological, physical, and chemical guidelines for drinking water **potability** (i.e., the *Guidelines for Canadian Drinking Water Quality*) with input from the provinces and territories (See Chapter 4, Section 4.2.1). Provinces and territories provide regulatory oversight and set the operational standards for water systems governed at the local level through individual provincial or territorial regulations.<sup>1,2</sup>

In BC, the protection and oversight of drinking water sources and drinking water systems is a shared inter-agency responsibility. Almost all watersheds in the province are used by multiple stakeholders for various purposes, as well as being home to wildlife. They are also subject to a wide variety of potential contaminants from natural disasters, extreme weather, and spills. Various land uses such as agriculture operations, industry, oil and gas activities, mining, road building, recreational activities, sewage, and waste disposal all have the potential to compromise water quality and pose risks to human health. Given this diversity of uses there are many pieces of legislation in place to ensure the protection, conservation, and sustainability of the water supply in BC (Table 2.1).

**Table 2.1: Legislation That Supports Drinking Water Protection and Agency Responsible**

Legislation	Agency Responsible
<p><i>Drinking Water Protection Act</i> and its regulation:</p> <ul style="list-style-type: none"> <li>• Drinking Water Protection Regulation</li> </ul>	<p>MoH (Policy) Regional Health Authorities (Operations)</p>
<p><i>Public Health Act</i> and its regulations:</p> <ul style="list-style-type: none"> <li>• Health Hazards Regulation</li> <li>• Sewerage System Regulation</li> </ul>	<p>MoH (Policy) Regional Health Authorities (Operations)</p>



Legislation	Agency Responsible
<p><i>Environmental Management Act</i> and its regulations:</p> <ul style="list-style-type: none"> <li>• Antisapstain Chemical Waste Control Regulation</li> <li>• Agricultural Waste Control Regulation</li> <li>• Code of Practice for Industrial Non-Hazardous Waste Landfills Incidental to the Wood Processing Industry</li> <li>• Code of Practice for Soil Amendments</li> <li>• Code of Practice for the Slaughter and Poultry Processing Industries</li> <li>• Contaminated Sites Regulation</li> <li>• Hazardous Waste Regulation</li> <li>• Land-based Finfish Waste Control Regulation</li> <li>• Municipal Wastewater Regulation</li> <li>• Organic Matter Recycling Regulation</li> <li>• Pulp Mill and Pulp and Paper Mill Liquid Effluent Control Regulation</li> </ul>	ENV
<p><i>Integrated Pest Management Act</i> and its regulation</p>	ENV
<p><i>Water Sustainability Act</i> and its regulations:</p> <ul style="list-style-type: none"> <li>• Dam Safety Regulation</li> <li>• Groundwater Protection Regulation</li> <li>• Water Sustainability Fees, Rentals, and Charges Tariff Regulation</li> <li>• Water Sustainability Regulation</li> </ul>	ENV (Policy) FLNRORD (Operations)
<p><i>Water Protection Act</i></p>	ENV FLNRORD
<p><i>Park Act</i> and its regulations</p> <ul style="list-style-type: none"> <li>• Park, Conservancy, and Recreation Area Regulation</li> </ul>	ENV
<p><i>Water Users' Communities Act</i></p>	FLNRORD
<p><i>Water Utility Act</i></p>	FLNRORD
<p><i>Utilities Commission Act</i></p>	FLNRORD
<p><i>Forest and Range Practices Act</i> and its regulations:</p> <ul style="list-style-type: none"> <li>• Government Actions Regulation</li> <li>• Range Planning and Practices Regulation</li> </ul>	FLNRORD

<b>Legislation</b>	<b>Agency Responsible</b>
<i>Drainage, Ditch, and Dike Act</i>	FLNRORD
<i>Dike Maintenance Act</i>	FLNRORD
<i>Land Act</i>	Ministry of Agriculture
<i>Local Governmental Act</i> and the <i>Community Charter</i>	MAH
<i>Local Services Act</i> and its regulation: <ul style="list-style-type: none"> <li>• Subdivision Regulations</li> </ul>	MAH MOTI
<i>Oil and Gas Activities Act</i> and its regulations: <ul style="list-style-type: none"> <li>• Drilling and Production Regulation</li> <li>• Environmental Protection and Management Regulation</li> </ul>	EMPR (Policy) OGC (Operations)
<i>Geothermal Resources Act</i> and its regulations: <ul style="list-style-type: none"> <li>• Geothermal Drilling and Production Regulation</li> <li>• Geothermal Operations Regulation</li> </ul>	EMPR OGC
<i>Mines Act</i> and the Health, Safety, and Reclamation Code for Mines in British Columbia	EMPR Federal Government
<i>Hydro and Power Authority Act</i>	BC Utilities Commission
<i>Transportation Act</i>	MOTI
<i>Transport of Dangerous Goods Act</i>	MOTI
<i>Environmental Assessment Act</i>	ENV Environmental Assessment Office

### **Legend:**

**EMPR** – Ministry of Energy, Mines and Petroleum Resources

**ENV** – Ministry of Environment and Climate Change Strategy

**FLNRORD** – Ministry of Forests, Lands, Natural Resource Operations and Rural Development

**MAH** – Ministry of Municipal Affairs and Housing

**MOH** – Ministry of Health

**MOTI** – Ministry of Transportation and Infrastructure

**OGC** – BC Oil and Gas Commission

*The Drinking Water Protection Act (DWPA)* is one element of the *Action Plan for Safe Drinking Water in British Columbia* (the Action Plan). While it is the principal statute concerning drinking water protection in BC, many other statutes deal with matters of relevance to drinking water protection, including resource extraction, land use, and environmental practices. Many of these statutes contain their own provision for drinking water protection, particularly source water protection. The role of drinking water officers under the DWPA complements the roles of statutory officials under these other statutes, and the DWPA contains numerous provisions to balance respect for other statutory mandates while at the same time ensuring that public health protection respecting drinking water is achieved.<sup>3</sup>

As many government agencies are involved in aspects of drinking water protection, the Action Plan called for coordination and integration of these functions and for clear lines of responsibility within government.

The Ministry of Health is the lead provincial ministry responsible for drinking water protection under the DWPA and the Drinking Water Protection Regulation. The ministry is also responsible for the *Public Health Act* (2008), the Sewerage Systems Regulation and the Health Hazards Regulation, which include provisions to protect drinking water quality and consumers. The ministry develops provincial legislation, guidelines, and policies on drinking water, and assists the five regional health authorities to consistently execute the DWPA and Drinking Water Protection Regulation.

Under Section 3 of the DWPA, drinking water officers (DWOs) are the **medical health officer**. A DWO may also be any person appointed by the medical health officer or the Minister of Health. DWOs may delegate any person a power or duty of the DWO. In BC, **environmental health officers** and **public health engineers**<sup>a</sup> act as DWOs through this delegation and are employed by the health authorities to administer the DWPA and its regulation. DWOs are responsible for the inspection and monitoring of regulated drinking water supplies to ensure public health standards are met.

The Ministry of Health and the health authorities work closely with one another and other government ministries and water supply organizations to make sure the health of the public is protected from threats to drinking water. The ministry and the health authorities participate in several inter-agency health committees to develop policy direction and guide operational consistency around the administration of the DWPA, including the Drinking Water Leadership Council, Environmental Health Policy Advisory Committee, Regional Directors of Health Protection Council, Health Authority Drinking Water Council, and the Health Authority Public Health Engineers' Council (Appendix B). The Ministry of Health also participates in several other provincial or regional inter-agency committees (see Chapter 4), and provides policy advice and input to other ministries on the development of policies, legislation, guidelines, and best management practices that have the potential to impact drinking water and human health.

As discussed in Chapter 1, the Provincial Health Officer provides an oversight and accountability role for drinking water through annual reporting, reviews decisions by drinking water officers when requested, and provides independent advice to the Minister of Health for issues under the DWPA. This could include recommending that the Minister designate an area by Order for a **drinking water protection plan**, to protect a drinking water supply source (See Chapter 4). The Provincial Health Officer also approves laboratories for routine bacteriological testing under the DWPA.

The Ministry of Environment and Climate Change Strategy (ENV) is the lead agency for water resource management and source water quality protection as it relates to human health. This responsibility was set out in the Action Plan and re-affirmed in the 2006 Memorandum of Understanding regarding inter-agency accountability and coordination on drinking water protection. The Action Plan and the Memorandum of Understanding specifically state, "The Ministry of Environment will be responsible for source water quality standards, monitoring, compliance, and enforcement, and resource ministries will continue to be responsible for protecting drinking water sources

<sup>a</sup>Public health engineers hold delegated powers to issue construction permits. They also provide technical advice and accompany environmental health officers on inspections as required.

under their legislated mandates.”<sup>3</sup> In this role, ENV continues to be the lead for science and knowledge management, strategic framework, standards, policy and legislation development to protect, and manage water supplies. Shifts in these responsibilities across ministries over time are described in the text box below.

ENV is responsible for several statutes of relevance to source protection of drinking water, including the *Environmental Management Act* and the *Water Sustainability Act* (2016).<sup>b</sup> These statutes contain provisions that protect drinking water through setting objectives and regulating various land uses and resource extraction. The *Water Sustainability Act* is the principle law for managing the use and diversion

of water resources in the province. Under the *Environmental Management Act*, ENV works to prevent pollution and to promote and restore environmental quality, through the development of ambient water quality guidelines and water quality objectives, and through the authorization to discharge waste subject to requirements to ensure the discharge adequately protects human health and the environment. Authorizations typically include requirements for monitoring and reporting. ENV assesses compliance with authorization requirements through inspections and audits, and evaluates the effectiveness of requirements in protecting the environment through monitoring and environmental impact assessment.

## Responsibilities for Water and the History of the Ministry of Healthy Living and Sport

In 2008, the Ministry of Healthy Living and Sport was established.<sup>4</sup> Responsibility for drinking water protection under the *Drinking Water Protection Act* was transferred from the Ministry of Health Services to this new ministry. In addition, powers for water protection were transferred to the Ministry of Healthy Living and Sport from the Ministry of Environment:

The duties, powers, and functions of the Minister of Environment and Minister Responsible for Water Stewardship and Sustainable Communities that were part of the Water and Air Monitoring and Reporting section of the Environmental Quality Branch of the Ministry of Environment are transferred to the Minister of Healthy Living and Sport.<sup>5</sup>

Later in 2008, the mandate of the Ministry of Healthy Living and Sport was adjusted with respect to the transfer of powers from the Ministry of Environment:

The duties, powers and functions of the Minister of Healthy Living and Sport that were part of the Water and Air Monitoring and Reporting section of the Environmental Quality Branch of the Ministry of Healthy Living and Sport, except for those duties, powers, and functions respecting the provision of advice on policy, guidelines, and standards for air and water quality related to human health, are transferred to the Minister of Environment.<sup>6</sup>

This merger brought together water policy and guideline staff from the Ministries of Health Services and Environment into one team for the first time.

When the Ministry of Healthy Living and Sport was disestablished in 2010,<sup>7</sup> the responsibilities under the *Drinking Water Protection Act* were transferred back to the Ministry of Health Services. Likewise, the responsibilities for providing advice on policy, guidelines, and standards for air and water quality related to human health were transferred back to the Ministry of Environment. Despite this split in responsibilities for drinking water protection and water quality as it relates to human health, the two ministries (now known as the Ministry of Health and the Ministry of Environment and Climate Change Strategy) continue to consult on legislation, policy, and guideline development.

<sup>b</sup>The *Water Sustainability Act* replaces the former *Water Act* and addresses sustainability and conservation of provincial water resources in light of increasing pressures and climate change concerns.

While ENV is responsible for protecting BC resources through setting standards and legislation, the Ministry of Forests, Lands, and Natural Resources Operations and Rural Development (FLNRORD) manages those resources. FLNRORD administers the *Forest and Range Practices Act*, which outlines how all forest and range practices and resource-based activities are to be conducted on Crown land in BC. The Water Stewardship Division of FLNRORD oversees and approves licences to extract and use surface and groundwater sources under the *Water Sustainability Act* and the *Water Protection Act*. FLNRORD also administers the Groundwater Protection Regulation, which addresses well construction and design, as well as qualification for well drillers and pump installers. Responsibilities of the Water Stewardship Division and the Comptroller of Water Rights also include the regulation of water **utilities and water users' communities**.

The Ministry of Agriculture also deals with activities that can impact water supplies. Ministry officials provide advice and education to farming operations to support the implementation of beneficial practices to reduce potential impacts, such as nitrate contamination of groundwater. Other resource agencies such as the Ministry of Energy, Mines and Petroleum Resources and the BC Oil and Gas Commission manage waste disposal, run-off, effluent, and other energy resource extraction activities that may impact water resources.

The Ministry of Municipal Affairs and Housing (MAH)<sup>c</sup> works with other ministries such as the Ministry of Health, ENV, FLNRORD, and the Ministry of Transportation and Infrastructure (MOTI) to help local governments manage drinking water resources and meet drinking water protection, infrastructure, and conservation goals. Provincial legislation such as the *Local Government Act* and the *Community Charter* define the core authority and responsibilities of local governments. The *Local Government Act* also gives improvement districts the authority to provide services such as drinking water to their ratepayers (See Chapter 3).

MAH supports the development of sustainable drinking water infrastructure by assisting local governments with their administrative processes and provides both planning and

capital infrastructure funding to advance drinking water protection objectives.

MOTI, MAH and local governments all play a role in the development of land through subdivision and land use planning that directly impacts water and wastewater services. In general, MAH encourages the development of compact, complete, resilient communities. Local governments (i.e., municipalities and regional districts) derive their authority for regional growth strategies, planning, and land use under Part 13 and 14 of the *Local Government Act*.<sup>8</sup> MAH supports local governments by providing certain statutory approvals (e.g., Islands Trust Official Community Plans); a governance framework for finance and administration; advice and best practices; and infrastructure grants and programs.

The subdivision of land must be approved by an approving officer appointed under the *Land Title Act*. In a municipality or a treaty First Nation, the approving officer is appointed by the Council or by the First Nation, and in unincorporated areas, a provincial approving officer is appointed by MOTI. The approving officer may consider a wide range of factors such as local plans and zoning, drainage, and the provision of works and services (e.g., sufficient and satisfactory water supply).<sup>9</sup>

## 2.2 Water System Suppliers and Operators

**Water suppliers** are responsible for providing safe drinking water, meeting legislative requirements, and notifying the public and health authorities about water quality problems or the potential for health risk. These suppliers may be local governments, improvement districts, private utilities, water users' communities, corporations, strata corporations, societies, cooperative associations, individuals, and other organizations. With the exception of small water systems, all water suppliers must have a certified operator to run, maintain, and repair the system who is qualified in accordance with the Drinking Water Protection Regulation. The Drinking Water Protection Regulation gives the **Environmental Operators Certification Program** the authority to establish classification systems for drinking water systems, as well as standards and processes for certifying system operators. However, the Environmental

<sup>c</sup>MAH was known as the Ministry of Community, Sport and Cultural Development in the last PHO drinking water report.



Capillano reservoir in North Vancouver; one of three reservoirs in the protected watersheds for Metro Vancouver.  
Photo credit: Metro Vancouver.

## Private Water Suppliers Under the *Drinking Water Protection Act*

A single-family residence on its own water supply system is considered a private water system and exempt from most of the requirements of the *Drinking Water Protection Act* (e.g., construction and operating permits). Property owners on a private water supply are responsible for the safety of their own water supply and are not monitored or inspected by drinking water officers under the Act. Private water supplies do, however, benefit from the parts of the act related to threats to drinking water and source water protection.

Operators Certification Program does not have regulatory authority to impose legally binding requirements on any party. The responsibilities of private water suppliers are described above.

The complexity of the current regulatory structure in BC leads to challenges in ensuring source water protection. The overlapping and sometimes conflicting jurisdiction over activities in water source areas presents challenges, particularly when there are competing interests (See the Comox Lake example at right). For example, source protection is often challenged by the demand and needs of forestry, recreation, agriculture, range, mining, and oil and gas activities, which may also have interests within

the **watershed** or **capture zone**. A water supplier has the responsibility to treat water to ensure it is potable, but generally has little or no ability to control upstream source water quality because land use decisions are typically outside of their control. Exceptions exist when watersheds are protected from other uses, as in the case of Metro Vancouver or the Capital Regional District water supply for Greater Victoria—these are the only watersheds in the province where the water supplier controls the land and use is restricted solely for the protection of drinking water.

## Competing Interests and Conflicts in Source Protection

The Comox Lake watershed on north Vancouver Island is an example where overlapping jurisdiction and competing interests have challenged source protection. The Comox Lake watershed is the primary drinking water supply for the Comox Valley, currently serving over 45,000 residents.<sup>10</sup> In 2006, a contractor was hired to complete a watershed risk assessment for the Comox Valley Regional District. The assessment identified a number of risks to the watershed including climate change, transportation corridors, boating, vandalism, residential development, forestry road/bridge and logging operations, damming and redirection of streamflow, onsite sewage, wildlife, camping, and potential for aircraft crashes.<sup>11</sup>

Governance of the Comox Lake watershed is complex and continues to challenge water suppliers and drinking water officials who share responsibility for protecting drinking water supplies in the region. Like many watersheds in BC, the Comox Lake watershed is a multi-use watershed. Its governance involves many different stakeholder groups with differing interests, including BC Hydro, the federal Department of Fisheries and Oceans, private forest companies, private land users and owners, First Nations, the Village of Cumberland, and the Comox Valley Regional District. For some 25 years, despite all best efforts and much activity, these stakeholders had been unable to produce a plan to protect their watershed that was agreeable to all stakeholders and to the drinking water officer for Island Health. Over the years the Comox Valley Regional District water system has experienced several boil water notices, due to increases of turbidity that reduced the effectiveness of the water treatment. For example, in 2014 a large erosion event upstream of the intake led to the water system remaining on a boil water notice for 47 days. Other events and activities that cannot be addressed through a boil water notice have also occurred, such as a plane crash (2017), boating accidents, military exercises, and encroachment into riparian areas by private land owners.<sup>10</sup>

In 2016, the Comox Valley Regional District released a Comox Lake Watershed Protection Plan, after consulting and engaging with a variety of stakeholders.<sup>12</sup> A Watershed Protection Plan is a policy tool, and it has limitations in jurisdictionally divided watersheds such as Comox Lake. Such plans are not legally binding and depend on the cooperation of all parties, which has created barriers to implementation of the plan for Comox Lake.<sup>13</sup> This has led the Provincial Health Officer, at the request of the drinking water officer for Island Health, to make a recommendation to the Minister of Health to order the development of a legally binding Drinking Water Protection Plan for the area.

### 2.3 First Nations Water Systems

On October 1, 2013, the First Nations Health Authority (FNHA) took over responsibility from Health Canada for delivering Environmental Public Health Services on BC First Nations land, which includes addressing public health concerns related to drinking water on reserve. FNHA works in partnership with First Nations communities through the Drinking Water Safety Program to support access to safe and reliable drinking water within their communities. The Drinking Water Safety Program, which adheres to the *Guidelines for Canadian Drinking Water*

*Quality*, is a core part of Environmental Public Health Services that identifies, prevents, and works to mitigate public health risks in First Nations communities.<sup>14</sup>

The objectives of the program are to maintain the quality of drinking water through sampling and testing activities in distribution systems of community water systems, to reduce public health risks associated with potential water contamination, to advise communities on how to address potential public health concerns, and to build the capacity of First Nations through community-based water monitoring.<sup>14</sup>

Environmental health officers from FNHA are assigned to First Nations communities to support activities under the Drinking Water Safety Program. FNHA also has four regional environmental health technicians that support the program. FNHA staff use the provincial regulations and guidelines as guidance to support communities in meeting or exceeding provincial standards on reserve.<sup>14</sup>

Environmental health officers in FNHA work with water treatment plant operators and community-based drinking water monitors to develop sampling plans as recommended by provincial and federal regulations, guidelines and best practices, and that are representative of the distribution system. Community sampling programs are developed to be specific to the type, size, and complexity of the water system.<sup>14</sup>

Community-based drinking water monitors play a key role in the Drinking Water Safety Program as the designated position responsible for sampling, testing, recording, and communicating the microbiological quality of treated water within the community. For communities without a monitor, the environmental health officer or environmental health technicians will perform the sampling. Drinking Water Safety Program staff provide training to community-based

drinking water monitors on sampling and testing drinking water for potential bacteriological contamination using in-community laboratory equipment (Colilert®).<sup>14</sup> The community laboratory equipment and any additional sampling conducted at approved laboratories are funded through the Drinking Water Safety Program. Regular sampling of chemicals in drinking water is also conducted in community water systems depending on raw water quality and the type of treatment installed.<sup>14</sup>

Indigenous Services Canada<sup>d,15,16</sup> is responsible for providing funding for drinking water infrastructure and for building First Nations capacity to operate, monitor, and maintain drinking water and wastewater systems. During 2016/17, the federal government pledged to invest \$1.8 billion over five years for drinking water and wastewater infrastructure improvements. Indigenous Services Canada also supports operation of community water systems on reserve through the Circuit Rider Training Program, which is designed to assist water treatment plant operators with water system operation and troubleshooting when technical issues arise.<sup>14</sup> Efforts to develop federal drinking water regulations for First Nations lands are described below.

## *Safe Drinking Water for First Nations Act*

The federal *Safe Drinking Water for First Nations Act* came into force on November 1, 2013.<sup>17,18</sup> This Act is intended to ensure that First Nations have health and safety protections for drinking water and that drinking water and wastewater standards on First Nation lands are comparable to the standards enjoyed by all Canadians.<sup>19</sup> The Act enables the creation of regulations for drinking water and wastewater but does not impose any requirements itself. The federal government, in partnership with First Nations, intends to develop federal regulations for access to safe drinking water and drinking water source protection on First Nation lands for each region of Canada, after completing further consultation.<sup>20</sup> In 2017 the Assembly of First Nations passed a resolution calling for the Act to be repealed and that the federal government work directly with First Nations on the Act to address their concerns. The Assembly of First Nations is leading the process, which will include engagement with national and regional First Nations representative organizations, First Nations technical groups, and First Nations communities and other interested parties across Canada to re-visit the Act and address their concerns respecting the Act and to identify priorities and a course of action going forward.<sup>21</sup>

<sup>d</sup> Indigenous Services Canada changed names many times during the reporting period. From 2011 to 2015, the department was known as Aboriginal Affairs and Northern Development Canada; in 2015, the name was changed to Indigenous and Northern Affairs Canada. In 2017, the federal government dissolved Indigenous and Northern Affairs Canada and created two new departments: Indigenous Services Canada and Crown-Indigenous Relations and Northern Affairs Canada.

## 2.4 Conclusion

This chapter explored roles and responsibilities in providing and protecting drinking water in BC. As demonstrated in this chapter, the governance of drinking water and water supplies in BC is complex and involves many actors federally, provincially and locally. The decentralized nature of the regulatory structure in BC has led to challenges when competing interests arise, particularly for source water protection. In order to ensure the availability of clean, safe, and reliable drinking water, it is crucial to have clearly defined roles and responsibilities and effective inter-agency cooperation.

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# 3 Types of Water Systems

A large number of water systems are regulated in BC. As of March 31, 2017, there were 4,825 recorded water systems across the province, 91 per cent of which were small water systems. Small water systems are defined under the Drinking Water Protection Regulation as drinking water systems that serve 500 people or less in a 24-hour period. While the majority of water systems in the province are small, the majority of the population in the province is served by a small number of larger local government water systems such as the Metro Vancouver Water System and the Capital Regional District Water System.

While the number of water systems in BC is high, it has changed only slightly since 2014 when it peaked at 4,840 (Table 3.1). This slowdown may be due to small water systems not being discovered or developed at the same rate as in the past. It may also be due to the amalgamation of systems, small commercial systems shutting down and no longer requiring a permit to operate, or closed files being removed from the database. Monitoring water systems has challenges, including data collection and information system limitations. This report represents the first time the Provincial Health Officer (PHO) has been able to provide a reasonable estimate of the number of small water systems, using estimates of population served as per the definition in the regulation.

**Table 3.1: The Number of Small and Large Water Systems, by Health Authority, as of March 31<sup>st</sup>, 2013 to 2017**

Health Authority	2013			2014			2015			2016			2017		
	Small	Large	Total	Small	Large	Total	Small	Large	Total	Small	Large	Total	Small	Large	Total
Island Health	720	77	797	754	77	831	815	79	894	848	79	927	842	84	926
Northern Health	1,192	60	1,252	1,207	60	1,267	1,184	50	1,234	1,194	50	1,244	1,187	50	1,237
Vancouver Coastal Health	257	97	354	264	100	364	253	100	353	248	100	348	251	100	351
Interior Health	n/a	n/a	1,923	1,797	121	1,918	1,732	133	1,865	1,687	133	1,820	1,723	137	1,860
Fraser Health	425	47	472	418	42	460	412	42	454	409	43	452	409	42	451
<b>Total</b>			<b>4,798</b>	<b>4,440</b>	<b>400</b>	<b>4,840</b>	<b>4,396</b>	<b>404</b>	<b>4,800</b>	<b>4,386</b>	<b>405</b>	<b>4,791</b>	<b>4,412</b>	<b>413</b>	<b>4,825</b>

**Note:** Small water systems serve 500 or less people in a 24-hour period. Large water systems serve greater than 500 people in a 24-hour period.  
**Source:** Regional health authorities; 2012/13 – 2016/17.

### 3.1 Types of Water Systems and New Water System Categories

Water systems can be as large and complex as the water treatment plants and distribution network serving Metro Vancouver, or as simple as a hand-pump in a provincial park—yet all are regulated under the *Drinking Water Protection Act* (DWPA). Small water systems in BC include many types of systems that serve a variety of communities (e.g., subdivisions, rural neighbourhoods, public facilities, and commercial enterprises). Water systems can be public or privately owned or jointly owned by a group of users. The population served may be transient or non-transient, and the primary use of the water may be for residential, industrial, recreational, or institutional facilities or developments.

Past PHO reports have been limited to annually tracking of the number of water systems in BC by the number of water service connections to the distribution system. This count categorized water systems as follows: greater than 300 connections, 300–15 connections, less than 15 connections, and 1 connection serving a public facility. These four categories come from historic billing categories for permit fees and remain in use because they are easily

reportable from health authority databases. Unfortunately, these categories do not always correlate well with the size of the population served, nor do they align well with BC’s current definition of a small water system.

As part of the new indicator project discussed in Chapter 1, the PHO and the regional health authorities developed new categories for reporting on water systems based on a size of the population served (Table 3.2), source (Table 3.3), and the type of community water system or facility served (Table 3.4 & Table 3.5) The type of system can greatly influence the financial management, governance, and oversight of that system. It can also reflect the type of population using the water (i.e., transient or non-transient, residential or non-residential, or vulnerable populations [i.e., immunocompromised people, children, and the elderly]). The PHO intends to report on three types of water systems: **community water systems** (Table 3.4), **stand-alone facility water systems** (Table 3.5), and **bulk water haulers** (See Chapter 9).

**Table 3.2: Water System Categories Based on the Size of the Population Served**

Small Water Systems (≤500 people served per day)		Large Water Systems (>500 people served per day)			
≤ 50 people served per day	51–500 people served per day	501–5,000 people served per day	5,001–10,000 people served per day	10,001–100,000 people served per day	>100,000 people served per day

**Table 3.3: Water System Categories Based on the Source Type that Serves the System**

Surface water	Groundwater	Combined ground and surface water	Bulk supplied from an approved source (trucked or piped)
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**Table 3.4: Water System Categories Based on the Type of Community Water System**

Water System Type		Water System Sub-type	
Local Government Water System	Any community water system that falls under the <i>Local Government Act</i> (LGA). This includes municipalities, regional districts, and improvement districts. These water systems all have governance and financial requirements provided by the LGA and the <i>Community Charter</i> , with oversight provided by the Ministry of Municipal Affairs and Housing (MAH).	Municipal	Any community water system owned and/or operated by a municipality. This includes municipalities incorporated as a village, town, city, district municipality, mountain resort municipality, resort municipality, island municipality, or a municipality in conjunction with resource development under Section 10(1) of the LGA.
		Regional District	Any community water system owned and operated by a regional district. Regional districts are the local government for areas not incorporated as a municipality, and may provide governance and services such as drinking water to regions as a whole, such as Metro Vancouver.
		Improvement District	Any community water system owned and operated by an improvement district. Improvement districts—which include irrigation and waterworks districts—are independent public corporations that provide limited services in rural (unincorporated) areas of the province, such as drinking water, fire protection, or garbage collection. Improvement districts are not considered a form of local government because of the limited services they provide. <sup>1,2</sup> They may exist within the boundaries of a municipality or regional district but operate independently. (See Section 3.2.2)
Developments Incorporated by the Comptroller of Water Rights	Any community water system incorporated by the Comptroller of Water Rights at the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)	Utility	Utilities are water systems that are built by developers in areas where no existing water service is available. A utility provides water in exchange for compensation to five or more persons or a corporate facility (such as a ski resort). Utilities are regulated under the <i>Water Utility Act</i> and the <i>Utilities Commissions Act</i> and may be set up under several different business/ownership models, including a strata corporation, a society, a corporation, an individual, or partnership. The Comptroller of Water Rights and the Utility Regulation Section of FLNRORD provide oversight in terms of governance and financing. <sup>3</sup> (See Section 3.3.3)
		Water Users' Community	Water users' communities are a specific type of community water system that draws its system of governance and incorporation from the <i>Water Users' Communities Act</i> (formerly Part 3 of the <i>Water Act</i> ). They are a public corporate body to which the Comptroller of Water Rights has issued a Certificate of Incorporation. Six or more different licensees may form a water users' community, each of whom holds their own water licence(s). <sup>4</sup> (See Section 3.3.4)

Water System Type		Water System Sub-type	
<b>Independents</b>	Independent water systems include residential developments that have no administrative or financial oversight from FLNRORD or MAH. Independents are not regulated as a utility, water users' community, improvement district, regional district, or municipality. Examples include subdivisions, mobile home parks, shared interest properties, apartment buildings, and shared systems between neighbours.	Strata Corporation	Community water systems that are owned and operated by a strata corporation, where the governance of the water system falls under the <i>Strata Property Act</i> , not the <i>Water Utility Act</i> . Most strata developments are built as a utility, but once the majority of lots are sold the Comptroller may approve the transfer of ownership from the developer to the strata corporation and exempt the strata from the <i>Water Utility Act</i> to avoid regulatory duplication. <sup>5</sup>
		Private Corporation/ Registered Business	Community water systems that are owned and operated by a private company run as a corporation, partnership, or sole proprietorship, but do not meet the definition of a utility.
		Private Owner (Individual)	A water supply system owned and operated by an individual property owner serving water to tenants or neighbouring properties for domestic use. The owner of these systems has no formal business model and is not incorporated or registered as a company under any act. The users of the water are not co-owners of the system.
		Joint (User) Ownership – incorporated	Community water systems that are jointly owned and managed by the owners of the properties/residences the water system serves. The owners/users of these systems have incorporated to run their water system as a society or cooperative association. These jointly owned water systems are not stratas or regulated as a utility or a water users' community.
		Joint (User) Ownership – "Good Neighbour System"	Community water systems that are jointly owned by the users of the system. They are unincorporated and have no formalized business model or governance structure to follow to make decisions and run their water system. They are commonly known as "good neighbour water systems." These water supply systems may have some form of a joint works agreement or easements in place. (See section 3.3.5)
<p><b>Source:</b> BC Office of the Provincial Health Officer. Water system categorization guidance for PHO report purposes; unpublished.<sup>6</sup></p>			

**Table 3.5: Water System Categories Based on Type of Stand-alone Facility Water System**

<b>Industrial/Commercial Facilities</b>	<b>Work Camps</b> – Industrial or commercial premises in which structures used for employee living quarters are provided. These water supply systems are also regulated by the Industrial Camps Regulation under the <i>Public Health Act</i> .
	<b>Work Sites</b> – Industrial or commercial work sites that supply drinking water for domestic use to workers or the public from their own water supply system.
<b>Recreational Facilities</b>	<b>Publicly Owned</b> – Recreational areas, tourist attractions, and accommodations with a water supply system providing domestic water to visitors, owned by a provincial, federal, or local government. Examples include provincial parks, national parks, city parks, recreational areas, campgrounds, picnic grounds, government-owned tourist attractions, and rest areas.
	<b>Privately Owned</b> – Privately owned recreational and tourist facilities and accommodations. Examples include privately owned hotels, motels, inns, bed & breakfasts, resorts, camps, campgrounds, RV parks, water parks, golf courses, ski hills, race tracks, fairgrounds, tourist attractions, etc.
<b>Public Health Facilities</b>	Public Health facilities include facilities that are regulated by public health officials under the <i>Public Health Act</i> , <i>Food Safety Act</i> , or the <i>Community Care and Assisted Living Act</i> . These facilities include food facilities (regulated through environmental health programs) and community care facilities (regulated through licensing programs) that provide their own water supply and are therefore subject to the <i>Drinking Water Protection Act</i> (DWPA) as water suppliers. Health care facilities designated under the <i>Hospital Act</i> that provide their own water supply are also included.
<b>Schools</b>	This includes all schools (public and independent) providing Kindergarten to Grade 12 education that use water from a private source. This makes the school district or the independent school the water supplier under the DWPA.
<b>Civic and Community Facilities and Institutions</b>	Facilities or institutions that are buildings used to provide a service or public benefit. Examples include libraries, post offices, jails, community centres, town halls, event centres, churches, post-secondary institutions, and vocational training centres. Where such facilities rely on their own private water supply, they are considered water suppliers under the DWPA. These civic facilities may be publicly or privately owned.
Source: BC Office of the Provincial Health Officer. Water system categorization guidance for PHO report purposes; unpublished. <sup>6</sup>	

These categories will better reflect the use and capacity of different water systems and will allow officials to highlight the challenges, successes, and issues they face. The ability to break down the data collected by the specific type of water system, size, or source will create a greater understanding of where issues are and make it easier to develop targeted programs to address these issues.

At present, health authority data systems do not consistently allow for collection of this information; this issue must be addressed in order to meaningfully report out on drinking

water in BC. Interior Health and Fraser Health have begun piloting modifications to their administrative databases to allow future reporting on these data. While the data from regional health authorities on water system type are currently limited, some data are available from other government ministries (e.g., Ministry of Municipal Affairs and Housing [MAH]) and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development [FLNRORD]).

The following sections describe some of the most common and well defined types of water supply systems—as per the new

categories—using available data, and identify some of the specific challenges and strengths of these systems.

## 3.2 Governance Opportunities and Challenges Faced by Specific Types of Water Systems

### 3.2.1 Municipalities and Regional Districts

Most large water systems in BC are **local government systems** owned and operated by municipalities or regional districts. MAH provides governance and administrative oversight to these systems under the *Local Government Act* and the *Community Charter* and provides funding to support the development of sustainable drinking water infrastructure. Many of these water systems benefit from both an economy-of-scale to generate greater revenue and access to government grants and financing from the Municipal Finance Authority of BC. In addition, larger systems benefit from the capacity to hire trained personnel to operate and manage their systems, compared to smaller water systems. Other local government benefits include internal administrative expertise, control over community and land use planning, cost-recovery capabilities and methods, and superior borrowing and insurance rates.

Some local governments, especially regional districts, also operate several small water systems. In recent years, local governments have assumed responsibility for many small water systems within their jurisdictional boundaries.<sup>7,8</sup> While water supplies run by a local government benefit from the governance structure and oversight provided by the *Local Government Act* and the *Community Charter*, smaller, rural local governments still struggle to recruit and retain qualified staff—a challenge faced by all small and rural water suppliers. Once operator certification is achieved, operators from small rural areas are often recruited to run larger, better-paying water systems in larger urban centres.

Seeking public approval to authorize borrowing for capital projects may be a challenge for some municipalities and regional districts. Approval of the electorate is not required under the *Community Charter* if the money to be borrowed is required in order to comply with an order

issued under the DWPA to alleviate an imminent health threat; however this can put drinking water officers in a difficult position, as orders are a compliance tool to address health hazards, and they should not be used as a tool to bypass the public consultation and assent process.

Liquid or solid waste projects do not face the same challenge of seeking public approval for borrowing, when the project is part of a waste management plan under the *Environmental Management Act*. The development of the management plan includes requirements to ensure adequate public consultation. Public assent for borrowing is waived, as per Section 9 of the Municipal Liabilities Regulation under the *Community Charter*, for projects identified in an approved liquid or solid waste management plan.

### 3.2.2 Improvement Districts

Although improvement districts are incorporated with their Letters Patent under the *Local Government Act*,<sup>1</sup> they are not considered a form of local government because of the limited services they provide.<sup>1,2</sup> Improvement districts may exist within the boundaries of a municipality but are more typically found within electoral areas in a regional district. Improvement districts operate independently from local governments and do not have access to infrastructure funding available to local governments. To access this funding through MAH, improvement districts must commit to dissolve and transfer the assets, liabilities, and operation of the water system to a local government<sup>2</sup>—a process known as “conversion”, which is done through an Order in Council.<sup>9</sup>

For the past couple of decades the policy objective of government has been to facilitate voluntary conversion of improvement districts. The approach has been limited to creating financial incentives for improvement districts to convert by limiting access to infrastructure funding unless they agree to conversion. The number of improvement districts peaked in 1983, when there were 327. Since that time, a number of improvement districts have converted as a result of a number of municipal incorporations and large-scale municipal boundary extensions. As of September 2017, there were 205 improvement districts remaining in BC; 155 of these provide drinking water

and an additional nine have the authority to provide water via their Letter Patent but do not provide the service. Since 2014, there have been eight conversions of improvement districts that provide drinking water.<sup>10</sup>

The majority of improvement districts providing drinking water reside within Interior Health and Island Health (Table 3.6). The two regional districts with the highest number of improvement districts are Capital Regional District (Island Health) with 24, and the Central Kootenay Regional District (Interior Health) with 21.<sup>10</sup>

Improvement districts vary in size, ranging from small subdivisions to larger communities: the smallest improvement district providing drinking water (Stardel Waterworks) has seven service connections, and the largest improvement district (Black Mountain Irrigation District) has 8,187 service connections. While some improvement districts can be quite large, the majority serve a small population (Figure 3.1) and face many of the same challenges as small water systems do, as outlined in Chapter 9.

**Table 3.6: Number of Improvement Districts, by Health Authority, BC, 2017**

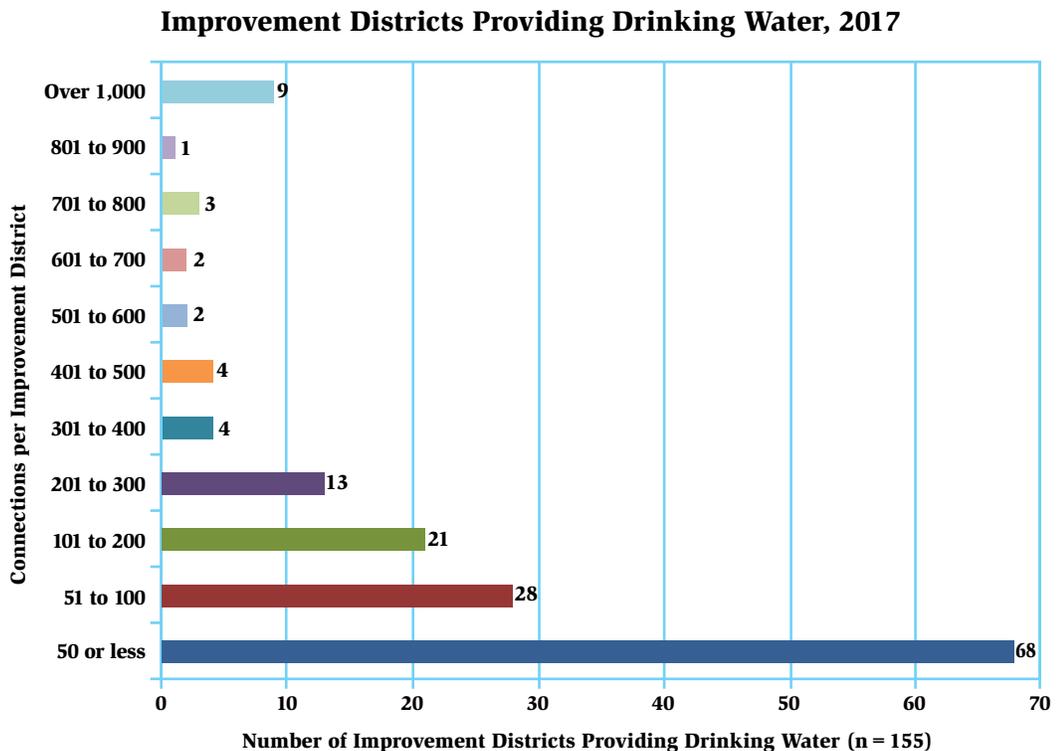
Health Authority	Number
Island Health	50 (32%)
Northern Health	3 (2%)
Vancouver Coastal Health	13 (8%)
Interior Health	83 (54%)
Fraser Health	6 (4%)

Source: BC Ministry of Municipal Affairs and Housing, Local Government Division; 2017.



Aerial view of the Black Mountain Irrigation District's water treatment plant. BC's largest improvement district.  
Photo credit: Black Mountain Irrigation District.

**Figure 3.1: Number of Improvement Districts, by Number of Connections, BC, 2017**



Note: In 2017, there were no improvement districts with 901 to 1000 connections.

Source: BC Ministry of Municipal Affairs and Housing, Local Government Division; 2017. Adapted by Population Health Surveillance and Epidemiology; BC Office of the Provincial Health Officer, BC Ministry of Health; 2019.

Improvement districts also face some specific governance and operation challenges. Improvement districts are governed by a board of elected trustees who serve as volunteers. Trustees hold powers under their improvement district bylaws and the *Local Government Act* to enact and enforce its regulations and charges, to assess and collect taxes, to acquire, hold, and dispose of lands, to borrow money, and to expropriate lands.<sup>11</sup> Although trustees are elected, only property owners can vote or serve on the board. This can limit residents and water users from having a say on matters pertaining to the system. And on top of board eligibility restrictions, it is becoming more difficult to recruit volunteers to run for the board, especially for small and rural improvement districts.

While many improvement districts are well managed, possess adequate administrative and financial capacity, and succeed in meeting operational requirements, some do not. The high numbers of long-term drinking water quality advisories occurring among many improvement districts reflect these challenges. A recent study of water systems in the Interior—where many of the remaining improvement districts exist—found that 35 improvement districts (36.8 per cent) were on an advisory, and 30 (85.7 per cent) of those were long-term advisories.<sup>12</sup> An analysis of the conditions leading to these long-term advisories revealed that 20 (57.1 per cent) of the improvement districts on advisory were relying on surface water with no approved treatment installed.<sup>13</sup>



UV reactors at Black Mountain Irrigation District; BC's largest improvement district.  
*Photo credit: Black Mountain Irrigation District.*

While improvement districts are overseen by MAH, they have less stringent financial reporting requirements compared to municipalities and regional districts. Improvement districts must submit financial statements to MAH but they are not required to have a long-term financial plan, which is compulsory for local governments. Nevertheless, improvement districts are required to establish a reserve fund and deposit amounts to finance at least a portion of the cost of renewing capital works.

Improvement districts may struggle to borrow funds for capital improvements, as many financial institutions are hesitant to lend without the guarantee of the property owned by the trustees. To address this borrowing challenge, MAH—during this reporting period—facilitated a successful connection between a private sector banking institution (Royal Bank of Canada) and improvement districts, building the bank's experience and comfort in providing loans to unconventional borrowers.

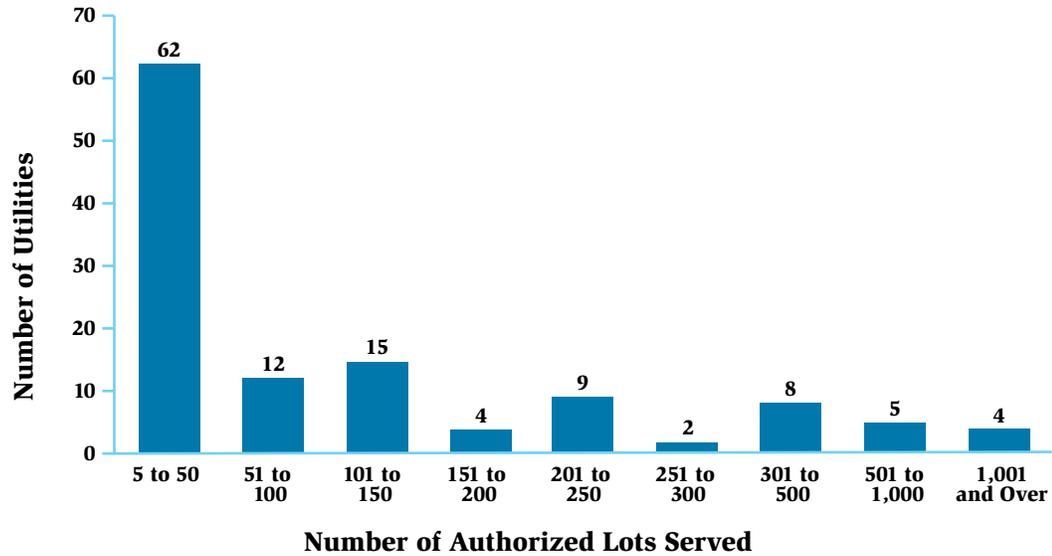
While the borrowing climate for improvement districts is better than in the past, the property owner approval requirements for adopting a

borrowing bylaw that authorizes borrowing to finance a capital project is challenging. Under this process, property owners can vote against plans to borrow money to upgrade or improve the water system, even if the work is required to come into compliance with the DWPA. However, if there is an imminent threat to public health, the Inspector of Municipalities could approve a loan authorization bylaw without the formal approval of the property owners as per the Municipal Liabilities Regulation. A borrowing bylaw and public assent is also not required for capital upgrades if the trustees have accumulated adequate funds in reserve through taxation in advance of the capital asset acquisition. Small improvement districts may be challenged to raise adequate funds for this approach because of the significant increase in taxation necessary to finance capital infrastructure renewal.

### 3.3.3 Private Water Utilities

Developers create utilities as part of a rural land development where community water service is required for subdivision approval. Compared to other non-local government water

**Figure 3.2: Number of Private Water Utilities, by Number of Authorized Lots Served, BC, March 2017**



Source: BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development – Utility Regulation Section; 2018. Adapted by the BC Office of the Provincial Health Officer, BC Ministry of Health; 2019.

systems in BC, utilities benefit from financial and administrative oversight and an approval process prior to incorporation from FLNRORD. Prior to construction, utilities must get approval from the **Comptroller of Water Rights** (the Comptroller) through a **Certificate of Public Convenience and Necessity**. The Certificate of Public Convenience and Necessity describes the conditions under which a utility is developed and outlines how it will operate. The Comptroller does not issue this certificate until the applicant has secured a proven source of water with an adequate supply to meet design needs,<sup>a,14</sup> provided an acceptable engineered design, and has met the required administrative and financial viability conditions.<sup>5</sup> Developers must submit a wide range of financial considerations and documentation in order to prove financial viability.<sup>b,5,15</sup>

The Comptroller also approves water rates for utilities. Water rates are approved on the basis of collecting sufficient revenues to pay for operating costs at a fair and reasonable price.<sup>16</sup>

As of March 31, 2017, FLNRORD recorded 121 water utilities in the province, four of which are managed by the Comptroller. No new utilities have been created since 2012.<sup>17</sup> The number of utilities is slowly shrinking in recent years, as more utilities have been transferred to local governments than have been created in that time. During 2014/15–2016/17, seven utilities transferred ownership to local government, and as of August 2017 five other utilities were talking with local governments about a possible transfer of ownership.<sup>18</sup> Typically this transfer<sup>c</sup> occurs when the owner no longer wishes to operate the system. The transfer may also be the result of poor service quality and/or deterioration of the water system and drinking water quality.<sup>19</sup>

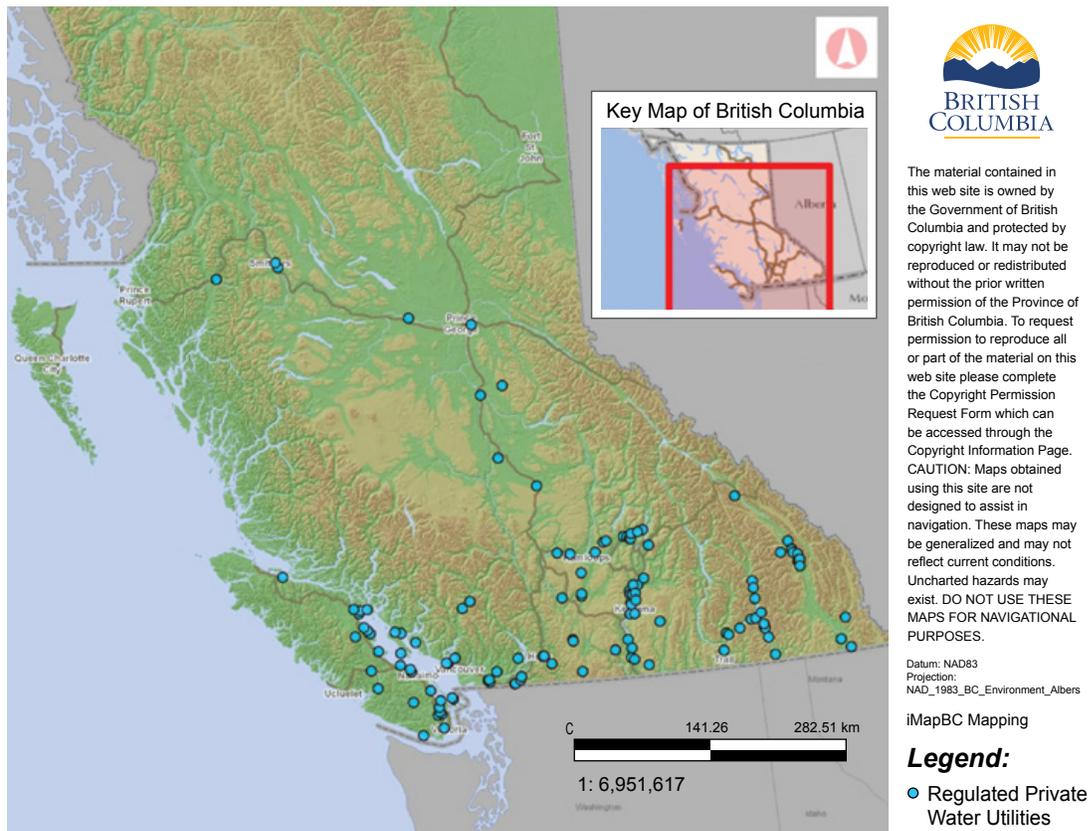
FLNRORD records the size of a utility by the number of authorized lots (i.e., properties) served, not the number of people served. While some utilities can be quite large, over half of utilities (51 per cent) service 50 lots or fewer (Figure 3.2). Only 14 per cent of utilities (17) serve more than 300 authorized connections.

<sup>a</sup> Utilities must meet FLNRORD’s *Design Guidelines for Rural Residential Community Water Systems* (2012).

<sup>b</sup> Developers must follow FLNRORD’s *Guide to Applying for a Certificate of Public Convenience and Necessity* (2016) and *Financial Guidelines for Certificate of Public Convenience and Necessity Applications* (2016).

<sup>c</sup> Water utility owners have the option to sell or transfer their water systems to others individuals or companies, societies, municipalities, regional districts, or improvement districts.

**Figure 3.3: Location of Private Water Utilities, October 2017**



**Note:** A private water utility under the *Water Utility Act* is a person/business who owns or operates equipment or facilities for the delivery of domestic water service to five (5) or more persons or to a corporation for compensation. Private water utilities are usually created by developers to serve rural land development where community water service is required for subdivision approval and where there is no other water purveyor in the area that can provide service.

**Source:** Data from BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development – Water Management; custom map prepared using iMapBC web-based mapping tool; prepared by BC Office of the Provincial Health Officer, 2017 Oct 25.

There are three areas in the province that contain the majority of privately owned water utilities (Figure 3.3). The highest concentration is found in southwestern BC, with the majority located on the south east coast of Vancouver Island. The second highest concentration is in the Okanagan, and the third is in the Kootenays.

Unfortunately, the governance structure of utilities sometimes fails, which can leave water systems in a state of disrepair and legal uncertainty. Property owners may create a water users' society under the *Societies Act* to acquire the utility when the original owner/developer no longer wishes to or is unable to operate the utility and no local government options are available. The provincial government's preferred form of organization is a local service area, which

is normally formed within a regional district to acquire water systems and provide services. However, sometimes the formation of a society is the only option available when the number of connections is too small, or the regional district is unwilling, to form a local service area.<sup>20</sup>

The Ministry of Finance's Registrar of Companies may also dissolve a utility after the company or society fails to file required documents or when the director(s) of the company resigns or walks away from the water system.<sup>2</sup> When the governing body of a water system dissolves, the company or society that owned and operated the water system no longer legally exists and ownership of the system and its assets shifts to the Crown (i.e., the Attorney General of British Columbia). This transfer process falls



In 2016, the Columbia-Shuswap Regional District took over the Sunnybrae water system. The utility had escheated to the Crown and was on a long-standing boil water notice resulting from a problematic shallow lake intake and inadequate treatment (i.e., chlorination only on a surface water source). After taking over the system, the regional district proceeded to upgrade the intake and treatment with completion in the spring of 2018. The system now has a new deep water intake, pump station and treatment plant building (left) with new pumps and equipment, UV disinfection treatment and analyzers (right), secondary disinfection, and Supervisory Control and Data Acquisition (SCADA) monitoring.

*Photo credit: Columbia-Shuswap Regional District.*

under the *Escheat Act*, which requires that the escheated property not be disposed of until two years after its dissolution.<sup>21</sup> If the society or company reforms itself within two years, the property reverts back to the society or company.<sup>2</sup> Drinking water officials have identified the escheat process as cumbersome and a challenge and barrier for utilities (small or large) caught in legal uncertainty after dissolution. The **escheat** process also poses challenges in increased costs and liability for both the local and provincial governments.

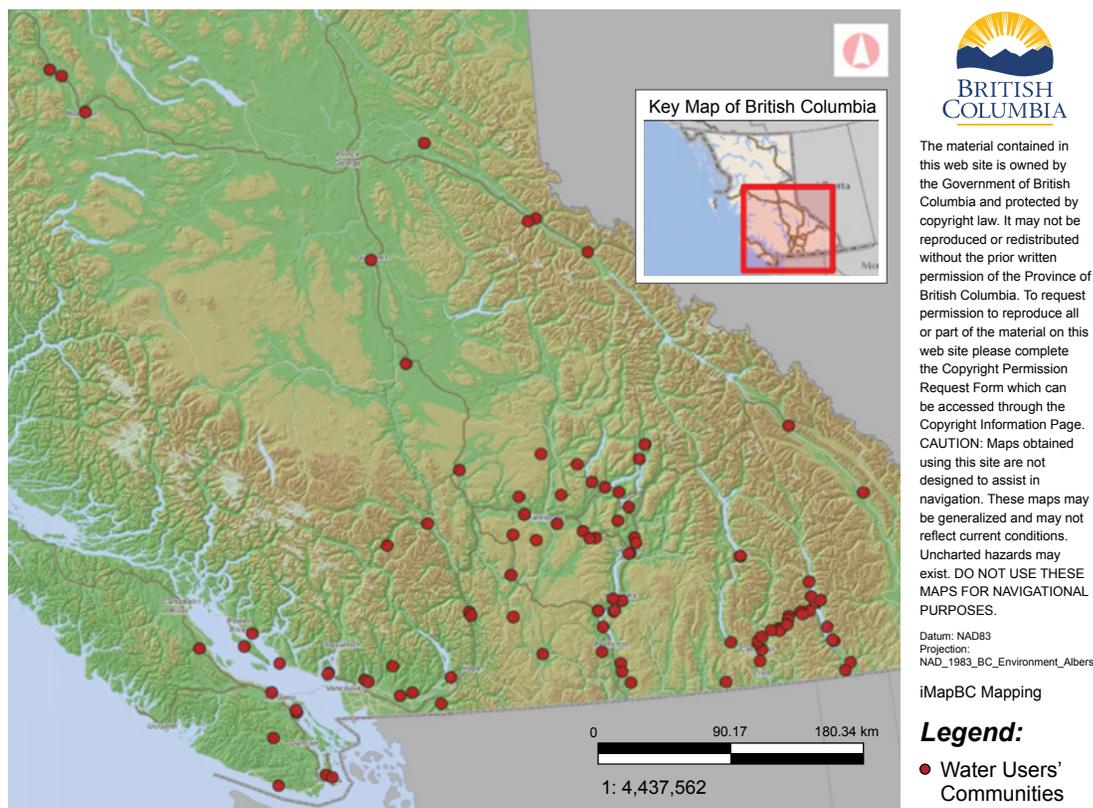
Over the last three years, one water utility fell into escheat. Sunnybrae Water System (2771617 Holdings Ltd.) escheated May 26, 2014, and was subsequently transferred to the Columbia-Shuswap Regional District on October 14, 2016. Three utilities during this same time had their management seized by the Province: North Shore Water Utility Nelson Ltd. on March 22, 2014 (subsequently transferred to Aqua Diversities Inc. on September 5, 2015); Van West Water

on December 9, 2016; and 753 Waterworks in October 2017. During the time this report was being developed, four private water utilities continued to be managed by the Comptroller of Water Rights: 753 Waterworks, Van West Water, Sage Mesa Water and Eastside Utility.

### 3.3.4 Water Users' Communities

Water users' communities are generally quite small, serving rural hamlets or neighbourhoods. Six or more water licensees may form a water users' community.<sup>4</sup> A licensee may be an individual property owner, a mobile home park, a small subdivision, or another type of establishment; therefore, it is difficult to estimate the population size served by the water users' community by tracking the number of licences. Historically, water users' communities relied on strictly surface water sources, as BC only licenced surface water. Now that BC licenses groundwater use under the new *Water Sustainability Act*, water users' communities can now consist of a combination of surface and groundwater licences.

**Figure 3.4: Location of Water Users' Communities in BC, October 2017**



**Note:** A water users' community is a public corporate body incorporated under Section 51 of the *Water Users' Communities Act* and to which the Comptroller of Water Rights has issued a Certificate of Incorporation.

**Source:** Data from BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development – Water Management; custom map prepared using iMapBC web-based mapping tool; prepared by BC Office of the Provincial Health Officer, 2017 Oct 25.

As of March 31, 2017, there were 107 water users' communities in BC. Of those, 90 hold domestic water licences for drinking water.<sup>d</sup> The majority are found within Interior Health, with a high concentration within the West Kootenays near Nelson and across the Thompson/Okanagan (Figure 3.4). Most water users' communities comprise less than 20 domestic licences; however a handful of larger ones exist. For example, Seymour Arm water users' community, the largest water users' community in BC holds up to 173 domestic licences among its membership.<sup>22</sup>

The number of water users' communities in BC has remained relatively constant. Over the past three fiscal years (2014/15–2016/17),

one new water users' community formed, and FLNRORD received two applications that are currently being processed.<sup>23</sup> During this period, only one water users' community dissolved.<sup>22</sup>

The benefits to licensees of forming a water users' community are the joint use of a water system to store and/or deliver water to their respective places of use; the ability to acquire, hold, replace, and control property, works, and equipment listed in the water licences; the power to refuse the benefits of the waterworks to any member in default of payment or out-of-compliance with a regulation; and, if needed, the power to enforce payment of an assessment in court.<sup>4</sup>

<sup>d</sup> Water users' communities are not limited to domestic use water licence holders. Many of these communities also include licence holders for irrigation use. However, if the licence holders in a water users' community only holds licences for irrigation use, and have an alternate water source for domestic use (e.g., a private well), that water users' community would not fall under the DWPA.

There are also ecological benefits to water users' communities. When water licensees build joint works for collecting and storing water, the number of intakes into sensitive aquatic ecosystems can be reduced. Source protection officers who administer the *Water Sustainability Act* hold powers to order licensees to construct joint works for this ecological reason; however, they often avoid doing so as it would create shared works under the DWPA, triggering the need for a construction and operating permit along with the associated requirements, costs, and liabilities for those surface water users.<sup>24</sup> Interior Health has taken steps to alleviate these conflicts and developed an operational policy excluding a shared fish screen from the definition of intake works.<sup>25</sup> This allows multiple intakes to use the same fish screen without becoming a water supply system under the DWPA.

A water users' community falls under the operation of a manager, which may include a committee of management. Members of the community resolve their business at general meetings through a majority vote by members in attendance and in accordance with the *Water Users' Communities Act* (WUCA). Like all non-local government systems, water users' communities are not eligible for government funding and must fund themselves by user fees. The manager prepares an assessment showing the amount payable by each member<sup>e</sup> on an annual basis or when additional funds are needed. These assessments and other financial statements are filed with the Comptroller's office with proof of compliance of notification to members. Members may request an appeal of the assessment from the Comptroller.<sup>4</sup>

Although water users' communities have some administrative oversight from FLNRORD and the Comptroller, many struggle financially and operationally to maintain their water system so that it provides potable water in compliance with the DWPA. Water users' communities lack an economy-of-scale, and users are frequently unable or unwilling to pay the required costs to install treatment or upgrade their infrastructure. Additionally, water users' communities under WUCA can only address the shared works listed in the water licence for the community;

therefore, any shared works not listed in the water licence are outside the scope of the incorporated community under WUCA.<sup>22</sup>

Because most existing water users' communities use surface water, they require at least two forms of treatment to meet the BC drinking water treatment objectives for surface water (see Chapter 5). Most water users' communities lack two forms of treatment. In fact, a high number of them have no treatment at all and often operate with long-standing boil water notices.<sup>12</sup> A 2012 study of water system types in the Interior found that 76 per cent of water users' communities were on an advisory, 97 per cent of which qualified as long-term advisories. Most of these advisories pre-date existing drinking water legislation, have existed for years if not decades, and 85 per cent were issued as a result of having no treatment.<sup>12</sup>

The infrastructure of most water users' communities—rarely designed and constructed with engineering approvals—is also deteriorating with age.<sup>12</sup> Water users' communities depend on community member volunteers to manage and sometimes operate the drinking water system, making recruitment and retention of qualified personnel a concern. These volunteers often lack the capacity (administratively and operationally) to financially manage and operate these systems. While they have a basic business model to follow under WUCA, the governance structure of these water systems has limited oversight and accountability. Consequently, they rarely succeed in raising rates, securing funds, or producing viable long-term management plans to upgrade and maintain their water supply in a manner that meets health requirements.

Unlike utilities, water users' communities do not need to prove financial viability or produce documentation of engineering plans that meet the design and health requirements for a construction permit, issued by the local health authority, before receiving approval by the Comptroller. According to the Water Management Branch at FLNRORD, this is because each member of the community is a licence holder and is responsible for their own works. Under the *Water Sustainability Act*, the licensees are only authorized to construct the

<sup>e</sup> The respective interests of the members of a water users' community are proportionate to the respective maximum quantities of water the members would be entitled to divert and use under the licences referred to in the certificate of incorporation.



The creek intake and reservoir for a water users' community supplying approximately 40 homes in rural BC.

Photo credit: Denny Ross-Smith, Small Water Users Association of BC.

works listed on the water use licence, and WUCA provides the ability for licensees to share and manage those works. As such, the Comptroller does not view the water users' community as a water supplier but rather as a form of joint works where the water licensees are responsible for their own water.<sup>22</sup> In contrast, the DWPA includes shared waterworks within the definition of a water supply system, which in turn makes the water users' community a water supplier. This historical disconnect in the approval process and definition of a water supplier has created challenges for the regional health authorities, who must enforce the standards of the DWPA and have often become involved with regulating the shared waterworks of water users' communities, after they have already been established as a domestic water supply system.

### 3.3.5 Independents and Good Neighbour Systems

**Independent water systems** refer to residential developments that have no administrative or financial oversight from FLNRORD or MAH. Independents range in size but are often small water systems and include strata corporations, mobile home parks, seasonal and/or recreational properties, shared interest properties and cooperatives, private developments/complexes, and "**good neighbour systems**", which refers to a group of neighbours that have constructed and connected to a shared water supply system (with or without any approvals from officials under the DWPA).

Good neighbour systems develop in an ad-hoc manner when one neighbour requests to tap into the same well or surface intake on a neighbour's property. Some of these good neighbour systems have grown to serve up to 20 or 30 households,<sup>26</sup> but they can also be as small as two neighbours or two dwellings on the same property. The management and business models of these independents vary greatly, ranging from societies, cooperative associations, sole proprietorships, or partnerships, to corporate management structures. Good neighbour systems lack any form of governance or management structure and may rely entirely on informal agreements between neighbours.

Health officials have found it particularly challenging to engage with good neighbour systems to ensure water quality. As this type of system is not legally incorporated or formally organized, determining or finding someone to take responsibility or claim ownership for the system has proven difficult.<sup>26</sup> The absence of a clear owner or governance structure for many of these good neighbour systems results in major gaps in operational, administrative, and financial capacity, as the owners and users of these systems have no clear process for making decisions, settling disputes, managing their assets, acquiring property or access, generating revenue, setting or collecting rates, or enforcing rules or payment.

Like all other small systems, independents are ineligible for any government infrastructure funding and they lack an economy of scale for raising sufficient revenue to pay for treatment and system upkeep. Many independents pre-date the DWPA and were built without any construction approvals. As a result, many of these systems fail to comply with design, treatment, and water quality standards and therefore are out-of-compliance with the DWPA at the time a drinking water officer discovers them. Bringing these systems into compliance has proven a difficult task for the limited resources of the regional health authorities, especially when the users of the water system do not wish to be regulated or pay for system upgrades.

At this time, the PHO is unable to report on the number of independent community water systems within BC, as health authorities do not yet track water systems under these categories and many remain unrecognized.

### 3.3.6 Stand-alone Facility Water Systems

In rural areas it is common for facilities to not be connected to community water systems and to provide their own water supply through their own well or surface water intake. The PHO refers to these water supply systems as “stand-alone facility water systems,” which includes industrial-commercial facilities, recreational facilities, public health facilities, schools, and civic and communities facilities and institutions described in Table 3.5. Stand-alone facility water systems face many of the same financial and operational challenges of other small water systems; however, they often face added challenges and different exposure risks depending on the type of facility, the nature of the use, and the type of population being served. Many stand-alone facilities experience seasonal peaks, sporadic use, and often serve transient populations. Operations of such systems often fall to the owners,

managers, or custodians of the facility, who may have other job duties and no formal experience in running a water system.

At this time, the PHO is unable to report on the number of stand-alone facility water systems within BC, as health authorities do not yet track water systems under these categories.

### 3.3 Water Systems in BC First Nations Communities

First Nations drinking water systems on-reserve are categorized and defined differently than water supplies found off-reserve in BC. Table 3.7 describes the categories used by Indigenous Services Canada and First Nations Health Authority (FNHA). Only community water systems with five or more connections are eligible for infrastructure funding through Indigenous Services Canada. FNHA provides service to all drinking water systems, regardless of the size.<sup>27</sup>

**Table 3.7: Categories of First Nations Drinking Water Systems, BC**

Category	Description
<b>Community Water Systems</b>	Community system with five or more connections.
<b>Public Water Systems</b>	Water supply system with fewer than five connections, but includes one or more public facilities. Public water systems are further broken down as follows: <ul style="list-style-type: none"> <li>• Public Water System – Non-Transient Population</li> <li>• Public Water System – Transient Population</li> <li>• Trucked Public Water System – Non-Transient Population</li> <li>• Trucked Public Water System – Transient Population</li> </ul>
<b>Private Water Systems</b>	Water system with fewer than five connections. Private water systems are further broken down as follows: <ul style="list-style-type: none"> <li>• Individual Water System: private well or surface intake serving a single private connection</li> <li>• Trucked Water System (&lt;5): trucked water system serving less than five connections</li> <li>• Community water system (&lt;5): shared community water system with less than five connections</li> </ul>

**Notes:** First Nations community water systems use a similar number of service connection categories as those used in regional health authority billing: 5-14, 15-300, >300; Transient vs. non-transient refers to the length of time the population is served by the water system.

**Source:** First Nations Health Authority; 2017.<sup>27</sup>



Cross organization collaboration in action - operators, consulting engineer, researcher, and an environmental health officer visiting a First Nations community.

Photo credit: RES'EAU a Centre for Mobilizing Innovation.

There are 201 First Nations Bands in BC, and of these, 191<sup>f</sup> have a combined count of 333 on-reserve water systems (284 community water systems and 49 public water systems) that participate in the FNHA Drinking Water Safety Program.<sup>27</sup> Additionally, more than 1,300 private systems or well clusters are monitored on a periodic basis. The population served by each community water system ranges from nine to 6,000, with the majority (76 per cent) serving a population of 250 or less.<sup>g,27</sup>

Approximately 54 per cent of the 284 community water systems are supplied by groundwater. Fifteen per cent of the community water systems are supplied by surface water. The remaining 31 per cent of systems are supplied either by a combination of surface water and groundwater, purveyor (such as a municipality), trucked system or other.<sup>28</sup> Seventy-one on-reserve community water systems (serving an estimated 25 per cent of the population) are bulk supplied water from an off-reserve water supplier through a Municipal Type Service Agreement or other arrangement.<sup>27</sup>

Although the governance of First Nations water supply systems is different than other water supplies in BC, they face many of the same operational and capacity challenges as other small water systems.

### 3.4 Conclusion

This chapter provided a basic overview of the different types of water systems in BC as per the new categories developed as part of the drinking water indicator project. Water systems vary in the population sizes they serve, the sources they rely upon, and how they are governed as a water supplier. These differences can influence operational, financial, and administrative capacity, which can lead to certain types of systems being at greater risk of non-compliance with regulatory requirements, or providing water that does not meet potability standards. During this transition period to the new reporting structure, specific data relating to these new categories are not yet available from health authority databases. Future reports will use these new data to compare outcomes and compliance rates between the different types of water systems. However, despite current data limitations at the health authority level, this chapter draws on drinking water program experience and data from the Ministry of Municipal Affairs and Housing and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development to highlight some of the governance challenges faced by smaller, non-local government systems and improvement districts, compared to larger water systems owned and operated by a municipality or regional district.

<sup>f</sup> Ten of the First Nations Bands are either independent, do not have a land base, or do not have a community water system.

<sup>g</sup> Data as of June 8, 2016, and are subject to change. Water systems are decommissioned, built, or joined, and connections are added and removed, on an ongoing basis, and there are always exceptions to the general classifications.

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# PART 2

## The Multi-barrier Approach—Key Elements



# 4 Source Water Protection

Source protection is the first line of defense in the multi-barrier approach to safe drinking water. This component of the multi-barrier approach includes selecting the best available water source and protecting it from contamination. Source water can be surface water from lakes, streams, and springs, or groundwater. Preventing contamination from reaching the source of drinking water is the first key step to reducing public health risks.<sup>1</sup> Prevention of contamination can also reduce capital and operating costs by reducing treatment demand or the need for extra treatment barriers.

Source water protection requires an inter-agency, coordinated approach between all stakeholders. It requires that stakeholders develop both short- and long-term plans to reduce, prevent, or control potential sources of contamination and enhance water quality. The development of plans requires an assessment of the watershed or capture zone of an aquifer to delineate its boundaries and identify potential hazards.<sup>1</sup>

Source protection planning and drinking water safety relies on an integrated system of management that includes clear roles and responsibilities for the actors involved, supported by legislative and policy frameworks; guidelines, objectives, and best practices;

source water monitoring; partnerships and interagency coordination; research, science, technology, and information management systems; and public engagement, education, and training. The sub-sections that follow provide an update of activities that occurred during the 2012/13–2016/17 reporting period within each of these elements of an integrated system of management.

## 4.1 Legislation and Policy Frameworks

The provincial government regional health authorities, local governments, and federal agencies all work to ensure that water is managed and protected. The primary legislation for source water protection includes the *Drinking Water Protection Act*, *Forest and Range Practices Act*, *Environmental Management Act*, and the *Water Sustainability Act* (Figure 4.1). Other legislation that may serve to protect water supplies through the management of land and resource extraction activities is discussed in Chapter 2.

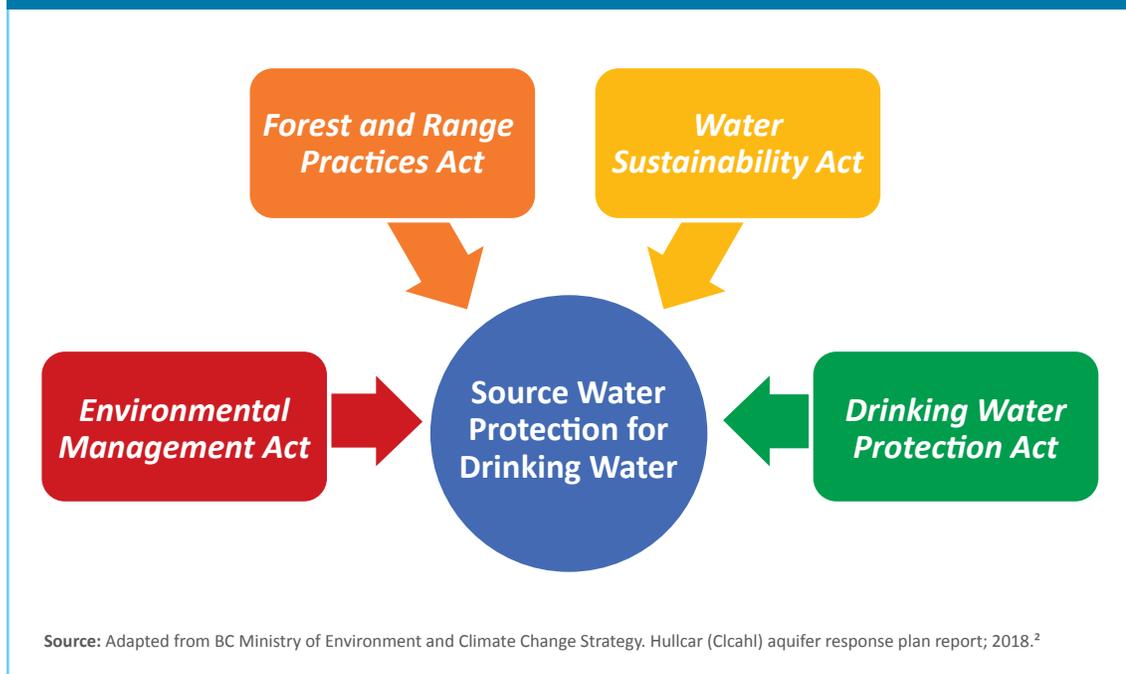
The sub-sections that follow describe these key pieces of legislation and their associated policy frameworks to protect drinking water supplies, and provide a summary of legislative updates during the reporting period.



Lake Okanagan - a BC multi-use watershed.

Photo credit: Joanne Edwards, Office of the Provincial Health Officer.

**Figure 4.1: Primary Legislation for Source Water Protection in BC**



#### 4.1.1 The Drinking Water Protection Act

The *Drinking Water Protection Act* (DWPA) provides the legislative framework for health authorities to regulate drinking water supply systems to ensure water suppliers deliver potable water; it also has provisions and powers specific to source protection. Section 23 of the DWPA states the following:

- ... a person must not
  - (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge, zone or an area adjacent to a drinking water source, or
  - (b) do or cause any other thing to be done or to occur,if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system.<sup>3</sup>

The Act includes several mechanisms to enforce this provision, including but not limited to hazard abatement and prevention orders (Section 25) and orders respecting contraventions (Section 26).

Health authorities work closely with water suppliers to help them complete some form of a source water assessment and source protection plan. The two main source water protection planning tools under the DWPA are water source and system assessments and response plans, and **drinking water protection plans**. Both of these planning tools are described next.

#### Source and System Assessments and Response Plans (DWPA, Sections 18 & 22)

The fourth principle of the *Action Plan for Safe Drinking Water in British Columbia* (the Action Plan) calls for water systems to be thoroughly assessed to determine risks. This includes an assessment of the source water, which includes identifying and assessing hazards within a water supply system watershed or aquifer capture zone.

Sections 18 and 22 of the DWPA support this principle of the Action Plan and provide drinking water officers (DWO) with the authority to order a water supplier to complete a source or system assessment (Section 18) and prepare a response plan (Section 22) to address any identified risks. DWOs may also make completion of an assessment and plan a requirement through a water supplier's operating permit (Section 8(2)).



The East Canoe Creek watershed supplies the City of Salmon Arm's Metford Dam Reservoir with about 10 per cent of their annual total water supply. It is operational when turbidity levels are below 1.0 pmm and includes disinfection utilizing sodium hypochlorite supplemented with UV disinfection.

Photo credit: City of Salmon Arm, BC.

The provincial government has developed several tools of varying levels of complexity to guide water suppliers through the assessment process so that appropriate plans can be developed to address vulnerabilities. These tools include the *Comprehensive Drinking Water Source-to-Tap Assessment Guideline*,<sup>4</sup> *Water System Assessment Guide*,<sup>5</sup> and the *Drinking Water Source-to-Tap Screening Tool*.<sup>6</sup> Assessment tools specific to groundwater include the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens*<sup>7</sup> and the *Well Protection Toolkit*.<sup>8</sup>

The *Comprehensive Drinking Water Source-to-Tap Assessment Guideline* is the most thorough and robust assessment tool developed in BC and is designed to be conducted by professionals to help water suppliers develop a better understanding of the risks to their water system. Unfortunately, very few water supply systems have completed part or all of the comprehensive assessment. Drinking water officials report

that the limited uptake in this tool is primarily due to the high costs and complexity of the assessment. The assessments require a team of professionals, and smaller water supply systems generally lack the personnel or the resources to hire those with the needed expertise. The intent of the *Drinking Water Source-to-Tap Screening Tool* and the *Water System Assessment Guide* are to provide an alternative way for smaller water systems with fewer financial and human resources to assess a system. While these tools have been available for some time, it remains difficult to evaluate their uptake and how many water suppliers have undergone an assessment.

The new indicator project led by the Provincial Health Officer (PHO) has identified completion of source water assessments and development and implementation of source protection plans as source protection indicators for future reporting. Health authorities are working to adapt their information systems to collect this information.

## Source Water Assessments and Protection Plans for First Nations

Between 2009 and 2011, a *National Assessment of First Nations Water and Wastewater Systems* examined 290 on-reserve water systems in BC and identified that 90 per cent of the systems did not have a source protection plan in place.<sup>9</sup> To assist First Nations communities develop a source protection plan, Indigenous Services Canada<sup>9</sup> released the *First Nations On-Reserve Source Water Protection Plan, Guide, and Template* in 2014.<sup>10</sup> A source water risk assessment will be used to guide the source protection measures required.

<sup>9</sup> In 2014, Indigenous Services Canada was known as Aboriginal Affairs and Northern Development Canada.



Comox Lake, a multi-use watershed on north Vancouver Island, BC. The Comox Lake watershed is the primary drinking water source for the Comox Valley.

*Photo credit: Zoe Norcross-Nu'u, Comox Valley Regional District.*

### Drinking Water Protection Plans (DWPA, Sections 31–39)

A drinking water protection plan is a legislative source protection tool that can provide special powers to local authorities to regulate activities in areas of concern for a community water supply system. Part 5 of the DWPA outlines the requirements to designate an area for a drinking water protection plan, the plan authority, and the planning and implementation process. The decision whether to initiate a plan is made by the Minister of Health. Under Section 31 of the DWPA, the PHO may make a recommendation to the Minister to designate an area by order for the purpose of developing a drinking water protection plan for the area. The PHO may only make such a recommendation if the following requirements under the Act are satisfied:

- (a) based on monitoring or assessment results, the Provincial health officer is satisfied that a drinking water protection plan will assist in addressing or preventing a threat to drinking water that the Provincial health officer considers may result in a drinking water health hazard, and
- (b) no other practicable measures available under this Act are sufficient to address or prevent the drinking water health hazard.<sup>3</sup>

A DWO may request that the PHO consider making a recommendation to the Minister if they can demonstrate the above criteria have been met. In addition, a local authority or a water supplier may request that a DWO make a request to the PHO on their behalf.

To date no drinking water protection plans have been ordered by the Minister of Health in BC; however, the PHO recommended a drinking water protection plan for the Comox Lake watershed on four separate occasions (2008, 2010, 2015, and 2018). A response to the 2015 request was outstanding when the provincial government changed in 2017; therefore, the PHO re-issued the request in early 2018. A challenge with a drinking water protection plan is that under the legislation it serves as a measure of last resort, which limits its ability to serve as a proactive tool. Given this limitation, source protection efforts in BC stand to benefit from more collaborative and proactive source protection tools that can be legally binding.

### Other Source Protection Tools Under the *Drinking Water Protection Act*

DWOs often become involved in source water issues in response to adverse events or controversial land use proposals where overlapping jurisdictions and responsibilities exist. While there are compliance tools for source water protection under the DWPA (e.g., hazard abatement and prevention orders [Section 25] and prohibitions against contaminating drinking water or tampering with a system [Section 23]), compliance programs under the Act are typically more suited for managing point source contamination when a single responsible party can be identified, rather than cumulative impacts caused by non-point sources. The Hullcar Aquifer example below illustrates these limitations.

### The *Public Health Act* and the *Drinking Water Protection Act*

The powers of public health officials with regard to drinking water protection—such as medical health officers who may also act as drinking water officers under the DWPA—are not limited to the DWPA. These officials also have powers

under the *Public Health Act* that may be used to address public health issues as they apply to drinking water. These powers include, but are not limited to, Part 4 of the *Public Health Act* respecting health hazards, and regulations developed under the former *Health Act*.<sup>11</sup> These powers complement those under the DWPA; they do not displace them.

### 4.1.2 The *Forest and Range Practices Act*

The *Forest and Range Practices Act* (FRPA) outlines how all forest and range practices and resource-based activities are to be conducted on Crown land in BC, while ensuring protection of everything in and on them, such as plants, animals, ecosystems, and water.<sup>12</sup> All activities undertaken by forest and range licensees are governed by the FRPA and its regulations during all stages of planning, road building, logging, reforestation, and/or grazing.<sup>12</sup> In BC, the *Forest and Range Practices Act* does not apply to privately owned forestry land. Information on the Private Managed Forest Land Program is described later in this section.

## The Hullcar Aquifer Example: The Request to Issue an Order

In 2016, a drinking water officer with Interior Health received a request to issue a Hazard and Abatement Order under Section 25 of the *Drinking Water Protection Act* to address nitrate contamination in the Hullcar Aquifer #103. Specifically, the request was to order a complete and permanent moratorium on the application of liquid manure effluent on a 210 acre field owned by one large agricultural operation in the valley. In this case, enforcement was difficult because of the challenges of identifying which of the many potential point sources of nitrate were contributing to contamination in the area. As such, the drinking water officer determined that more information was required and the Section 25 order, as requested, could not be issued until the investigation and studies being led by a multi-ministry working group were complete. In the interim, an advisory that warned users of the aquifer about the elevated nitrates and associated risks remained in place. The Ministry of Environment and Climate Change Strategy later issued two Pollution Prevention Orders and seven Pollution Abatement Orders to nine agricultural operations in the Hullcar Valley. In 2017, Interior Health—in conjunction with the Orders issued by the Ministry of Environment and Climate Change Strategy—issued Section 25 Hazard and Abatement Orders under the *Drinking Water Protection Act* to two separate agricultural operations, once the results of the investigations identified them as contributing to the rising nitrate levels in the aquifer.

**Notes:** For up-to-date information on the provincial government's response to the Hullcar Aquifer situation, visit the following website, which was created by the Ministry of Environment and Climate Change Strategy to share information with the public: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-permitting-compliance/hullcar-aquifer>.



Sources of nitrates in groundwater include agricultural activities (e.g., the application of chemical fertilizers and animal manure, storage, and feedlots). Other common sources include failing septic systems, fertilizers, and industrial processes.

### Community Watershed Designation

The FRPA and its supporting Government Actions Regulation allow for the designation of community watersheds. This designation is important for protecting water quality for communities and private water users who rely on surface water sources. The Act outlines terms and conditions regarding the protection of designated community watersheds. These measures help conserve the quality, quantity, and timing of water flow and prevent cumulative hydrological effects from having a material adverse effect on water.

A community watershed is defined under the FRPA as “...all or part of the drainage area that is upslope of the lowest point from which water is diverted for human consumption by a licensed waterworks.”<sup>13</sup> There are currently 466 designated community watersheds in BC, with most established in the 1980s and 1990s.<sup>13</sup>

No community watersheds were designated or rescinded in the last three fiscal years.<sup>14</sup>

As a result of organizational changes in the provincial government in 2011, the responsibilities for administering community watersheds was spread amongst several work units in the Ministry of Forests, Lands, Natural Resource Operations and the Ministry of Environment.<sup>b</sup> In 2017, a matrix was developed to provide clarity regarding roles and responsibilities for the administration of the community water provisions under the FRPA.<sup>14</sup> While many responsibilities are shared between ministries and program areas, the ultimate accountability for community watershed administration resides with Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD). During this reporting period, FLNRORD also launched a community watershed project described below.

## The Community Watershed Project

In February 2015, the Resources Practices Branch of FLNRORD initiated the Community Watershed Project to support the management of community watersheds. The purpose of this project was to determine the status of drinking water use and risks in the 466 community watersheds currently designated in BC; provide the necessary information to enable decisions about which watersheds warrant continued designation; and assess the potential for greater water user involvement in land use planning decisions within community watersheds. In 2016, FLNRORD hired a contractor to conduct research and prepare a report on the project.<sup>14</sup>

<sup>b</sup> In 2017 after a change in government, the names of these two ministries changed to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) and the Ministry of Environment and Climate Change Strategy (ENV). For the purpose of this report, the acronyms ENV and FLNRORD are used to refer to activities of those ministries both before and after the name change in 2017.



Forest development and road building can increase sediment and have impacts on water quality.

## Private Managed Forest Land Program

In BC, the *Forest and Range Practices Act* does not apply to privately owned forestry land. Approximately 5 per cent—4.5 million hectares—of the land base is privately owned. Similarly, an even smaller percentage (2 per cent) is private forest land, of which 51 per cent—823,000 hectares—is classified as managed forest land.<sup>15</sup> The Managed Forest Council regulates all managed forest land activities under the *Private Managed Forest Land Act* and is responsible for the administration of the Managed Forest Program under the Act.

One key management objective under the Act is the protection of water quality for domestic consumption. During the reporting period, the Managed Forest Council undertook a study to evaluate whether harvesting practices on managed forest lands are carried out in a manner that protects drinking water quality for licensed water intakes, and to determine if private forest landowners are aware of their regulatory responsibilities related to drinking water source protection. The 2016 study found that the assessments, planning procedures, and operational practices of managed forest landowners meet the standard practices for the forest industry, with large managed forests achieving the greatest consistency. Survey results also indicated communication between owners of managed forests and water licensees occurred in advance of activities.<sup>16</sup>

### Range Management

Range activities have the potential to impact drinking water directly, via contamination caused by animals in direct contact with water supplies, and indirectly, via the introduction of sediment into streams caused by trampling and grazing of **riparian** vegetation. FLNRORD range management staff undertake range land health assessments across the province to monitor range and riparian areas for potential problems and proactively apply techniques to reduce risk, particularly in community watersheds.<sup>14</sup>

### 4.1.3 The Environmental Management Act

Under the *Environmental Management Act* (EMA), the Ministry of Environment and

Climate Change Strategy (ENV) is responsible for regulating waste discharges from industries that may contaminate water supplies, through prohibitions and authorizations issued by the ministry. The Act also enables the use of orders and the development of area-based management plans, and supports the development of **ambient water** quality guidelines and objectives to protect aquatic and human health. Regulations under the Act that protect source waters through the management of industrial, agricultural, and municipal activities include the Agricultural Waste Control Regulation, Contaminated Sites Regulation, Hazardous Waste Regulation, Municipal Wastewater Regulation, and Organic Matter Recycling Regulation.

**Enforcement Tools for Source Protection under the *Environmental Management Act***

ENV holds both inspection and enforcement tools under the EMA to protect source water through the identification and control

of pollution. Table 4.1 describes some key compliance tools under the EMA. Other tools not discussed in the table include the ability to require environmental impact assessments.

**Table 4.1 Key Compliance Tools Under the BC *Environmental Management Act***

Section	Compliance Tool	Description
79	Spill Prevention and Reporting Orders	May be issued if the Minister of Environment and Climate Change Strategy considers it reasonable and necessary to lessen the risk of an escape or spill or a polluting substance. The order can require a person with possession, charge, or control of any polluting substance to undertake investigations, tests, surveys, or other actions; prepare a contingency plan; or construct or carry out work to prevent or abate an escape or spill of the substance. If an escape or spill of a polluting substance occurs for which a contingency plan was prepared, a director may order a person with possession, charge, or control of the polluting substance at the time of the escape or spill to put the contingency plan into operation at their expense.
81	Pollution Prevention Orders	May be issued after an inspection reveals the potential for a substance to cause pollution. The Ministry of Environment and Climate Change Strategy (ENV) must believe the application of the substance to the environment is “likely to cause” pollution.
83	Pollution Abatement Orders	May be issued if ENV believes there are reasonable grounds that pollution has been caused by the introduction of a substance into the environment. The order can require the responsible person(s) to take actions to control, abate, and stop the pollution.
85	Environmental Protection Orders	May be issued at the discretion of the Minister. Such orders declare that an existing or proposed work, undertaking, product use, or resource use has, or potentially has, a detrimental environmental impact. Once the order has been issued, restrictions, modifications, and prohibitions on the work or use of the product or resource can be applied.
86	Environmental Management Plans	If an order under Section 85 has been issued, the Lieutenant Governor in Council may direct the Minister to prepare an environmental management plan for the area that is, or would be, impacted.

Source: *Environmental Management Act* [SBC 2003, c.53].<sup>17</sup>

In 2015, ENV released its first annual Compliance Inspection Report.<sup>18</sup> These annual reports share the results of the environmental protection officer's inspection and compliance activities under the EMA. As such, an overview of these activities is not included within this report.

### Area Based Management Plans

Under Section 89 of the EMA, the Minister of Environment and Climate Change Strategy may order an area based management plan.<sup>17</sup> An area based management plan is a multifaceted strategy developed to address an environmental issue in a specific area. For the purpose of developing a plan the Minister may:

- Designate the area for the plan.
- Establish the party responsible for preparing the plan.
- Require that a technical advisory committee be established.
- Establish the terms of reference for the plan.
- Require ongoing monitoring and reporting.

An area based management plan must consider cumulative impacts of **point sources** and **non-point sources** of waste as well as environmental management objectives and outcomes. Once developed, the Minister may order that the plan be considered when statutory decisions are made under the EMA.

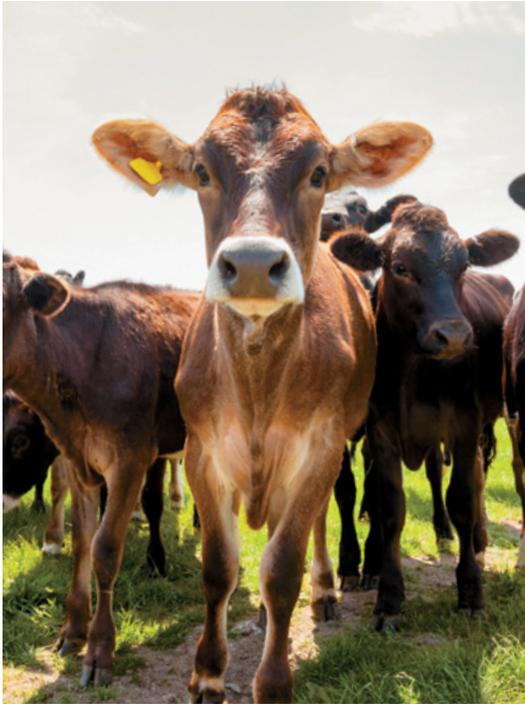
Although area based management plans do provide a mechanism to protect source water supplies and the environment, one of their limitations is that compliance can only be compelled through statutory decisions made under the EMA. As such, the value of their application can be limited to situations where permits or approvals are required for a particular land use, such as the Elk Valley area based management plan described below.

## The Elk Valley Area Based Management Plan

In April 2013, an area based management plan was ordered for the Elk Valley, with Teck Coal Limited designated as being responsible for preparing the plan. Teck Coal Limited submitted the plan in July 2014, and it was approved in November 2014. This represents the only time in BC that an area based management plan has been ordered.

The Elk Valley is in the southeast corner of the province and includes the Elk River and its tributaries. The aim of the plan was to stabilize and reverse concentrations of selenium, cadmium, nitrate, and sulphate in Fording River and Elk River; remediate water quality effects of past coal mining; and guide future development.<sup>19</sup>

The development, review, and approval of the Elk Valley area based management plan required knowledgeable and dedicated resources from the proponent, First Nations, government agencies, and other involved stakeholders. The demand on these resources has continued with implementation of the plan.<sup>20</sup> The Ministry of Environment and Climate Change Strategy reports that a positive working relationship between Teck Coal Limited, the ministry, and the Ktunaxa Nation Council allowed for the development of a monitoring and management plan acceptable to all parties that supports the stabilization and improvement of water quality for the Elk Valley. Benefits of the plan include consistency in application of the plan, as a result of having a single statutory decision maker under the *Environmental Management Act* for the area. The establishment of an Environmental Monitoring Committee, which includes representation from Teck Coal Limited, Ministry of Environment and Climate Change Strategy, Ministry of Energy, Mines and Petroleum Resources, Interior Health Authority, the Ktunaxa Nation Council, and an independent scientist, has allowed for the timely review of monitoring data and the development of responsive management plans.<sup>20</sup>



#### Water Quality Guidelines and Water Quality Objectives

The EMA gives ENV the authority to develop water quality guidelines and objectives for receiving source waters, in order to protect human health. The guidelines and objectives are used to inform resource management decisions and conduct source water assessments. As with all ambient water quality guidelines, the water quality guidelines are not directly enforceable, but may be used as the basis for legal documents such as waste management permits, approvals, plans, or operating certificates. For more information on these guidelines and objectives, see Section 4.2.

#### Agricultural Waste Control Regulation

Under the EMA, agricultural waste is dealt with under the Agricultural Waste Control Regulation. This regulation requires all agriculture operators to follow the requirements of the Code of Agricultural Practice for Waste Management (the Code). The Code identifies how agricultural waste should be stored and applied to land, and identifies requirements for agriculture boiler/heater emissions, on-farm disposal of mortalities, feeding areas and access to water, and use and storage of agricultural products (e.g., management of chemical fertilizers).<sup>21</sup>

Nutrient management plans, a better practice that considers the relationship between farm management techniques, crop requirements, and land application to maximize nutrient use and minimize environmental impacts, are not mandatory under the current Code. Instead nutrient management plans are a subcomponent of the voluntary Environmental Farm Plan Program described in the text box below.<sup>22</sup>

ENV is currently undertaking a comprehensive review to update and amend the Agricultural Waste Control Regulation. This review is part of provincial-level efforts to prevent groundwater pollution and manage nitrate levels in agriculture areas, in response to concerns identified with the Hullcar Aquifer in the North Okanagan. The proposed amendment aims to enhance and improve groundwater protection by ensuring that environmentally responsible agricultural practices are followed; facilitating nutrient management storage and planning; and providing regulatory certainty through clear requirements and guidance on desired environmental outcomes.<sup>23</sup>

### Environmental Farm Plan Program

The Environmental Farm Plan Program is a voluntary federal-provincial program delivered in BC by the BC Agricultural Research and Development Corporation. The program provides farm and ranch operators with the opportunity to identify agri-environmental risks and opportunities. The goal is to improve the agriculture sector's awareness and knowledge of good environmental practices and risks, with particular focus on water quality, environmental sustainability, climate change, and issues identified in on-farm risk assessments.<sup>24</sup> The Ministry of Agriculture supported the program under Growing Forward 2, a five-year policy framework (2013–2018), and will continue to do so under the Canadian Agricultural Partnership framework (2018–2023).<sup>25</sup> More information on the Environmental Farm Plan can be found on their website, at: <https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/programs/environmental-farm-plan>.



Groundwater at risk of containing pathogens. A shallow dug well without protection from contamination.

#### 4.1.4 The *Water Sustainability Act*

In 2009, the province of BC began engaging widely with British Columbians on modernizing the *Water Act*. On February 29, 2016, the *Water Sustainability Act* (WSA) replaced the *Water Act*.

The WSA, administered and enforced by FLNRORD, is the principal piece of legislation for managing the diversion and use of water resources. The Act provides important new tools and updates BC's strategy for protecting, managing, and using water efficiently throughout the province. Under the Act, there are regulations in three key areas: water use, management of rights, and protection of water resources. In addition, the new Act addresses seven key areas of improvement:<sup>26</sup>

- Protect stream health and aquatic environments.
- Consider water in land use decisions.
- Regulate groundwater use.
- Regulate during scarcity.
- Improve security, water use efficiency, conservation.
- Measure and report.
- Enable a range of governance approaches.

##### Licensing of Water Use

One of the biggest changes under the WSA involves the licensing of groundwater. Under this

Act, anyone who diverts and uses groundwater for anything other than non-domestic use is required to obtain a water licence and pay water fees and rentals. Prior to the WSA, only surface water use was licensed. Licensing groundwater use establishes equity between surface water and groundwater users, and gives groundwater users rights to use water based on the priority allocation scheme **“first-in-time-first-in-right”** that currently exists for surface water in BC. Licensing groundwater use will also provide more detail on how much water is being used in the province. Under the WSA, terms and conditions that could be used to support source water protection can also be placed on individual water licences, use approvals, and change approvals.<sup>23</sup>

To give existing groundwater users time to apply for a licence, the province established a three-year transition period to bring the approximately 20,000 existing non-domestic users into the licensing scheme.<sup>27</sup> At the time of this report, the number of existing groundwater users that have applied for a licence is considerably lower than expected: as of March 31, 2017, ENV had received 65 applications for new groundwater licences (i.e., water use began after the WSA came into force) and 963 applications for transitioning groundwater use (i.e., the water use had begun prior to the WSA coming into force).<sup>28</sup>

**New Source Protection Tools under the *Water Sustainability Act***

A number of new tools within the WSA allow

for management of issues on either an area or site-specific basis; these tools have the potential to improve source water protection<sup>14</sup> (Table 4.2).

**Table 4.2 Key Compliance Tools Under the *Water Sustainability Act***

Section	Compliance Tool	Description
43	Water Objectives	Water objectives are established under regulation. Unlike water quality objectives established under the <i>Environmental Management Act</i> , water objectives under the <i>Water Sustainability Act</i> must be considered by all decision makers, including local governments. Water objectives can be established for water quality, water quantity, and ecosystem health. This approach is intended to align with BC’s <b>cumulative effects framework</b> . More detailed information on water objectives can be found in Section 4.2.2 of this report.
46, 47	Stream Remediation	Introducing foreign matter into a stream is prohibited under Section 46 unless authorized under another enactment. Under Section 47, if an industry introduces a foreign matter into a drinking water source, they can be required to mitigate impacts, remediate the problem, and potentially provide an alternative drinking water source until the problem is fixed.
64-85	Water Sustainability Plans	Sections 64–85 enable the development of water sustainability plans, which serve as watershed or aquifer-based plans that address water use and the impacts to water from land-based activities. Water sustainability plans are scalable to watershed size, and number and magnitude of issues, and can incorporate elements of both land and water management. The plan can result in a regulated approach to how land and water are managed. Both the <i>Water Sustainability Act</i> and the <i>Drinking Water Protection Act</i> allow water sustainability plans and drinking water protection plans to be developed through the same process and in concert with each other. To date, no water sustainability plans have been initiated, and the concept of developing one alongside a drinking water protection plan for the same source remains untested.
62	Drilling Authorizations	Drilling authorizations can be established via regulation for an aquifer. This requires an additional authorization to be obtained before a well is drilled for any purpose. This process can also require additional monitoring and reporting by individual licensees.
Part 6	Area Based Regulations	Part 6 of the Act allows for the creation of area based regulations, which gives government the opportunity to customize solutions for watersheds in response to regional or watershed-level issues. These regulation-making authorities encompass the planning provisions, but also apply to the broad regulation authorities under the Act.

Source: *Water Sustainability Act*.<sup>29</sup>

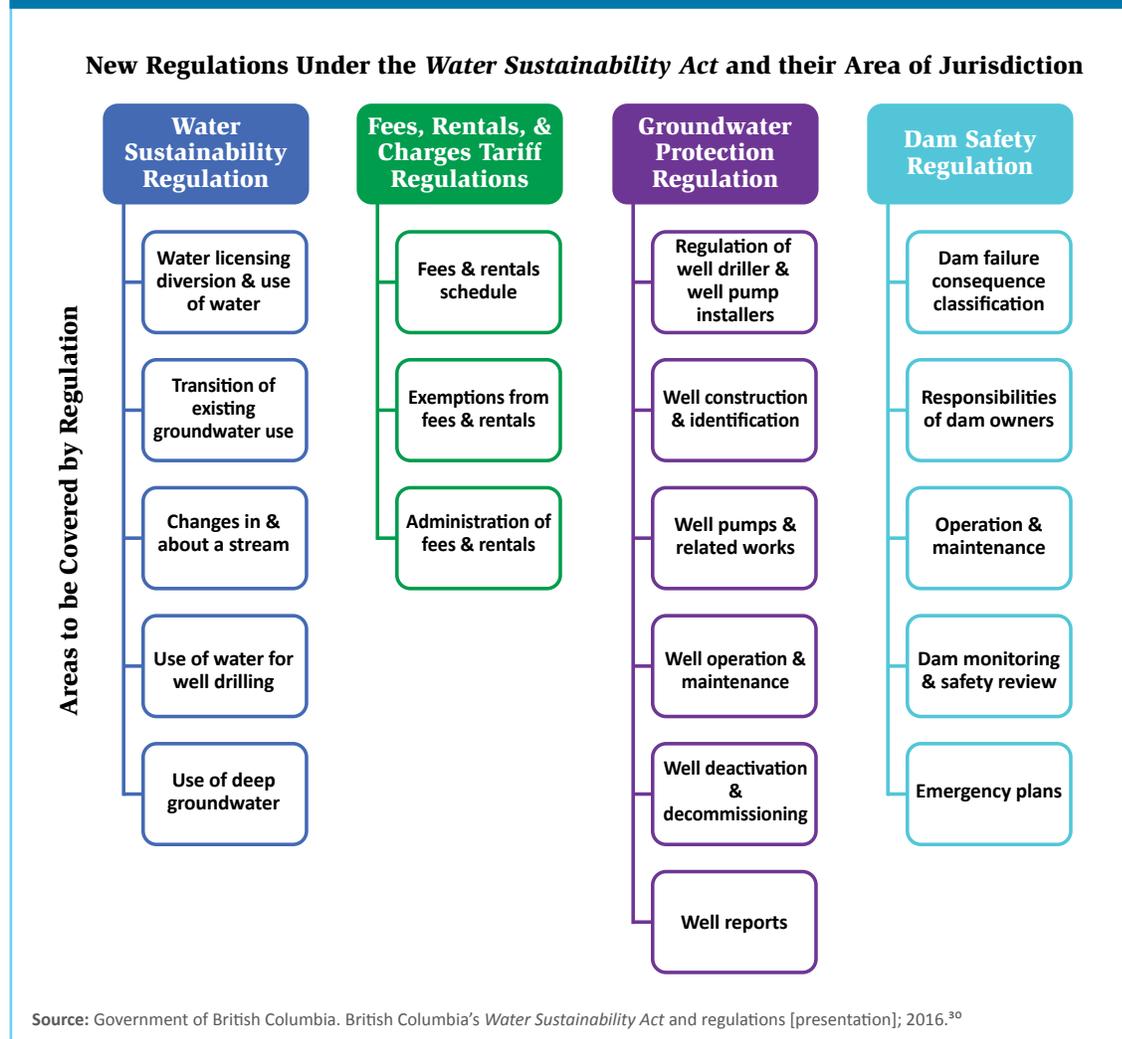
### Regulatory Updates under the Water Sustainability Act

During the reporting period, ENV also developed regulations and operational policies to guide implementation of the WSA and to ensure safe and sustainable water use throughout the province. Due to the complexity of the Act and the number of proposed regulations, ENV is taking a phased approach to developing and implementing new regulations. The regulations developed during the reporting period include the following: Dam Safety Regulation; Groundwater Protection Regulation; Water Sustainability Fees, Rentals and Charges Tariff Regulation; and Water Sustainability Regulation. These regulations, and the topics that fall within them, are depicted in Figure 4.2.

Now that work has been completed on the regulations related to essential water management under the WSA (Figure 4.2), the Ministry of Agriculture and ENV have begun work on the next phase of regulatory development with the development of the Livestock Watering Regulation. The new regulation is intended to manage direct access of cattle to water supplies, in order to minimize opportunities for direct contamination of source water supplies.<sup>31</sup>

In addition to these new and updated regulations, the provincial government updated the Violation Ticket Administration and Fines Regulation, under the *Offence Act*, to align with the WSA. These updates include changes to fines for some offences and adding new offences.

**Figure 4.2: Water Sustainability Act Regulations At-a-Glance**



Finally, as part of the modernization of the *Water Act*, several other pieces of legislation and regulations were adapted. For example, the *Fish Protection Act* was repealed and its provisions were brought into either the WSA or the *Riparian Areas Protection Act*.

### Groundwater Protection Regulation

The new Groundwater Protection Regulation under the WSA came into force in 2016, during the reporting period. It regulates all types of wells in BC beyond those used for domestic drinking water. FLNRORD is responsible for administering the regulation and can order certain types of work to be done. The Groundwater Protection Regulation ensures that activities related to wells and groundwater are performed in an environmentally safe manner. Specifically, it regulates minimum standards for well construction, maintenance, deactivation and decommissioning, and identifies the types of qualified people certified to drill wells, install well pumps, and perform related services.<sup>32</sup> Notable new requirements for groundwater protection under the new regulation include the following:

- Enhanced well construction requirements, such as
  - surface seals required for all cased wells;
  - plastic casings and liners certified for drinking water; and
  - setbacks to protect existing uses.
- Flowing artesian wells must be controlled.
- New well pits restricted.
- Well maintenance obligations for owners.
- Mandatory well reports.<sup>30</sup>

The Comptroller of Water Rights, pursuant to the Groundwater Protection Regulation, must establish and maintain a register of qualified well drillers and a register of qualified pump installers who are authorized to operate in BC.<sup>33</sup> At the end of 2014 in BC, there were approximately 240 certified well drillers listed on the Register of Well Drillers, and 310 certified pump installers listed on the Register of Pump Installers.<sup>34</sup> As of March 31, 2017, these numbers had increased to 270 certified well drillers and 313 certified pump installers.<sup>35</sup>

### Water Users' Communities Act

Although most of the former *Water Act* was modernized into the new WSA, the section on water users' communities became a new,

independent piece of legislation—the *Water Users' Communities Act*. The only substantial change for water users' communities is that the water licences held by members are now governed under a different piece of legislation (the WSA).

## 4.1.5 Other Regulatory Updates to Protect Water Quality

### Geothermal Operations Regulation

The Geothermal Operations Regulation under the *Geothermal Resources Act* came into force effective March 31, 2017. Several provisions in the new regulation help protect groundwater resources from geothermal resource exploration and operations. For example, Part 4 Section 21(1)(b) requires that no fluids from a **geothermal well**, tank, or facility run into or contaminate useable groundwater. Section 21(3)(b) of the regulation also requires that an earthen pit used to store waste is not within 200 metres of a water supply well. Furthermore, the regulation requires that injection rates and pressures are recorded.<sup>36</sup>

### Defining Deep Groundwater and Regulatory Harmonization

During the reporting period, several ministries (FLNRORD, ENV, the BC Oil and Gas Commission and the Ministry of Energy, Mines and Petroleum Resources) worked together to define "**deep groundwater**" for the development of the Water Sustainability Regulation. The development of a clear, scientifically defensible, practical definition of deep groundwater, and the associated development of a regulatory framework under the WSA, provides for enhanced protection of potable groundwater quantity and quality, particularly in northeastern BC.<sup>37</sup>

The definition of deep groundwater within the Water Sustainability Regulation (Section 51)<sup>c,38</sup> was subsequently harmonized with the definitions in the Environmental Protection and Management Regulation and Drilling and Production Regulation—both under the *Oil and Gas Activities Act*—to address regulatory conflict and clarify groundwater protection requirements for deep well drilling, construction, and operation. Such requirements include those of the Drilling and Production Regulation that pertain to cementing of wells and the use of non-toxic drilling fluids to protect "usable groundwater", which includes drinking water.<sup>37</sup>

<sup>c</sup> Deep groundwater means the following: (a) unless paragraph (b) applies, groundwater that is found in the subject area at a depth greater than 600 m below the earth's surface; (b) groundwater that is found in the subject area (i) below the base of fish scales marker, or if there is no base of fish scales marker, below strata that are older than the base of fish scales marker, and (ii) at a depth greater than 300 m below the earth's surface.

## 4.2 Guidelines, Objectives, and Best Practices

Water quality guidelines and objectives are important for the protection of both the environment and human health. Guidelines are recommended benchmarks against which water quality can be assessed, but are not legally enforceable unless a DWO adds compliance to conditions on a permit, or determines they pose a drinking water health hazard and issues an order. Objectives are site-specific values for the protection of water for various uses. The following sections highlight guidelines and objectives, as well as guidance documents and best practices developed during the reporting period to support the protection of source water supplies in BC.

### 4.2.1 Guidelines

#### Guidelines for Canadian Drinking Water Quality

Health Canada leads the Federal-Provincial-Territorial Committee on Drinking Water (Committee on Drinking Water), which develops and publishes the *Guidelines for Canadian Drinking Water Quality* (the Canadian Guidelines).<sup>39</sup> This committee also produces technical documents on specific microbiological, chemical, and radiological parameters, as well as other guidance documents related to the delivery of potable water.<sup>40</sup> The Canadian Guidelines set out

the **maximum acceptable concentration** for the substances in drinking water. These limits are set based on scientific studies that look at potential harm from both short-term and long-term exposure to a parameter at concentrations above certain levels.<sup>41</sup>

The Committee on Drinking Water also develop aesthetic quality guidelines—known as aesthetic objectives—that address concerns with physical characteristics of water, such as taste and odour. Operational guidelines are developed for parameters that may affect processes at a treatment plant or in the drinking water distribution system (e.g., an operational guideline was developed for aluminum for treatment plants using aluminum-based coagulants).<sup>41</sup>

Between 2012 and 2016, Health Canada and the Committee on Drinking Water developed or updated guidelines or guidance documents for 16 parameters (Table 4.3). Health Canada is currently developing or reviewing guidelines or guidance for the following parameters: uranium, copper, lead, perfluorooctanoyl sulfonate/perfluorooctanoic acid, strontium, chloramines, 1,4-dioxane, trihalomethanes, chromium, 2,4-D, manganese, atrazine, cyanobacterial toxins, natural organic matter, qualitative microbial risk assessment, barium, haloacetic acids, aluminum, cadmium, enteric viruses, enteric protozoa, and enterococci.<sup>42</sup>

**Table 4.3: Guidelines and Guidance Documents Released 2012–2016**

Year	Parameters Updated or Developed	Guidance Documents Developed
2012	Enteric protozoa, E. Coli, Total Coliform, Turbidity	Heterotrophic plate count (HPC)
2013	Ammonia, Nitrate, Nitrite, Vinyl Chloride	Use of microbiological guidelines, waterborne bacterial pathogens
2014	1,2-Dichloroethylene, Selenium, Toluene, Ethylbenzene, Xylene	
2015	pH, Tetrachloroethylene	Issuing and rescinding boil water advisories in Canadian drinking water supplies
2016	Benzo[a]pyrene	

Source: Health Canada. Guidelines for Canadian Drinking Water Quality summary table; 2017.<sup>39</sup>

In BC, DWOs use the Canadian Guidelines as a benchmark for determining potability of water supplies. For example, the BC microbiological treatment objectives for both surface and groundwater supplies are based on the Canadian Guidelines related to microbiological parameters. For chemical, physical, and radiological parameters, DWOs also turn to the Canadian Guidelines to inform their assessment of risk and treatment needs for a drinking water supply.

Federal guidelines establish a minimum standard, and provinces retain the authority to adopt more conservative values where appropriate. Some jurisdictions adopt the Canadian Guidelines through their legislation, making them legally binding, while others use them as a guide. In BC, the Ministry of Health applies Health Canada's guidelines on a substance-by-substance basis, ensuring the guidelines are appropriate in the BC context (see text box: *Guideline for Canadian Drinking Water Quality – Selenium* for an example of BC departing from these guidelines).



Coliert testing - adding the sample.

Photo credit: BC Centre for Disease Control - Public Health Laboratory.

## *Guideline for Canadian Drinking Water Quality – Selenium*

The 2014 update to the selenium guideline is the first circumstance where the Ministry of Health departed from the guidance found in the *Guidelines for Canadian Drinking Water Quality*. The Ministry recommends a maximum acceptable concentration (MAC) of 10 µg/L of selenium in drinking water, while Health Canada relaxed the MAC for selenium in 2014 to 50 µg/L. In this circumstance, the Ministry was concerned that raising the selenium threshold in drinking water may result in unacceptable exposure levels for some populations in the province.<sup>43</sup>

The departure from the guideline in BC stems from evidence that shows that British Columbians are exposed to higher levels of selenium in food compared to those living in other parts of Canada.<sup>11</sup> Thus, BC took a precautionary approach. While the BC MAC for selenium is more stringent than Health Canada's, most water systems in BC are well below levels of 10 µg/L, so maintaining this threshold will have minimal impact on water supply systems across the province.<sup>11</sup>

### **BC Water Quality Guidelines**

Under the *Environmental Management Act*, ENV develops ambient water quality guidelines (ambient guidelines) to assess and manage the health, safety, and sustainability of BC's aquatic resources.<sup>d,44</sup> ENV consults with health officials on the public health aspect of ambient guidelines that are under review or development. Ambient guidelines are different from the Canadian Guidelines in that they are

not specific to the protection of human health from contaminated drinking water; instead, they are developed for the protection of aquatic wildlife, agriculture (i.e., irrigation and livestock watering), drinking water, and recreation. The ambient guideline is set to protect the most sensitive receptor and considers exposure through multiple pathways; as a result, the established limit may be different from the limits established in the Canadian Guidelines.

<sup>d</sup>BC's approved water quality guidelines are located at: <http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines>.

Ambient guidelines are used to assess water quality and may be used as the basis for determining allowable limits in waste discharge authorizations. Exceeding an ambient guideline does not imply that unacceptable risk exists, but rather that the potential for adverse effects may be increased and additional investigation may be required. For substances that are relevant to BC but do not have formally approved guidelines, working guidelines are adopted for both water and sediments.<sup>e</sup> During the reporting period, ENV developed and adopted ambient guidelines for sulphate (2013), selenium (2014), and cadmium (2015).<sup>44</sup>

In the fall of 2017, ENV released an update of the *Source Drinking Water Quality Guidelines* (Source Guidelines).<sup>45</sup> Source Guidelines are ambient guidelines that inform resource management decisions related to drinking water quality. These guidelines provide benchmarks to reduce risks to drinking water sources, which indirectly protects human health. These guidelines are particularly relevant in multi-use watersheds where cumulative impacts are of concern to human health. As with all BC ambient guidelines, the Source Guidelines are not legal requirements, but may be used to support the development of waste management permits, approvals, plans, or operating certificates.

BC Source Guidelines are established through one of two approaches:

1. Adoption of the Canadian Guidelines in collaboration with the BC Ministry of Health.
2. Development of a provincial guideline when none are available from Health Canada, or when required by BC-specific circumstances. In these cases, ENV collaborates with the Ministry of Health and other pertinent groups to develop or adopt an appropriate guideline.<sup>45</sup>

## 4.2.2 Objectives

### Water Quality Objectives

Under the *Environmental Management Act*, ENV develops water quality objectives on a site-specific basis for water bodies or watersheds. The water quality objective reports include water use, impacts to water quality, water quality assessments, rationale for water quality objective values, and a

recommended monitoring program. The objectives are re-evaluated and updated if required, based on changes to the area.<sup>46</sup> During the reporting period, ENV released or updated a total of 12 water quality objectives.<sup>47</sup>

### Water Objectives

Section 43 of the WSA enables government to develop water objectives under regulation. As of March 31, 2017, the regulation to establish water objectives remained under development,<sup>27</sup> meaning no water objectives had been established yet. Water objectives under the WSA are different from water quality guidelines and water quality objectives established under the EMA. Water quality guidelines and water quality objectives apply only to statutory decisions made under the EMA with regard to permitting and authorizations. On the other hand, water objectives, once established under regulation, must be considered by all decision makers, including local governments. Water objectives can also address issues beyond water quality, and can be used to set objectives for water quantity.

## 4.2.3 Policy Guidance and Best Practices

The following sub-section highlights policy guidance documents and best practices developed during the reporting period to protect source water.

### Guidance Document for Determining Ground Water at Risk of Containing Pathogens

Section 5(2) of the Drinking Water Protection Regulation states:

- For the purposes of Section 6(b) of the Act, drinking water from a water supply system must be disinfected by a water supplier if the water originates from
- (a) surface water, or
  - (b) groundwater that, in the opinion of a drinking water office, is at risk of containing pathogens.

In 2015, the BC Ministry of Health released Version 2 of the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens*.<sup>7</sup> The document assists regulatory authorities and water suppliers to assess the level of potential risk and to inform regulatory and planning decisions.<sup>f</sup>

<sup>e</sup> In BC, the definition of water quality includes sediments; therefore, water quality guideline documents may include sediment quality values.

<sup>f</sup> The BC Ministry of Health released Version 3 of the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens* in the fall of 2017, after the reporting period. It is available at: [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/how-drinking-water-is-protected-in-bc/garp\\_assessment\\_oct\\_2017.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/how-drinking-water-is-protected-in-bc/garp_assessment_oct_2017.pdf).



Power House Springs groundwater protection zone.

Photo credit: District of Squamish, BC.

If a DWO identifies that a groundwater source is at risk of containing pathogens after a **Groundwater at Risk of Containing Pathogens (GARP)** assessment, then the drinking water must be disinfected as per Section 5(2) of the Drinking Water Protection Regulation. The 2015 *Drinking Water Treatment Objectives (Microbiological) for Ground Water Supplies in British Columbia*<sup>48</sup> outlines the disinfection requirements for groundwater supplies at risk for containing pathogens (see Chapter 5).

GARP is defined as any groundwater supply likely to be contaminated from any source of pathogens, continuously or intermittently. Potential sources of pathogens include sewage discharged to land, leaking municipal sewage pipes, agricultural waste stockpiles, runoff intrusion into uncovered or poorly constructed wells, and contaminated surface water. The procedure outlined in the guidance document follows a staged approach from initial screening and assessment, the determination of GARP, reviewing risk mitigation options, and long-term monitoring. DWOs may determine risk to a groundwater source at any of these four stages of the process. Determining whether a groundwater source is GARP is not regarded as a one-time process but is subject to the results of continued long-term monitoring of the water supply system, conditions of the aquifer, well capture zone, and watershed over time.<sup>49</sup>

### Underground Stormwater Infiltration: Best Practices for Protection of Groundwater Resources in British Columbia

During the reporting period, ENV developed a best practice document for protecting groundwater from underground stormwater infiltration. There is a connection between stormwater management and watershed health and protection. Stormwater infiltration facilities can be used to protect water bodies and aquatic ecosystems by reducing pollutant levels and flow to receiving streams. The best practice document, *Underground Stormwater Infiltration: Best Practices for Protection of Groundwater Resources in British Columbia*, was released in November 2014.<sup>50</sup>

### Model Well Regulation Bylaw

In March 2012, the Ministry of Community, Sport and Cultural Development (now called the Ministry of Municipal Affairs and Housing<sup>51</sup>) and the Ministry of Environment prepared a guidance document, *Model Well Regulation Bylaw: A Guide for Local Governments*, to complement two other existing documents: the Groundwater Bylaws Toolkit and the Well Protection Toolkit. The guide helps local governments prepare a bylaw to require deactivation of privately owned wells that are currently connected to community drinking water systems. Benefits to closing these wells include reducing the potential for contamination through back-flow and cross connections, protecting public health and community water systems, and protecting groundwater resources.<sup>51</sup>

<sup>48</sup> For the purpose of this report, the ministry name Municipal Affairs and Housing (MAH) is used to refer to activities of both MAH and the Ministry of Community, Sport and Cultural Development during the reporting period.

## Source Protection and Onsite Sewerage Policies and Practices

During the reporting period, the Ministry of Health led the development of a number of onsite sewage initiatives and policies, with a primary focus on source water protection.

- Worked with the Ministry of Municipal Affairs and Housing to develop a provincial best practice guideline for subdivision of residential land with onsite sewage. This guideline was developed to protect groundwater resources and to provide consistency within the decision-making processes of the regional health authorities.<sup>52</sup>
- Developed communication protocols for wastewater practitioners and health authorities, to facilitate timely and efficient handling of onsite sewage threats to drinking water. These protocols include guidance to better define potential health hazards for wastewater practitioners when building and maintaining onsite systems.<sup>53</sup>
- Developed, in partnership with ENV, a guideline to assist regulators, local government, and wastewater practitioners to determine when sewage systems fall under the jurisdiction of the EMA instead of the *Public Health Act*.<sup>54</sup>
- Amended the Sewerage System Regulation, under the *Public Health Act*, to include a minimum setback of 30 metres of a sewerage system from a drinking water well.<sup>55</sup>

### 4.3 Source Water Monitoring

Source water quality monitoring is an important part of the multi-barrier approach.<sup>1</sup> Source water quality data can serve as an early warning of source contamination or degradation. The following sub-sections describe the source water monitoring and assessment activities of different BC ministries during this reporting period.

#### 4.3.1 Ambient Water Quality and Quantity Monitoring

ENV leads/has led a number of water monitoring networks that monitor the quantity and quality of ambient water sources:

- Lead, with FLNRORD, the Provincial Groundwater Observation Well Network program. This program monitors

groundwater levels in key aquifers and helps ensure groundwater use is sustainable. There are approximately 186 observation wells that provide data from various aquifers in BC, and seven observation wells have been added since 2015.<sup>23</sup>

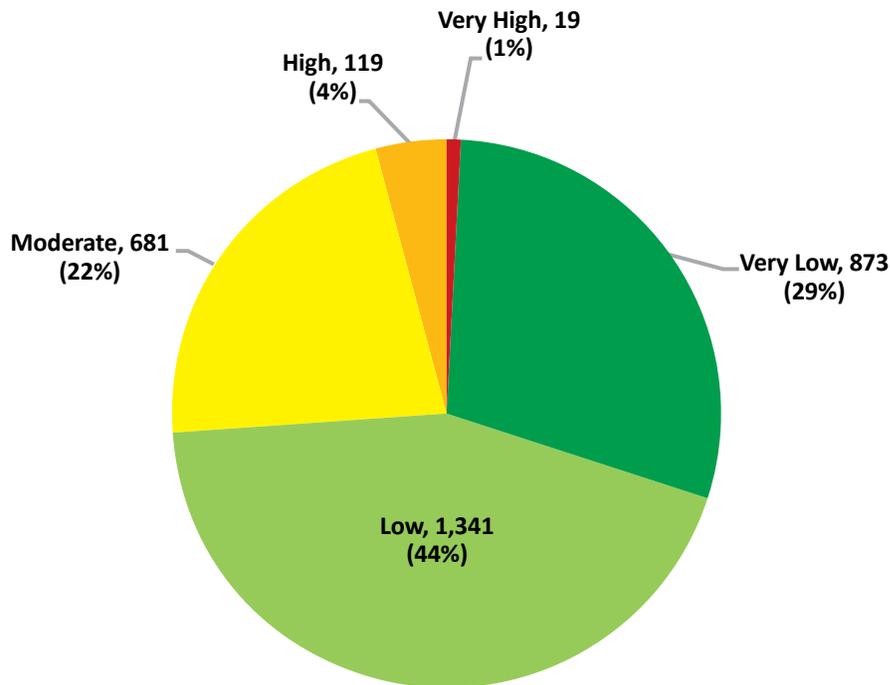
- Developed the BC Lake Monitoring Program.<sup>56</sup> This program includes monitoring of water quality for 95 lakes across the province.<sup>23</sup> Many of these lakes supply drinking water to various water systems throughout the province.
- Participates in the management of the Canada-British Columbia Water Quality Monitoring Agreement,<sup>57</sup> which includes 40 monitoring stations.<sup>23</sup> The network focuses on data collection, to provide long-term trend monitoring and assessment of surface waters at watersheds that cross international, provincial, or territorial boundaries and/or are important for the water supply, fisheries, or recreation; and may be harmed by human activity.

During the reporting period, ENV oversaw a number of other projects to monitor the effects of resource development, many of which were delivered as multi-stakeholder and First Nations partnerships. For example, the ministry examined sediment loading in resource development areas, as part of the cumulative effects framework,<sup>h</sup> in order to estimate sedimentation hazard. This can help identify areas that may be of higher priority for further investigation of water quality, including for drinking water sources. Additionally, the ministry monitored those water bodies across the province that have approved water quality objectives, to assess whether the objectives were being met.<sup>23</sup> The ministry also monitored lakes and streams for environmental impact assessment in areas where there may be multiple point and non-point sources of contaminants.

Finally, ENV manages authorizations in the Waste Discharge Regulation, under the EMA. Industries, businesses, trades, activities, and operations prescribed in the Act are required to monitor the water body where contaminants are discharged, as specified in the applicable waste discharge authorization.<sup>58</sup>

<sup>h</sup> Cumulative effects framework – A framework that is comprised of policies, procedures, and decision-support tools that helps the natural resource sector manage and identify cumulative effects, the combined environmental, social, or economic changes that result from past, present, future human activity, or natural processes.

**Figure 4.3: Water Quality Impact Rating, Sampled Sites, BC, 2012-2016**



**Notes:** The Water Quality Effectiveness Evaluation protocol provides a means of ranking sampled sites into five water quality impact classes based on the total volume of fine sediment generated at the site as follows: Very Low <0.2m<sup>3</sup>; Low 0.2-1m<sup>3</sup>; Moderate 1-5m<sup>3</sup>; High 5-20m<sup>3</sup>; Very High >20m<sup>3</sup>. The total number of sample site assessments completed in the time period was 3,033.

**Source:** BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Forest and Range Evaluation Program Water Quality Effectiveness Evaluations Sampling; prepared by Population Health Surveillance and Epidemiology, BC Office of the Provincial Health Officer, BC Ministry of Health, February 2019.

### 4.3.2 Forest and Range Evaluation Program

Since 2005, FLNRORD has administered the Forest and Range Evaluation Program to assess the effectiveness of the FRPA in meeting the provincial government's objectives for each of the 11 resource values<sup>1,59</sup> under the Act, including water quality.<sup>60</sup> As part of the program, effectiveness evaluations were developed to determine whether forestry licensees are meeting the objectives. These evaluations look at selected indicators or attributes of a particular resource value (e.g., water quality) to determine the effects of forest management on the value. The water quality effectiveness evaluation protocol under the program evaluates the amount of fine sediment generated by forestry activities that are then transported into natural water bodies.<sup>61</sup>

Between 2012 and 2016, 3,033 site assessments for the Forest and Range Evaluation Program were completed where potential forest-related fine textured sediment could enter a stream or other water body and affect water quality (See Figure 4.3). Among those 3,033 assessments, 19 were rated as very high and 119 as high. Management issues associated with water quality impact ratings of moderate or higher shows that the top four issues identified to reduce fine sediment reaching streams were (1) increased frequency and strategic placement of road culverts; (2) better management of grader berms; (3) improved quality of road fill/surfacing materials on roads and; (4) making better use of logging slash to mulch road right of way.<sup>14</sup>

All Forest and Range Evaluation Program data results and year-end reports can be found at their website.<sup>60</sup>

<sup>1</sup> The *Forest and Range Practices Act* identifies 11 resource values: soils, biodiversity, riparian/fish, visual quality, timber, forage and associated plant communities, water, wildlife, recreation, resource features, and cultural heritage resources.

**Table 4.4 Status of Regional Drinking Water Teams**

<p><b>Island Health Authority</b></p>	<p>Changes in the structure of participating ministries, increasing workloads and responsibilities of previously participating agencies on the team, and the loss of oversight and accountability for the team led to a lack of participation from team members on the Island. As a result, the drinking water team on the Island no longer meets. Island Health continues to work with provincial and regional district partners on an individual basis to move forward with the goals of the Memorandum of Understanding (MOU) regarding the regional drinking water teams.<sup>63</sup></p> <p>At the request of a number of communities on Vancouver Island, Island Health and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) have identified a process to meet with the appropriate former drinking water team members to discuss any areas of concern to a community and to work together to find a solution to the issue. Island Health continues to participate in a number of municipal or regional government technical advisory committees, and these committees have a very similar process as the regional teams, although at a smaller scale. These technical advisory committees are a subset of the original drinking water team.<sup>63</sup></p>
<p><b>Northern Health Authority</b></p>	<p>The Northern Health regional drinking water team continues to meet, although irregularly. FLNRORD currently chairs the team.<sup>64</sup> Northern Health reports positive growth and coordination between participating agencies. Examples include responses to recent spills in the Northeast, Section 29 investigations, cyanotoxin issues in the Northern Interior, and active participation in provincial environmental assessment working groups across the north. While there is motivation to continue the group to support the existing MOU, Northern Health reports that the absence of the Assistant Deputy Ministers’ Committee on Water has resulted in a loss of the dispute resolution processes that were to be carried out for the regional teams. As a result, the regional teams must rely on gaining consensus to resolve jurisdictional issues. Northern Health also participates in a number of other provincial platforms, where collaboration and sharing occur.<sup>65</sup></p>
<p><b>Vancouver Coastal Health Authority and Fraser Health Authority</b></p>	<p>Regional drinking water teams are no longer functioning within Vancouver Coastal Health or Fraser Health. Initially these regions had regular meetings (two to three times per year) with various ministry agencies and local municipalities and shared many common concerns and issues.<sup>66,67</sup> Protocols were initially developed and operationalized, but over time, there was less interest shown by various provincial agencies to meet due to concerns over ineffective use of time and resources, particularly on identifying any significant common resource development challenges affecting drinking water within the region. There were other issues identified as well, such as difficulties that arose in organizing meetings, including who was responsible for arranging meetings (according to the terms of reference for the regional team, this responsibility was supposed to rotate, but largely defaulted to the health authority) and where meetings were to be held (for some agencies, the meeting locations would require significant travel arrangement).<sup>68</sup></p> <p>Attempts were made to join the Fraser Health regional team with Vancouver Coastal Health. This merger worked for a while, but over time the regional team became less effective, and there was an increasing lack of interest and discussions on significant resource development issues of interest to various agencies at the table. As a result, members suggested that the most effective way to involve other agencies on drinking water issues or protection was to deal directly with that resource agency, unless government developed a new MOU and renewed mandate with accountability to reinstate the inter-agency teams.<sup>68,69</sup></p>

The Southern Interior regional drinking water team was dissolved in 2013. Functions of the team were transferred to the regional managers committees in 2014. Since that time, Interior Health has actively participated in the respective Kootenay-Boundary, Thompson-Okanagan, and Caribou management groups. The committees provide a link between operational managers for all agencies. Interior Health continues to seek ways to leverage these groups to address outstanding concerns with land use and contamination across the region.<sup>70,71</sup>

## 4.4 Partnerships and Inter-agency Coordination

The complex, decentralized structure for source water quality protection in BC makes partnerships and inter-agency coordination essential. This inter-agency coordination is also a core principle in the *Action Plan for Safe Drinking Water in British Columbia* (the Action Plan). The following sub-sections describe the work of various inter-agency teams and coordinated efforts during this reporting period to address source water protection and water quality.

### 4.4.1 Regional Drinking Water Teams

In response to the Action Plan, the Assistant Deputy Ministers' Committee on Water (the ADM Committee on Water) and the Directors' Inter-agency Committee on Drinking Water (the Directors Committee) were created to facilitate an integrated approach to source protection.

In 2006, a *Memorandum of Understanding Regarding Inter-Agency Accountability and Coordination on Drinking Water Protection* (MOU) was created to clarify each agency's accountability concerning drinking water protection. Signatories to the MOU were the Ministry of Agriculture and Lands; Ministry of Energy, Mines and Petroleum Resources; Ministry of Environment; Ministry of Community Services; Ministry of Health; Ministry of Forests, Range and Housing; Ministry of Transportation; the Office of the PHO; and the five regional health authorities. The MOU established a regional drinking water team in each of the five regional health authorities.

Since that time, most of the signatory ministries have been reorganized and renamed on more than one occasion, and responsibilities for drinking water and source protection have changed. In particular, many of the provincial and regional land use authorizations are now concentrated in one ministry—FLNRORD. The reorganization of

the ministries and water source protection responsibilities affected the composition of the regional drinking water teams.

The ADM Committee on Water has not met since 2010. This left the Directors Committee and the regional teams as the only facilitating bodies for the Action Plan. In 2011, members of the regional drinking water teams requested a review of the MOU to assess support for continued operations of the teams and to determine their effectiveness in meeting the MOU's original objectives. The review, completed in 2012, involved interviews with representatives from local government, chairs or members of the regional drinking water teams, and directors from the Directors Committee. Results indicated that members from the drinking water teams saw value in having an inter-agency group, but that the current structure lacked a clear mandate. With the dissolution of the ADM Committee on Water, the health authorities tasked with trying to keep the regional drinking water teams together noted that oversight and accountability of the teams was lost. Some members suggested that there may be a different way to share information across agencies and collaborate on site-specific issues.<sup>62</sup>

During the reporting period, activity and participation in the regional drinking water teams dwindled, and in most regions they are no longer active. The status of the teams is described in Table 4.4.

While the regional drinking water teams no longer regularly meet, there has been some success in using a project-focused approach when issues arise, bringing together ministries, local government, and stakeholders with related interests and responsibilities. Examples of this approach include the cross-government team formed to address nitrates in the Hullcar Aquifer, the Inter-agency Drought Working Group (see Section 4.4.8), or the Northeast Water Strategy (see Section 4.4.7).

This project-focused approach aligns groups across government and allows more flexibility to tailor solutions to specific needs; as a result of the use of this approach, the Directors Committee has become dormant. However, while this approach has been effective in some cases (e.g., inter-agency drought working groups), in other instances it has not (e.g., preventing contamination of the Hullcar Aquifer). In the case of the Hullcar Aquifer, the response and formation of the working group was reactionary, and inter-agency coordination came too late in the process to proactively address the issue.

Inter-agency coordination and partnership is essential for source protection and the multi-barrier approach and should remain as a core principle for drinking water protection in BC. Referral protocols need to be in place and followed so that early in the approval process, DWOs can be made aware of, and be consulted on, any controversial land use decisions that may impact drinking water.

#### 4.4.2 Drinking Water Leadership Council

Drinking Water Leadership Council is a forum established by the Ministry of Health to provide advice on the development of drinking water policy and technical guidance. Membership includes representatives from regional health authorities, First Nations Health Authority, and related government ministries (ENV, FLNRORD, and the Ministry of Municipal Affairs and Housing). A primary objective of the Council is establishing coordinated discussions and cooperation among all the agencies involved in administering the DWPA. Information on other environmental health program inter-agency committees that address policy and operational issues under the DWPA are listed in Appendix B.

#### 4.4.3 Inter-Ministry Groundwater Technical Team

The inter-ministry groundwater technical team consists of staff from the ENV, FLNRORD, and the Ministry of Health, and it develops groundwater resources and coordinates groundwater information sharing across ministries. The team provides a forum for technical input to guidelines and legislation developed during the reporting period, including but not limited to, the WSA and the accompanying

Groundwater Protection Regulation, and the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens*.<sup>43</sup>

#### 4.4.4 Water Policy and Legislation Committee

The Water Policy and Legislation Committee, co-led by ENV and FLNRORD, is responsible for operational, legislative, and strategic policy for the provincial water program. This committee replaced the Policy and Legislation Committee of the Water Stewardship Division, Ministry of Environment, in 2010, following the merger of the resource ministries into the Ministry of Forests, Lands and Natural Resource Operations (now FLNRORD). Membership includes ENV, FLNRORD and the BC Oil and Gas Commission; the Ministry of Health is not a member. The committee is responsible for the following:

- Maintaining a consistent policy development process and communications protocol.
- Prioritizing and coordinating policy and legislation initiatives.
- Ensuring policy development and implementation are appropriately resourced.
- Providing direction on policy development and implementation.
- Identifying provincial/regional champions for implementation of specific policies.
- Approving and endorsing policies.
- Providing corporate interpretation of policies.
- Monitoring policy implementation and effectiveness.<sup>72</sup>

#### 4.4.5 Water Act Modernization Cross-government Directors Committee

Between 2007 and 2014, ENV led a cross-government Directors Committee to help direct policy development as part of the *Water Act* modernization project. Membership included ministries with responsibilities around source water protection and drinking water protection, including the Ministry of Health. Now with the WSA in place, cross-agency project steering committees are used when input on strategic policy items like Water Sustainability Plans and Water Objectives are needed.<sup>73</sup>

#### 4.4.6 Inter-ministry Agriculture-Environment-Health ADMs' Committee

The Inter-ministry Agriculture-Environment-Health Assistant Deputy Ministers' Committee provides executive-level policy project direction and identifies outstanding policy questions on health and environmental impacts from agriculture operations. Membership includes assistant deputy ministers from the Ministry of Agriculture (Agriculture Science and Policy Division), ENV (Environmental Protection Division), and the Ministry of Health (Population and Public Health Division). The PHO and the Provincial Chief Veterinarian also participate as ex-officio members. The committee provides a forum for executive-level communication and enables agencies to allocate and share resources for cross-government policy objectives and initiatives. The impact of agriculture on drinking water is one of the many topic areas covered by the committee. Recent activities related to drinking water include developing a regulatory response to the Hullcar Aquifer issue and a review of policy for agricultural waste control.

#### 4.4.7 Northeast Water Strategy

The Northeast Water Strategy, launched in 2015, is a long-term approach for the sustainable use and management of water resources in northeastern BC.<sup>74</sup> The strategy is an inter-agency initiative that brings together the natural resource sector ministries (FLNRORD, ENV, and the Ministry of Energy, Mines and Petroleum Resources), BC Hydro, the Oil and Gas Commission, the Ministry of Agriculture, the Ministry of Health, and Northern Health, along with other levels of government, First Nations, industry, academia, non-government organizations, and community representatives. As part of its mandate, the Northeast Water Strategy meets monthly to share information and common approaches to water management. Between 2015 and 2017, the Ministry of Energy, Mines and Petroleum Resources was the groundwater lead for the inter-agency group.<sup>75</sup>

The first year of the Northeast Water Strategy focused on foundational work and bringing the partners together. The *Northeast Water Strategy 2016 Annual Report*<sup>76</sup> highlights activities within the initial five action areas:

- Developing enhanced information and tools to support water decisions.

- Strengthening the regulatory regime to protect water resources.
- Coordinating water decision-making processes across the natural resource sector.
- Developing enhanced reporting, compliance, and enforcement.
- Laying the groundwork for building a water stewardship ethic.

During the reporting period, the Ministry of Health participated in the strategy and provided financial support for the private well sampling program.<sup>43</sup> Results from the private well samples identified elevated arsenic concentrations, leading to the public health messaging by Northern Health in 2015 to groundwater users across the region.<sup>77</sup>

#### 4.4.8 Inter-agency Drought Working Groups

The quantity of water available can have an impact on water quality, the environment, and communities. Just as too much water from flooding and extreme weather events can negatively impact water quality, too little water also poses a risk. Many water supply systems, particularly small ones, do not have the water storage capacity to withstand a severe, prolonged drought and are at risk of running out of water. The BC Drought Response Plan, developed in 2010, has guided the provincial response to drought. It outlines roles and responsibilities, criteria and procedures for setting drought levels, and communication protocols, and directs actions to be taken by all parties as drought levels escalate.

Under the BC Drought Response Plan, FLNRORD is responsible for coordinating provincial drought response and planning, and collaborating with a number of agencies to protect public health and safety. Additionally, water suppliers must have an emergency response plan, as per the DWPA, to prepare for disruptions to the quantity and quality of their supply.

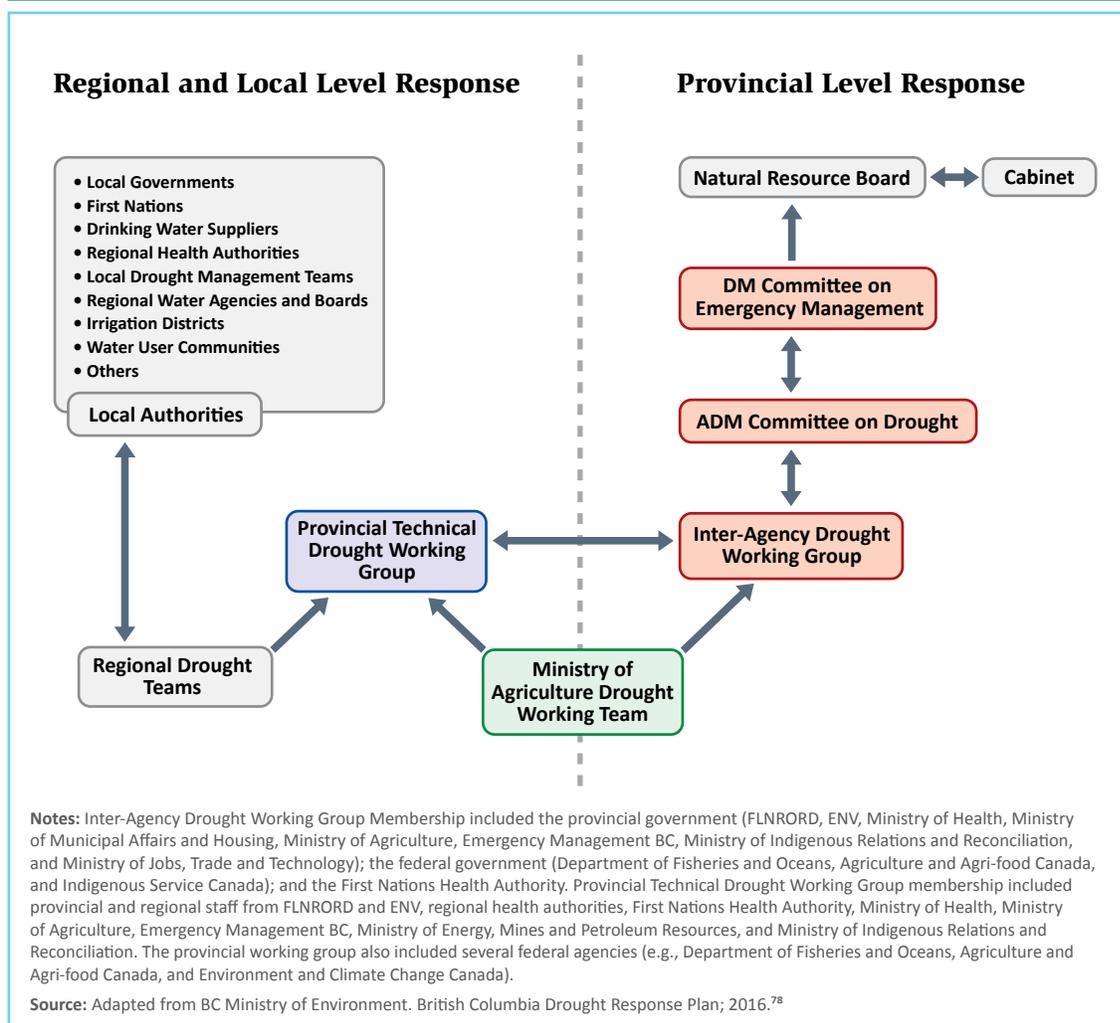
In the summer of 2015, some of the worst drought conditions in recent history were experienced across much of southern BC, resulting in a range of social, ecological, and financial impacts. In response, the Province initiated a number of management actions, including setting drought levels, communicating with the public and water users, and regulatory actions.<sup>78</sup>

The BC Drought Response Plan established a governance structure (Figure 4.4), which includes a number of inter-agency working groups and a reporting and accountability structure. Four principal drought committees were activated in 2015 to implement efficient drought response and effective drought strategy planning (see the sections that follow for more detail). Regional drought teams were also established as needed to coordinate regional drought response. Further, the Ministry of Agriculture Drought Working Team provided coordination to the work of ministry staff on the technical working groups and liaised with agriculture commodity groups and Agriculture and Agri-food Canada.<sup>78</sup>

### Inter-agency Drought Working Group

The Inter-agency Drought Working Group was formed in 2015 with a broad membership from affected provincial and federal agencies across the BC (Figure 4.4). The working group reports to the Assistant Deputy Ministers' Committee on Drought and is responsible for ensuring the Drought Response Plan is delivered upon.<sup>78,79</sup> This group works at a strategic level on tasks such as legislation, risk, economic impact, communications, and what-if scenarios. Current and ongoing projects include developing a Drought Management Strategy for BC; completing an economic impact study from drought; developing a First Nations engagement strategy and communications

**Figure 4.4: Provincial Inter-agency Drought Response Plan and Working Groups, 2017**





Low water levels during a period of drought in the Coldwater River near Merritt, BC.

Photo credit: BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

plan; improving drought management tools; surveying water supplier's vulnerability to drought; and expanding communications through social media information bulletins and drought status reports.<sup>79</sup>

#### Provincial Technical Drought Working Group

The Provincial Technical Drought Working Group also formed in 2015, and reports to the Inter-agency Drought Working Group. Membership includes provincial, regional, and federal staff from affected agencies across BC (Figure 4.4). The responsibilities of this group include monitoring stream flows and aquatic ecosystems, community water supply levels, and sectors such as agriculture to ensure that water supplies remain adequate throughout the province, using that information to set provincial drought levels, and sharing information to promote provincial consistency.<sup>78,79</sup>

#### Executive Drought Committees

In 2015, two executive-level drought committees led by FLNRORD were formed to carry out high-level strategic planning related to drought: the Deputy Ministers' Committee on Drought and the Assistant Deputy Ministers' (ADMs) Committee on Drought. The ADMs' Committee on Drought, which reports to the Deputy Minister's Committee on Drought, reviews

and approves recommendations from the Inter-agency Drought Working Group, oversees the functioning of the drought working groups, provides a bridge between the inter-agency group and the Deputy Ministers' Committee, and resolves issues and gaps and elevates if necessary. The Deputy Ministers' Committee on Drought resolves higher level issues, provides strategic guidance and approval of regulatory policy and financial decisions during both drought preparation and response, and elevates issues to political or inter-jurisdictional levels as necessary.<sup>79,80</sup> In 2017, the Deputy Ministers' Committee on Drought was superseded by the Deputy Ministers' Committee on Emergency Management, as part of the provincial government adopting an **all-hazards approach** to emergency management.<sup>79</sup>

#### 4.4.9 Ad hoc Water Quality Issues Committees

Inter-agency task groups have been formed historically when concerns arise about issues such as nitrates and aquifer contamination from agriculture and other land uses. Examples of this type of group include the Hullcar Aquifer Inter-agency Working Group and the Abbotsford-Sumas Aquifer International Task Force.

### Hullcar Aquifer Inter-ministry Working Group

The Hullcar Aquifer Inter-ministry Working Group formed in 2016 in response to growing concerns about rising nitrate levels in the Hullcar Aquifer within an agricultural area near Spallumcheen in the North Okanagan. Membership includes representatives from ENV (Regional Operations Branch), FLNRORD, the Ministry of Agriculture, and Interior Health, and expertise on the working group includes soil specialists, hydrogeologists, drinking water officers, dairy industry specialists, environmental impact assessment biologists, and environmental protection officers.

The group works with industry, the community, and local First Nations to protect drinking water quality while also supporting sustainable agriculture within the area. The group's focus has included identifying significant sources of pollutants, assessing a variety of approaches to resolve the water quality issue, and conducting monitoring of the activities above the aquifer. The following text box provides

an update since the reporting period for this report of ongoing work and inter-agency collaboration to address the concerns surrounding the Hullcar Aquifer contamination.

### Abbotsford-Sumas Aquifer International Task Force

The Abbotsford-Sumas Aquifer International Task Force was created in 1992 as a result of the Environmental Cooperation Agreement between Washington State and BC.<sup>84</sup> The task force's mission is to coordinate groundwater management strategies, in order to protect the aquifer across the common border between Canada and the United States from nitrates and other sources of contamination. The task force still exists; although activity with the group has been infrequent in recent years.<sup>85</sup>

The work of the task force over the years has had a positive impact on the nitrate issue in the region.<sup>85</sup> It generated serious attention and interest in the issue from all levels of government, the local farming community,

## Update on the Hullcar Valley

A significant amount of inter-agency work on the Hullcar file has occurred subsequent to the reporting period for this report. In August 2017, the Minister of Environment and Climate Change Strategy ordered an independent review of the Hullcar Aquifer issue, which led to the report *From Crisis to Solutions: Towards Better Source Water Protection and Nutrient Management in the Hullcar Valley* (the Polis Report).<sup>81</sup> The Polis Report included nine sets of recommendations to be addressed in the immediate, short, and long-term.

In December 2017, the Ministry of Environment and Climate Change Strategy and the Splitsin First Nation signed a Memorandum of Understanding (MOU)<sup>82</sup> to establish a collaborative Chief-to-Environment Minister approach for addressing water quality in the Hullcar Valley. Under this MOU, a steering committee was established to identify, develop, and implement solutions associated with water quality and governance in the Hullcar Valley. Shortly thereafter, the provincial government initiated an inter-agency working group—reporting to the steering committee—to address the recommendations of the Polis Report.<sup>2</sup> This inter-agency group included representatives from the Splitsin, Ministry of Environment and Climate Change Strategy, Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Ministry of Agriculture, Ministry of Health, Ministry of Indigenous Relations and Reconciliation, Ministry of Municipal Affairs and Housing, Office of the Provincial Health Officer, Interior Health, First Nations Health Authority, and Indigenous Services Canada.<sup>83</sup> In June 2018, the working group submitted a draft Hullcar Aquifer Response Plan to the Minister of Environment and Climate Change Strategy. This draft plan identified several actions to be undertaken to address the issue of increasing nitrates in the Hullcar Aquifer. In November 2018, the *Hullcar (Clcahl) Aquifer Response Plan* Report was released.<sup>2</sup>

academia, and on-the-ground interaction with berry growers and poultry industries. Specifically, both these industries—supported by research work by Agriculture Canada and various university studies and water quality monitoring data collected by Environment and Climate Change Canada—have stepped up to the issue of nitrate contamination of the aquifer and made farmers more aware of manure management practices. An example of a positive action was initiated by the Sustainable Poultry Farmers’ group; this action supported the removal and transport of excess manure from the aquifer area to other farming communities that needed it. In addition, the Ministry of Agriculture has helped a number of farms develop responsible environmental management plans to deal with manure issues.<sup>85</sup>



A view of the Fraser Valley near Abbotsford, BC.

Data from Environment and Climate Change Canada, which monitors the BC side of the Abbotsford-Sumas Aquifer, show that while nitrate values are still above the maximum acceptable concentration, the trend has been relatively stable over the years, with no appreciable long-term movement upward or downward, despite intensified growth in the region.<sup>86</sup> In addition, despite nitrate levels averaging above the maximum acceptable concentration over the years, there has never been a reported incidence of **methemoglobinemia** (i.e., blue baby syndrome) on either side of the BC–Washington State border.<sup>85</sup> This is likely supported by the public outreach and education to well water users in the region over the years about the risks to bottle-fed infants of nitrates in drinking water.

#### 4.4.10 Transboundary Watershed Task Groups

ENV leads a number of multi-stakeholder transboundary task groups, including the BC/Washington State Nooksack River Transboundary Water Quality Task Group, the BC/Alaska Technical Working Group, and the Lake Koochanusa Monitoring and Research Working Group. These task groups are primarily driven by transboundary concerns about potential impacts from discharges regulated under the *Environmental Management Act*.

##### BC/Washington State Nooksack River Transboundary Water Quality Task Group

The BC/Washington State Nooksack River Transboundary Water Quality Task Group, established in December 2016, is concerned with developing a common understanding of current water quality issues, data, and conditions related to fecal coliform bacteria in transboundary waters and tributaries to the Nooksack River and Portage Bay, as well as legislative, policy, and best practices to support reducing sources of fecal coliform bacteria pollution in each jurisdiction.<sup>87</sup> Pending the results of an inventory and analysis of the situation, recommendations for further action and next steps will be made. In 2018, ENV released the *Compliance Nooksack River Watershed Audit Report*.<sup>88</sup>

##### BC/Alaska Technical Working Group

The BC/Alaska Technical Working Group established in 2016, oversees and implements coordinated water quality monitoring programs. The objective of the monitoring is to help understand existing environmental conditions and the potential for upstream Canadian mining and other industrial activities to have an impact on Alaska’s downstream resources.<sup>89</sup>

##### Lake Koochanusa Monitoring and Research Working Group

The Lake Koochanusa Monitoring and Research Working Group is a multi-stakeholder group, established in 2014. The group’s objective is to conduct water quality monitoring and research to further assess whether regulatory requirements under the EMA for coal mines in BC’s Elk Valley are adequately protective of Lake Koochanusa, a BC/Montana transboundary reservoir.<sup>90</sup>

## 4.5 Research, Science, Technology, and Information Management Systems

Developments in research, science, technology, and information management systems are an important component of an integrated system of management and monitoring for the multi-barrier approach to clean, safe, and reliable drinking water. The following sub-sections highlight research, science, and technology activities as well as the various developments in information management systems during the reporting period relating to the protection of source water and drinking water quality.

### 4.5.1 Research Water Science Series

The Water Science Series, developed by ENV, is a technical publication for FLNRORD and

ENV that looks at scientific reports related to the understanding and management of water resources in BC.<sup>91</sup> “The series communicates scientific knowledge gained through water science programs across B.C. government, as well as scientific partners working in collaboration with provincial staff.”<sup>91</sup>

### Resource Practices Branch Research Projects

The Resource Practices Branch, FLNRORD, identifies priorities for source water protection by collaborating with partner agencies (Range Branch), forest licensees, and others. For example, the branch has partnered with Range Branch staff in the Okanagan Shuswap District and engineering faculty at the University of British Columbia-Okanagan to conduct research and produce reports, guidance, and best management practices for source water protection (Table 4.5).<sup>14</sup>

**Table 4.5 Resource Practices Branch Funded Research Projects Undertaken by the University of British Columbia - Okanagan, 2015 to 2017**

2015	Verification of best management practices for livestock using community watersheds in the Okanagan Valley of BC.
	Using non-merchantable timber as a barrier to livestock in order to protect riparian areas and small streams.
2016	Persistence and transport of <i>Cryptosporidium parvum</i> on rangeland in sediment, and the effects of off-highway vehicle use on water quality in the Kelowna Creek/Postill Lake area.
2017	The effect of off-highway vehicle traffic on the water quality at the Postill Lake site and from the Noble Creek Canyon site.
	The performance of field sediment dispersal studies and hydraulic modeling of the results of these studies.
	Determination of the level of sediment contaminated with <i>Cryptosporidium parvum</i> , through analysis of sediments from various locations in the watershed, including the banks of creeks where there are off-highway vehicle crossings, drinking water detention ponds, and other natural sedimentation areas.
	Maps of the watersheds containing Postill Lake and Noble Creek canyon areas, which show the water supply vulnerability areas and the off-highway vehicle trails within the area, and an analysis of when these trails intersect water supply vulnerability areas.
	Development of an off-highway vehicle user survey to provide information on characteristic patterns and behaviour of off-highway vehicle users. This survey will be given to off-highway vehicle groups on site at the two monitored locations.
<p>Source: BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Response to request for updates to the progress report on the action plan for safe drinking water in British Columbia 2015; 2017.<sup>14</sup></p>	

## Ministry of Health Human Health Risk Assessment

In northeastern BC, oil and gas development continues to grow, and there are concerns about the potential impact of this development on health. Issues include air and water quality, and regulation of the industry. In response to these concerns, the Ministry of Health led a three-phase human health risk assessment, which started in 2012, to identify, explore, and assess the potential human health risks related to oil and gas activities in northeastern BC.<sup>92</sup>

Phase 1, which was completed by the Fraser Basin Council, identified concerns raised by both the public and stakeholders in the region related to oil and gas development.<sup>92</sup> Key issues that were identified in the over 300 submissions included the following: environmental exposure (e.g., hydrogen sulphide gas or contaminated water, and accidents at the well site); operational issues (e.g. hydraulic fracturing, emergency response to incidents, air quality, and water quality and quantity); and institutional framework issues (e.g., monitoring, compliance, and transparency). The final report on Phase 1 was released in June 2012.

Phase 2, conducted by Intrinsic Environmental Sciences Inc., involved evaluating potential human health concerns related to oil and gas activities. This phase began in November 2012, and work included a scientific literature review, screening level risk assessment, detailed human health risk assessment, review of the current regulatory framework, and development of recommendations.<sup>92</sup> The final report on Phase 2<sup>93</sup> was publicly released in March 2015.<sup>92</sup>

The data and information in the Phase 2 report provides a valuable baseline to monitor health effects of future oil and gas developments and other resource activities in the region. While the human health risk assessment found there is a low probability of adverse health effects from exposures to contaminants related to current oil and gas activities,<sup>94</sup> the regulatory review found there is room for regulatory improvement in areas such as emergency planning; flaring, venting, and fugitive emission management; hydraulic fracturing; information management; and environmental monitoring.<sup>95</sup>

The Province accepted<sup>96</sup> the 14 recommendations made in the human health risk assessment<sup>97</sup> and is taking action to address the issues. The specific recommendations looking at water included:

- **Recommendation 4:** The implementation of baseline, pre-drilling ground water testing requirements for oil and gas activity in B.C. should be considered. Whenever possible, the process for collecting the information should be transparent, and the results publicly available, and reviewed on a regular basis. To facilitate the interpretation of results, it may also be beneficial to encourage the collection and reporting of well information in addition to sample data.
- **Recommendation 10:** While some aquifer mapping has been completed in Northeast B.C., it is recommended that the existing aquifer mapping (and vulnerability mapping) be expanded for the Northeast B.C. region to help enhance the protection of groundwater resources in relation to oil and gas development. This information would aid in regional and site-specific assessments of potential risks to groundwater. As one of the limitations with the current aquifer mapping relates to an overall absence of subsurface data, it is suggested that **surficial geology** mapping (on an appropriate scale) for the region be completed as well.
- **Recommendation 11:** Additional study of groundwater and surface water interactions within shallow aquifers and local ground water flow conditions in the Northeast B.C. region should be completed. This information could contribute to a better understanding of potential contaminant fate and migration. As well, studies could be carried out to investigate the location and sources of groundwater recharges.<sup>96</sup>

Phase 3, the public release of the Phase 2 report and communication of the findings, was initiated in March 2015. Stakeholder information sessions were held in Chetwynd, Dawson Creek, Fort St. John, Hudson's Hope, and Taylor in June 2015.<sup>92</sup>

### Northeast Water Strategy Research

Key research studies carried out or supported by the Northeast Water Strategy during the reporting period include the following:

- Development of a disturbance-sensitivity-based approach to prioritizing water monitoring in northeastern BC. It considers cumulative effects on water quantity and quality for surface water and groundwater. This research is led by the Ministry of Energy, Mines and Petroleum Resources.<sup>98</sup>
- A large collaborative research project to characterize groundwater in the Dawson Creek area, led by FLNRORD.<sup>99</sup>
- A large collaborative research project to map and understand the aquifer potential of paleovalleys in the Montney area, led by the Ministry of Energy, Mines and Petroleum Resources and FLNRORD.<sup>99</sup>
- Development of a cumulative effects water quality framework for the Murray River, led by ENV.<sup>100</sup>
- A research study to better understand and quantify the use of dugouts in the south Peace Region, which showed an increase in the use of dugouts by agriculture and the oil and gas industry.<sup>76</sup>

Detailed information regarding this research and other projects can be found in the *Northeast Water Strategy 2016 Annual Report*.<sup>76</sup>

### 4.5.2 Information Management and Information Technology

#### Environmental Monitoring System

ENV maintains the Environmental Monitoring System, a corporate electronic repository for the capture and extraction of results for chemical, physical, and biological analysis performed on air, water, waste discharges, as well as data from ambient monitoring locations throughout the province.<sup>101</sup> Samples are collected by ENV staff and permit holders under the EMA and are analyzed in both public and private laboratories. Results are entered into the Environmental Monitoring System.

The system has the capacity to capture physical, chemical, and bacteriological monitoring data on drinking water and recreational water sources, based on samples collected by water suppliers and drinking water officials. While inclusion of this type of data into the system

would improve data access and reporting for both water suppliers and health officials,<sup>102</sup> there are currently barriers to capturing these data, including a lack of coordination with private sector laboratories and no requirement for private laboratories to report chemical or physical water quality data.

#### Health Authority Administrative Databases

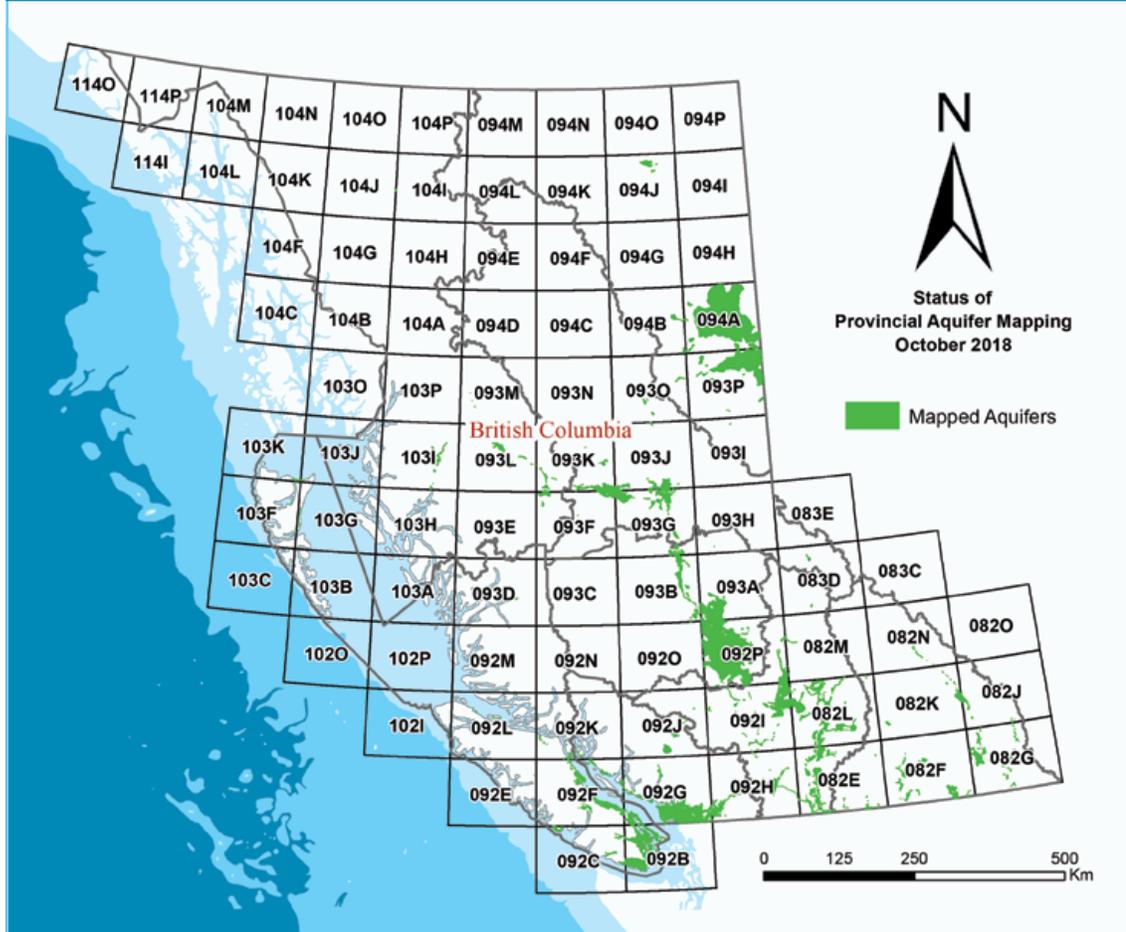
Three different administrative databases are used by the regional health authorities for the capture and retrieval of water monitoring data: Hedgehog<sup>103</sup> (used by Interior Health); HealthSpace<sup>104</sup> (used by Vancouver Coastal Health, Fraser Health, Island Health, and Northern Health); and WaterTrax<sup>105</sup> (used by First Nations Health Authority). Each database has different strengths and weaknesses. In particular, the users of HealthSpace and Hedgehog have limitations in sharing and capturing chemical and physical water monitoring data. Limited work has been done to explore electronic data transfer of data from laboratories into HealthSpace, but during the reporting period no concrete solutions have been identified.

#### WELLS Database

ENV maintains well records in the WELLS database.<sup>106</sup> A well record contains details of the construction, alteration, or decommissioning of a well, as well as information about the lithology encountered during drilling and the water-bearing characteristics of the aquifer. Well records are important to inform drillers of local drilling conditions when developing new water supplies, to indicate types of water use, to verify the water supply during property transactions, and to inform environmental and hydrogeological assessments.

Prior to 2016, it was voluntary for well drillers to submit most types of well reports to ENV. As a result, the WELLS database does not accurately capture all drinking water wells across the province. This makes it difficult to identify and map all groundwater users and to quantify the number of households relying on private wells. Under the WSA, it is now mandatory to submit well reports. For those well owners who pre-date the WSA and do not have a well record, ENV provides public education to encourage them to register their well to create a well record. The benefits of registration include creating a record of a

**Figure 4.5: Status of Aquifer Mapping in BC, 2018**



**Note:** This map was developed by the BC Ministry of Environment and Climate Change Strategy for the Office of the Provincial Health Officer.  
**Source:** Baye A. Water Protection and Sustainability Branch. BC Ministry of Environment and Climate Change Strategy; 2018 Oct.

person(s) water use, which can help ensure their use is considered in future water allocation decisions and during times of water scarcity.<sup>107</sup>

During the reporting period, ENV initiated rebuilding of the WELLS database. The new database, GWELLS, will have increased functionality for submitting, storing, and retrieving water well data, as well as enhanced capability to store key information related to aquifers, therefore supporting water planning.<sup>23</sup>

#### The BC Aquifer Classification System

In BC aquifers are mapped, identified, and categorized using data from the WELLS database. The map-based aquifer classification system was developed in 1994, and over 1,100 aquifers had been classified as of March 31, 2017.<sup>108</sup> This classification system has two components: a

classification component to categorize aquifers based on their current level of development, use, and vulnerability; and a ranking component to indicate the relative importance of an aquifer.<sup>109</sup> An aquifer classification database holds available information about aquifer location, size, and productivity, as well as concerns about water quality and quantity.<sup>110</sup>

ENV continues to inventory aquifers across the province. Since 2015, 145 aquifers have been mapped and classified, although much of the province has not been mapped.

Figure 4.5 illustrates the areas in the province that have been mapped and classified. Work is also underway to develop summary fact sheets for mapped and classified aquifers.<sup>23</sup>

In addition to mapping and classification, ENV continues to develop water budgets for key aquifers to quantify the amount of groundwater available for supply. These water budgets help inform water allocation decisions and help protect and manage source waters.<sup>23</sup> Since 2015, water budgets have been developed in 11 areas in the Southern Interior, Lower Mainland, and Southern Vancouver Island. Water budget reports are stored in the EcoCat Ecological Reports Catalogue<sup>111</sup> (see the following sub-section for more detail), and have been published as Water Science Series reports since 2016.<sup>91</sup>

### EcoCat Ecological Reports Catalogue

EcoCat is an online catalogue that contains reports on ecological activities in BC. EcoCat provides access to digital reports and publications, and associated files such as maps, datasets, and published inventory information.<sup>111</sup> Many reports and publications relating to drinking water quality and source water assessment and protection can be found on EcoCat.

### British Columbia Drought Information Portal

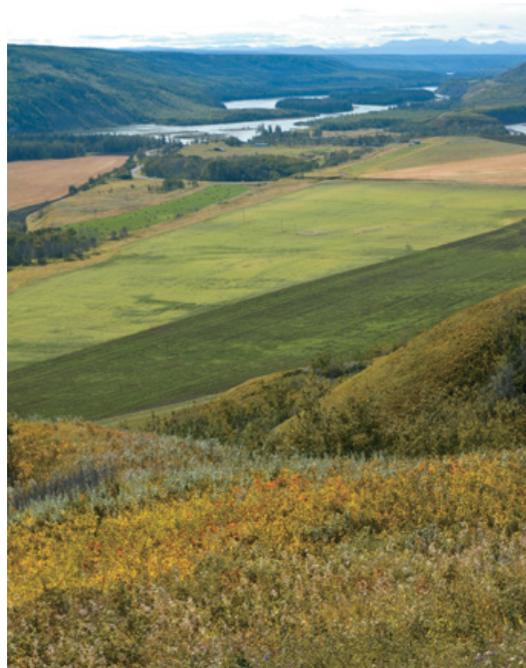
During the reporting period, FLNRORD developed the British Columbia Drought Information Portal, an online resource for up-to-date drought level information across the province.<sup>112</sup> “The application uses multiple embedded maps to provide information on provincial drought levels, angling closures, historical drought time-lapse information, and other drought-related information.”<sup>113</sup>

### The Water Portal

The Water Portal,<sup>114</sup> developed as a joint project by the BC Oil and Gas Commission and FLNRORD, is a map-based tool that provides public access to water-related data and information in northeastern BC.<sup>115</sup> The portal houses information for statutory decision-makers, resource development operators, and the general public. It provides access to more than 18 government and third-party data sets on surface and groundwater quantity and quality.<sup>76</sup>

### The Northeast Water Tool

The Northeast Water Tool is a map-based decision-making tool developed in partnership by GEOScience BC, the BC Oil and Gas Commission, and FLNRORD. It is used by local governments, applicants for water rights, and



The Peace River valley in northeastern BC.

FLNRORD and the BC Oil and Gas Commission in allocating and approving licences. The tool presents current and historic data on natural water supply and availability across the region. It generates custom watershed reports on water availability, monthly flows, environmental flow needs, current allocations, and available water for allocation, which provide regulators with the necessary information to make allocation decisions.<sup>76</sup>

### Groundwater Review Assistant

In 2017, the BC Oil and Gas Commission launched the Groundwater Review Assistant, an innovative data retrieval tool that compiles groundwater-related information from provincial databases. The tool facilitates a number of aspects of groundwater protection and management in northeastern BC, including groundwater licence applications, assessment of groundwater capture zones, site reclamation, and contaminated site assessments.<sup>37</sup>

### Ministry of Agriculture – Source Water Protection Technical Tools

AGRI with support from ENV led work on a number of tools and agriculture-related initiatives that support protection of drinking water. Six of these tools are described in Table 4.6.

**Table 4.6 Ministry of Agriculture Source Water Protection Tools**

<b>BC Agriculture Water Calculator</b>	The BC Agriculture Water Calculator <sup>116</sup> helps agricultural producers determine the annual water requirements for irrigation and livestock from surface water and groundwater sources. The calculator has made it easier for producers to fulfill the data and mapping requirements of the online surface water and groundwater licensing process. <sup>117</sup>
<b>Agriculture Water Demand Model</b>	The Agriculture Water Demand Model <sup>118</sup> estimates the current and future water requirement for agriculture from surface water, groundwater, and reclaimed water sources. The model is operational in over 20 regions in BC and is intended to cover the entire province by 2021. The model's results have served as baselines for local governments in developing water planning strategies. Many of these water plans are also linked to source protection plans. <sup>117</sup>
<b>Agriculture Irrigation Scheduling Calculator</b>	The Agricultural Irrigation Scheduling Calculator <sup>119</sup> assists agricultural producers in using water resources more efficiently and preparing for drought. <sup>117</sup>
<b>Farmwest</b>	The Farmwest.com website <sup>120</sup> is a federal-provincial-territorial initiative, supported by the Ministry of Agriculture and funded in part through Growing Forward 2. The website provides historical climate information from over 150 weather stations in BC, and decision-support tools for agricultural producers to make informed decisions on their daily farm operations, including irrigation management. Farmwest improves public and producers' access to weather and climate information in protecting our water sources. <sup>117</sup>
<b>Agriculture Land Use Inventory</b>	The Agricultural Land Use Inventory <sup>121</sup> is conducted by the Ministry of Agriculture to evaluate practices, emergency management, bylaw development, and to support the Agriculture Water Demand Model. The information collected can assist in the evaluation of land use management practices pertaining to agriculture in watersheds with drinking water sources.
<b>BC Water Use Reporting Centre</b>	The Okanagan Basin Water Board, in partnership with the Province of BC and Environment and Climate Change Canada, launched the BC Water Use Reporting Centre <sup>122</sup> as a pilot to help the agricultural sector make smarter management decisions and develop sustainable plans for the future. The pilot is an online tool that allows all BC agricultural water licence holders in the Okanagan (individual producers and water purveyors) to calculate and submit their water usage to the provincial government through a streamlined online system. <sup>117</sup>

## 4.6 Public Engagement and Education

Public awareness and involvement in protecting drinking water supplies is an important component that supports the multi-barrier approach. It builds cooperation and networks for protecting water supplies, helps ensure priorities for the health of the public and concerns of the public are understood and addressed, and builds support for drinking water protection

programs and activities. All government agencies with responsibilities in source water protection develop online and printed education materials for public use. These include but are not limited to websites, blogs, twitter feeds, brochures, guidebooks, and BC Health Files. Table 4.7 highlights some of the public engagement and education outreach activities during the reporting period to build public, local government, and industry awareness of and involvement in drinking water protection.

**Table 4.7 Public Engagement and Education Tools**

<p><b>wellSMART</b></p>	<p>In 2010, water staff with the Regional District of Nanaimo, the Ministry of Forests, Lands and Natural Resource Operations (FLNRO), and Island Health developed a workshop called wellSMART. The objective of the workshop was to educate private residential well owners about their responsibilities as the “water manager” of their system. The workshop addressed well operation and maintenance, source protection, water testing, and treatment options.<sup>123</sup> Attendance at the sessions varied over the years: 144 participants (2010), 13 (2011), 88 (2012), 103 (2013), 68 (2014), 89 (2015), and 66 (2016).<sup>124</sup></p>
<p><b>Rural Water Quality Stewardship Rebate Program</b></p>	<p>In 2013, the Regional District of Nanaimo launched the Rural Water Quality Stewardship Rebate Program<sup>125</sup> to provide financial support for upgrades to private wells within its jurisdiction, and to provide one-time well water quality testing cost-sharing for residential well owners. Upgrades eligible for rebates include providing a secure well cap for drilled or dug wells, increasing the well casing to stick up above ground level, installing or repairing the well surface seal, and closing an unused well.<sup>125</sup> Since 2013, this program has supported 38 well upgrades and 440 water analyses, and counting.<sup>124</sup></p>
<p><b>Well Owners Workshop</b></p>	<p>The Well Owners’ Workshop, developed by the Ministry of Environment, FLNRO Agriculture and Agri-Food Canada, and the BC Groundwater Association (BCGWA), educates private well owners in rural areas. During the reporting period, workshops were offered in Duncan (2012) and on Salt Spring Island (2013). No well owners’ workshops have occurred since 2013.<sup>34</sup></p>
<p><b>Groundwater Associations</b></p>	<p>In 2013, the Canadian Ground Water Association (CGWA) dissolved following a legal battle that led the Association into bankruptcy. For decades, it had provided certification and training programs for water well drilling trades, and professional development opportunities.<sup>34</sup></p> <p>After the demise of the CGWA, the BCGWA worked with the BC Industry Training Authority (ITA) to develop “made in BC” trade certification programs, with financial assistance from ENV. As of April 2014, ITA Challenge Programs had been established for three drilling trades (water well driller, geotechnical/environmental driller, and geoexchange driller) and the well pump installer trade. This program allows applicants to challenge the ITA exam if a panel of subject-matter experts determines that they have sufficient work experience. An applicant who passes the exam becomes ITA-certified and can apply to ENV for registration as a qualified tradesperson in BC.<sup>34</sup></p> <p>The BCGWA continues to carry on its mandate to promote the responsible development of groundwater resources, by hosting regional meetings, an annual convention and trade show, workshops, speaking engagements, and public outreach events. Finally, they work with the professional and scientific community to develop new technologies for improving responsible groundwater resource development.<sup>34</sup></p>

<b>Sediment and Erosion Control Training</b>	<p>In 2015, FLNRO's Resource Practices Branch collaborated with FPInnovations<sup>126</sup> to deliver several sediment and erosion control training courses per year to help forest licensees identify and mitigate water quality impacts in and around fish streams and domestic water intakes.<sup>14</sup></p>
<b>Groundwater at Risk of Containing Pathogens (GARP) training</b>	<p>In 2015, the Ministry of Health partnered with the Association of Professional Engineers and Geoscientists of British Columbia to deliver a series of half-day training seminars across BC. The seminars focused on the procedures outlined in the <i>Guidance Document for Determining Ground Water at Risk of Containing Pathogens</i> assessment document and the subsurface filtration credits outlined in the BC groundwater treatment objectives. Seminars were held in 2016 in Nanaimo, Nelson, Kelowna, Prince George, and Richmond for professionals, health officers, water suppliers, well drillers, and members of the water industry who deal with groundwater issues.<sup>43</sup></p>
<b>Drought Preparedness Workshops and Public Education</b>	<p>FLNRORD and the Inter-Agency Drought Working Group delivered various forms of external communications and public education outreach activities related to drought preparedness and response. Communications included media releases, and consistent updates and improvements to the BC Drought Information Portal<sup>112</sup> and the BC drought information web page.<sup>127</sup> Outreach activities included webinars directed at community water suppliers (in partnership with the Union of BC Municipalities) and with First Nations (in partnership with the First Nations Fisheries Council). FLNRORD also facilitated workshops and seminars with local authorities and water users within regional districts.<sup>79</sup></p>
<b>Outreach on the Water Sustainability Act and New Groundwater Licensing Requirements</b>	<p>During the reporting period, the provincial government, through ENV and FLNRORD, conducted a broad range of outreach activities to educate the public and industrial water users about the new <i>Water Sustainability Act</i>, which came into force in 2016. Outreach focused on the key elements of the legislation, in particular the new requirements for groundwater licensing. Direct outreach included blog and website updates, mail and email communications to stakeholder organizations, and numerous presentations to regional and provincial organizations. Workshops to assist groundwater users to complete and submit their water licence applications within the three-year transition period were held in partnership with FrontCounter BC, FLNRORD, local governments, and agriculture sector organizations. Ministry staff training has also been ongoing. Government outreach efforts were renewed in the fall of 2018, with further groundwater licensing workshops and increased advertising to encourage existing groundwater users to submit their applications.<sup>128</sup></p>
<b>Lake/Stream Water Quality Stewardship</b>	<p>ENV provides technical support and training to numerous lake/stream water quality stewardship groups. These groups have an interest in community education about protection of local water bodies. Many of these stewardship groups conduct voluntary lake monitoring and educational activities aimed at lakeshore residents.<sup>129</sup></p>



The Coquitlam watershed. One of three protected watersheds serving Metro Vancouver.  
Photo credit: Metro Vancouver.

## 4.7 Conclusion

As one of the three pillars of the multi-barrier approach, source protection is crucial in ensuring that water is used sustainably, and that the water entering drinking water systems is as clean and safe as possible and protected from the effects of resource development, agriculture, and other land-based activities. Source protection is an area with multiple actors and pieces of legislation involved. As such, the Action Plan called for clear lines of responsibility and effective inter-agency collaboration. This chapter examined the integrated system of management required for source protection across agencies, including legislative and policy frameworks; guidelines, objectives, and best practices; source water monitoring; partnerships and inter-agency coordination; research, science, technology, and information management systems; and public engagement, education, and training.

As this chapter showed, the legislative and policy framework for source protection in BC is multi-stakeholder, involves many pieces of legislation, and is supported by ongoing development of guidelines, objectives, best practices, policy, and other technical guidance. The monitoring networks and mapping of water supply quantity and quality continues to grow; however, further support is required to fully report on the state of BC's water. Areas

of challenge with the legislative framework include inter-agency coordination in areas of jurisdictional overlap. While several inter-agency committees have had success addressing specific topics, regional concerns, or policy development, the inter-agency groups tasked with overseeing the implementation of the Action Plan have disbanded, leaving an accountability gap. Time has also shown us that the use of certain source protection tools developed under legislation is restricted, thus limiting their effectiveness. For example, drinking water protection plans under the *Drinking Water Protection Act* can only be ordered by the Minister of Health as a measure of last resort, which mean they are not available as a proactive planning tool.

The Province has successfully developed many different source assessment tools, planning guides, technical documents, and public educational materials. Despite these resources, very few water supply systems have completed a source and system assessment or developed a response plan. Data system limitations further hinder our ability to evaluate those assessments and plans that are developed. As this chapter highlighted, a large number of online tools and databases relating to water resources now exist. However, while large volumes of data are now available, the integration of these data across agencies and databases requires more work.

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# 5 Drinking Water Treatment and Distribution

Drinking water treatment and distribution are integral components of the multi-barrier approach to safe drinking water. After the quality and quantity of the source water is assessed and hazards are identified, the next step in implementing the multi-barrier approach is to understand the treatment processes in place, including their limitations. Ensuring that effective treatment processes are in place, and that the water is protected from further contamination as it moves through the distribution system are vital to the safety of drinking water.

Effective and robust treatment reduces or eliminates pathogens and prevents waterborne illness. It can also reduce or remove physical and chemical compounds present in the water supply to levels below the maximum acceptable concentrations as outlined in the *Guidelines for Canadian Drinking Water Quality* (the Canadian Guidelines). Water treatment design and process selection is complex and depends on many factors including source water quality and quantity, finished water quality, reliability of processing equipment, operational requirements and operator capabilities, flexibility in dealing with the changing water quality, and capital and operating costs.<sup>1</sup>

Disinfection of water supplies is not only important from a health protection standpoint; it is also required under provincial legislation. Section 5.2 of the Drinking Water Protection Regulation—under the *Drinking Water Protection Act* (DWPA)—states that drinking water that originates from surface water or groundwater that, in the opinion of a drinking water officer, is at risk of containing pathogens must be disinfected by the water supplier.<sup>2</sup> Further to this requirement, Section 6 of the DWPA requires water suppliers to provide potable water.<sup>3</sup>

## 5.1 Treatment Facility Performance Standards and Design

A major element of any drinking water protection program is ensuring the adequacy of the treatment processes and design.<sup>1</sup> To achieve this, authorities must: i) develop and publish performance and design standards and guidelines for water systems to meet; and ii) undertake project design reviews and issue approvals for the construction of works based on compliance with standards and guidelines.<sup>1</sup> The following sections describe treatment performance standards in BC, as well as facility design standards for the construction and operation of water supply systems.

### 5.1.1 Treatment Performance Standards

During the reporting period, the Ministry of Health developed treatment objectives for both surface and groundwater supplies: *Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia (2012)*<sup>4</sup> and the *Drinking Water Treatment Objectives (Microbiological) for Ground Water Supplies in British Columbia (2015)*.<sup>5</sup> These documents, based on the Canadian Guidelines, provide the minimum goals for drinking water treatment. They also provide a reference for assessing a water supplier's progress towards updating or improving existing treatment processes. The Provincial Health Officer (PHO) has selected the ability of a water system to meet treatment objectives as the basis for assessing the adequacy of drinking water treatment systems in BC systems.

The BC treatment objectives for surface water, commonly known as “4-3-2-1-0” (Table 5.1), provide treatment requirements that address turbidity and selected microbiological parameters: enteric viruses, pathogenic bacteria, and protozoa (e.g., *giardia* cysts and *cryptosporidium* oocysts). Surface supplies are open to the atmosphere and have a greater vulnerability than groundwater to contamination from wildlife, human activity, and surface run-off caused by seasonal or extreme weather events.<sup>6</sup> Given that no single form of treatment can eliminate all potential health threats associated with the varying quality of source water supplies, multiple barriers of protection (such as two or more forms of treatment) are often needed to reduce related health hazards and meet the treatment objectives.<sup>7,8,9,10</sup>

Depending on the assessment conducted according to the *Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP)* (see Chapter 4, section 4.2.3),

groundwater supplies classified as “at risk of containing pathogens” require treatment equivalent to surface water.<sup>11</sup> If only those risk factors related to the potential presence of viruses and bacteria in groundwater are present, then the drinking water officer has the discretion to limit the microbiological treatment objectives (Table 5.2). A 3-log reduction of *cryptosporidium* and two methods of treatment would not be required in this case.

Meeting and maintaining compliance with the treatment objectives is an ongoing process that requires regular monitoring, planning, and management. The length of time required by a non-conforming water system to meet the treatment objectives is specific to the individual system. Upgrading and/or installing new treatment is costly and as a result, it is recognized that upgrades may need to be made over time.

**Table 5.1: Drinking Water Treatment Objectives (Microbiological) for Surface Water**

Objective	Details of Each Objective
4	4-log reduction or inactivation of viruses
3	3-log reduction or inactivation of <i>giardia</i> and <i>cryptosporidium</i>
2	Two treatment processes
1	Less than or equal to one nephelometric turbidity unit (NTU) of turbidity
0	No detectable <i>E. coli</i> , fecal coliform, and total coliform bacteria

Source: BC Ministry of Health. Drinking water treatment objectives (microbiological) for surface water supplies in British Columbia; 2012.<sup>4</sup>

**Table 5.2: Drinking Water Treatment Objectives (Microbiological) for GARP-Viruses**

Objective	Details of Each Objective
4	4-log reduction or inactivation of viruses
0	No detectable <i>E. coli</i> , fecal coliform, and total coliform bacteria

Source: BC Ministry of Health. Drinking water treatment objectives (microbiological) for ground water supplies in British Columbia; 2015.<sup>5</sup>



Metro Vancouver's Seymour-Capilano filtration plant in North Vancouver (pictured above) treats water from both the Capilano and Seymour reservoirs. Water from the Coquitlam reservoir is treated at the Coquitlam water treatment plant. Metro Vancouver supplies clean, safe, reliable drinking water that meets BC's surface water treatment objectives.

Photo credit: Metro Vancouver

At present, the PHO is unable to fully report out on the number of currently operating water systems that achieve the treatment objectives, because the regional health authorities currently do not inspect against or consistently track **log-reduction credits** within their data systems. In 2016, the PHO requested that regional health authorities provide, to the best of their ability, estimations on how many large water systems (those serving greater than 500 people in a day) were meeting the treatment objectives for surface water. Information was not collected for groundwater systems as the treatment objectives for groundwater had only just been released. This request also asked regional health authorities to distinguish between local government systems (municipalities and regional districts) and non-local government systems (i.e., those not eligible for infrastructure grants).<sup>a</sup>

Fraser Health is currently the only health authority able to fully report out on large water systems that are in compliance with the treatment objectives for surface water: of its 20 large water systems using surface water or groundwater combined with surface water, 17 meet the BC treatment objectives for surface water, and all 17 use filtration<sup>12</sup> and are owned and operated by a local government.<sup>13</sup>

Island Health reports that six of its large water systems currently meet the treatment objectives for surface water. Half (three) of these systems are meeting the treatment objectives without filtration, as they met the conditions for exclusion of filtration.<sup>14</sup> At this time, Island Health cannot report on how many of its

79 large water systems rely on surface water or a combination of surface water and groundwater.

At the time of the request by the PHO, Vancouver Coastal Health was not tracking water systems by population size. Historically, they tracked water systems by the permit billing categories, which are based on the number of connections. They do attempt to track filtration type, but there is not currently an output report to compare filtration and compliance with treatment objectives. Despite these limitations, Vancouver Coastal Health reports that 15 out of 16 water systems with >300 connections that rely on surface water within the health authority meet the treatment objectives for surface water; this includes most of the population of Metro Vancouver.<sup>15</sup>

Both Northern Health and Interior Health are unable to report out on compliance with treatment objectives or on the number of large systems in their regions at this time. Interior Health reports that some data on progress with treatment objectives were collected in 2014, but that data have not been updated since that time. The water data that Interior Health is now collecting in the Hedgehog data system, as part of the pilot project with the new PHO data indicators (See Chapter 1, Section 1.5), will eventually enable them to provide data on the number of both large and small water systems compliant with treatment objectives.<sup>16</sup> Northern Health's data system does not currently capture the information requested by the PHO, but ongoing efforts are underway to improve data collection and quality.

<sup>a</sup> Only water supply systems owned and operated by municipalities or regional districts are eligible to apply for infrastructure grants through the BC Ministry of Municipal Affairs and Housing.

While information on source and compliance with treatment objectives is limited while this work is ongoing within the data systems of the regional health authorities, information on the type of treatment and source is available within the individual files for each system.<sup>17</sup> Until changes to the information management systems are complete, retrieving the available data in the format required to report up to the PHO will continue to require time consuming manual searches that are prone to errors or incompleteness. A few examples of water systems meeting BC's treatment objectives are featured on the following pages.

The indicator project being led by the PHO will help address this data gap and will provide a means of evaluating the progress that water supply systems are making towards meeting treatment objectives. Furthermore, the new categories for water system type and size will allow for useful comparisons of progress between types and sizes of water supplies, which can help inform policy and resource decisions.

While data on compliance with treatment standards are currently limited from the regional health authorities, some data on local government systems are available from the annual service plan reports of the Ministry of Municipal Affairs and Housing,<sup>b</sup> specifically related to Objective 2.2: "Communities have effective water and waste management."<sup>18</sup> The performance measure used to report on this objective is the "percentage of British Columbians served by drinking water systems that meet emerging treatment standards for the protection of drinking water quality."<sup>18</sup> In 2013/14, 2014/15, and 2015/16, these percentages were 36.3 per cent, 59.3 per cent, and 59.6 per cent respectively.<sup>18</sup>

### 5.1.2 Facility Treatment and Distribution Design Standards and Guidelines

Facility treatment and distribution design standards and guidelines are essential to the implementation of the multi-barrier approach, and to health protection programs tasked with ensuring the safety of drinking water. These standards and guidelines serve as the benchmark upon which designs are reviewed and approvals are issued.

Ensuring the adequacy of the facility and water distribution design is a key component of the drinking water programs administered by the regional health authorities. Before a water system is constructed, the future water supplier must first obtain a construction permit from the regional health authority (DWPA, Section 7). The requirement for a construction permit is not limited to new systems. Alterations, extensions, and upgrades all require a construction permit unless the requirement is waived by the issuing official.

Under Section 6(1) of the Drinking Water Protection Regulation, public health engineers employed by the regional health authorities' health protection programs are delegated the duty as issuing officials to review and issue construction permits for water supply systems. The construction permit process ensures that proposed new systems or changes to an existing system meet appropriate public health engineering standards for that type of system, which in turn ensures that the design of the water system provides the water supplier with the ability to provide safe, clean, and reliable drinking water to end users, when the system is operated appropriately. The process also ensures that redundancies are built into the system to ensure treatment standards are met and the water is protected as it moves through the distribution network.

The regional health authorities receive and process a large number of construction permit applications each year. During the 2016/17 fiscal year (April 1 – March 31), a total of 784 construction permits were issued by the five health authorities, with the majority issued in Interior Health (294 permits, or 38 per cent) and Island Health (279 permits, or 36 per cent). The number of construction permits issued in previous years was as follows: 714 (2015/16); 702 (2014/15); 745 (2013/14); and 632 (2012/13).

When reviewing water system construction applications and system designs, public health engineers often reference a variety of industry-accepted standards such as the Canadian Guidelines, American Water Works Association/American National Standards Institute standards, Recommended Standards for Water Works "Ten State Standards," and National Sanitation Foundation/American National

<sup>b</sup> After a change in government in 2017, the Ministry of Community, Sport and Cultural Development was re-named the Ministry of Municipal Affairs and Housing (MAH). For the purposes of this report, the name MAH is used to refer to activities of this ministry both before and after the name change in 2017.

## Examples of water systems successful at achieving BC's surface water treatment objectives



The Kamloops Centre for Water Quality (bottom left), commissioned in 2005, uses a combination of coagulation, flocculation (bottom right), membrane filtration, dissolved air flotation (top left), and chlorination to provide potable water to the City of Kamloops that achieves the BC surface water treatment objectives. The Level IV plant uses low-pressure ultra filtration membranes and has 12 primary filter trains and six secondary filters (top left). The filter cassettes (middle right) are underneath the aluminum primary mixing floor (top right). The City's source supply is the South Thompson River.

*Photo credit: Olsen imaging.*



The Village of Ashcroft is building a new water treatment plant (bottom left and right) scheduled to be completed in late summer 2019. The new facility will be equipped with membrane filtration (top left) and a new chlorination system providing primarily disinfection. With the upgrades, the Village will provide potable water that achieves the BC surface water treatment objectives.

*Photo credit: Maple Reinders Constructors Ltd.*



Operational in 2015, the Village of Chase Level III Water Treatment Plant is an ultrafiltration systems utilizing raw surface water from the mouth of the South Thompson River. This combined with the option to use a groundwater well gives the Village two options to provide potable water to the people of Chase. Two raw water pumps (top left) bring untreated water to the treatment facility (middle right). The chemical cleaning system (bottom left) is designed to extend the life of the filtration membranes. The Village produces its own Hypochlorite (top right) for additional disinfection and maintaining a distribution system residual. This along with UV disinfection (bottom right) ensures clean, safe, and reliable drinking water that will meet treatment objectives.

*Photo credit: Village of Chase.*



The City of Salmon Arm's water treatment plant (bottom), brought online in 2009 is a Level IV facility. The primary source for Salmon Arm is Shuswap Lake, which is made potable through the processes of coagulation, flocculation, sand/anthracite filtration, UV disinfection (top left) and a sodium hypochlorite generator capable of producing 40 ml/day. The City's main pumping station (right) is supplied with treated lake water from the nearby treatment plant. The city has seven pumping stations, 14 reservoirs, and meets the BC surface water treatment objectives.

*Photo credit: City of Salmon Arm.*

Standards Institute Standards. Other industry-recognized standards/guidelines that are used include the United States Environmental Protection Agency's *Ultraviolet Disinfection Guidance Manual* and BC's *Design Guidelines for Rural Residential Community Water Systems*.

Although the DWPA does not prescribe what guidelines and standards must be considered when reviewing a construction permit, the *Drinking Water Officers' Guide* does offer guidance on what information to consider. According to the *Drinking Water Officers' Guide*, public health engineers are expected to consider BC guidelines and standards first. Where no BC standard or guideline exists, other industry standards may be used, which can lead to inconsistency in which standards are applied.<sup>19</sup>

In BC, the Ministry of Health has not developed a guideline for water system designers to follow. Instead, the five regional health authorities have each developed their own application and approval processes for the construction of waterworks for their public health engineers to follow when reviewing applications for a construction permit.<sup>c</sup> Island Health, Northern Health, and Interior Health each developed their own guidelines for the construction of waterworks, whereas Vancouver Coastal Health and Fraser Health provides a construction permit application that outlines basic requirements for applicants. As a result some differences in process and guidance for water systems and water system designers may exist between the regions.

The Canadian Guidelines technical documents (i.e., *Enteric Protozoa: Giardia* and *Cryptosporidium*, *Enteric Viruses*) provide guidance for assigning log reduction/inactivation credits to meet the BC treatment objectives.<sup>20,21</sup> While all public health engineers have access to these documents, the practice of how log-reduction credits are being assigned and evaluated against the BC treatment objectives vary. A provincial guideline for assigning log-reduction credits would be beneficial, as it would provide some provincial consistency and clarity for designers and public health engineers to follow.

## 5.2 Distribution System Design and Integrity

The design and integrity of water distribution systems is integral to the safe delivery of water to the end users. As such, distribution system design and protection is a core prerequisite of the multi-barrier approach to safe drinking water. Just as treatment requires a multi-barrier approach to ensure contaminant removal, distribution system integrity also requires a multi-barrier approach through proper maintenance, operations, and plans.

Typical hazards associated with the distribution system include **cross-connections** and infiltration of contaminants from breaches in pipe integrity (e.g., leaks and main breaks), pathogen regrowth and bio-films, and heavy metal contamination from corrosion. These risks can be adequately managed through the distribution system design, layout, and system pressure; proper operations and maintenance (i.e., through the implementation of a distribution operations and maintenance plan/manual); maintenance of disinfection residuals; cross-connection control programs; and corrosion control measures.

To measure the progress that water supply systems are making on protecting distribution systems, the PHO and the regional health authorities identified a set of key indicators for future reporting. These new indicators include the following:

- Having a cross-connection control program and/or backflow prevention devices in place.
- Monitoring and maintaining disinfection residual within the distribution system.
- Following a leak and pressure detection plan or schedule that meets best practices or operating permit requirements.
- Following a maintenance plan and schedule that meets best practices or operating permit requirements.
- Having a corrosion control program or plan in place where required.

The size and complexity of the plans and programs will vary based on the size and complexity of the distribution system. For example, for small water systems,

<sup>c</sup> Information on the construction of waterworks can be found on the individual health authority websites: Vancouver Coastal Health (<http://www.vch.ca/Documents/Water-system-construction-permit.pdf>); Fraser Health (<https://www.fraserhealth.ca/health-topics-a-to-z/drinking-water/drinking-water-permits>); Northern Health (<https://www.northernhealth.ca/services/environmental-health/public-health-engineering>); Island Health (<https://www.islandhealth.ca/learn-about-health/drinking-water/drinking-water-legislation-approval>); Interior Health (<https://www.interiorhealth.ca/YourEnvironment/DrinkingWater/Documents/construction%20of%20waterworks%20guidelines.pdf>).

a cross-connection control program may be no more than the water supplier providing education to its users on how cross-connections occur, the associated hazards, and how to prevent them.

At this time, the regional health authorities are unable to provide data on any of the above indicators, as this information is currently not tracked within their existing data systems. The information may be on file, but it cannot be readily compiled given the large number of water systems across the province and relatively few resources. The regional health authorities have committed to modifying their existing administrative data programs to be able to collect and report out on these indicators within five years of this report.

### 5.2.1 Cross-connection Control

The objective of a cross-connection control program is to prevent the backflow of any source of contamination from entering into the potable water supply. Backflow of contaminated water into the distribution system through a cross-connection with a non-potable source of water or waste can be a very serious—even life-threatening—water quality problem. Cross-connection control programs and backflow prevention devices are the best defense against these kinds of occurrences. Pressure control and proper water system design, building codes, and plumbing codes also protect against cross-connections. For information on the *Building Act*, which regulates building and construction activities, see the text box below.

## The *Building Act* and Cross-connection Control

In December 2015, the *Building Act* came into force, the first Act dedicated solely to building and construction. Over time, multiple levels of government had been granted authority to regulate building and construction activities, which included backflow prevention requirements in buildings and cross-connection control programs. A key objective of this Act is to bring greater consistency to technical building requirements in BC. The Act gives the province pre-eminent authority to set technical requirements for building activities such as construction, alteration, repair, or demolition, and in turn limits local government authority.<sup>22</sup>

Technical building requirements are found in the BC Building Code (the Code). Under Section 5 of the *Building Act*, if a matter is addressed by the Code, then a technical building requirement for that matter in any local government bylaw had no legal force after December 15, 2017, unless the matter was unrestricted by regulation.<sup>4</sup> Administrative requirements in local government bylaws that regulate building construction or requirements for the enforcement of building regulations are not affected or changed by the Section 5 restriction.<sup>22</sup>

These changes have the following impacts on local government cross-connection control programs, and on the installation of backflow prevention devices where a cross-connection control hazard has been identified within the property of an existing building or building under construction:

1. *Requirements for the installation of backflow prevention devices:*  
Local government bylaws can include requirements for the installation of backflow prevention devices in facilities where a cross-connection hazard has been identified providing a) the requirement for the installation is in a location where the Code requires it; or b) in the case of existing buildings, where the Code would have required it; and c) the classification of the hazard coupled with the corresponding level of mitigation (i.e., type of backflow device) is aligned with the current Code. Local government bylaws that specify the type of backflow prevention device to be installed have no legal force, as this matter is addressed by technical standards in the Code.
2. *Requirements for the periodic testing of backflow prevention devices:*  
Requirements for backflow preventer testing are considered administrative in nature and are not affected by the Act. Therefore local government bylaws can include requirements for the periodic testing of backflow prevention devices.<sup>23</sup>

<sup>4</sup> The *Building Act* only applies to bylaws enacted under the *Local Government Act*, *Community Charter*, *Islands Trust Act*, *University Act*, and the *Fire Services Act*. Bylaws enacted under the authority of another act (e.g., *Environmental Management Act* for sewage) would be out of scope of the *Building Act*.



A double backflow prevention device on a drinking water main.

A cross-connection control program typically refers to the enforcement of a bylaw regulating cross-connections. Municipalities and other communities set up cross-connection control programs that monitor the installation, maintenance, and field testing of backflow preventers in accordance with local bylaws and other codes and standards. While small water systems that are not owned and operated by a local government may not have the same resources to develop a cross-connection control program, there are proactive measures a smaller water supplier can take to implement cross-connection control within their system. Depending on the governance structure of the water supply system, the purveyor may have some power to develop rules or bylaws (e.g., strata bylaws) that the members/water users must follow. Regardless of the type of system, water suppliers can proactively have their system assessed to identify potential cross-connections, and then take steps to address them and educate their users.

In BC, the BC Water & Waste Association is the recognized administrative body for the

voluntary certification of backflow assembly testers and cross-connection control inspectors. The Association provides annual certificate and member services, offers certification exams and manual sales, and works with training institutions and community programs.<sup>24</sup> Backflow assembly tester certification is limited to testing backflow prevention assemblies; whereas cross-connection control inspector certification also includes identifying new or existing cross-connections within a facility by conducting a comprehensive cross-connection risk assessment on drinking water systems.<sup>25</sup> The Association maintains a community cross-connection control program directory on its website, which lists water purveyors and local governments with a cross-connection control program.<sup>26</sup> In the fall of 2017, 55 purveyors and/or local governments were listed within the directory.<sup>e</sup> The vast majority of the purveyors listed were either municipalities or regional districts. The list included only one improvement district (Ootischenia Improvement District, near Castlegar) and one First Nations water system (Westbank First Nation—the largest First Nations water supply system in BC).

### 5.2.2 Secondary Disinfection

While water entering into a distribution may be of high quality, the quality of that water can deteriorate as it moves through the distribution system, because of breaches in integrity and conditions within pipes and storage. For example, intrusions and cross-connections can occur and water within a distribution system can precipitate compounds, which can then provide the conditions for bacterial growth.

“Secondary disinfection”—or “residual disinfection”—is a best risk management practice for maintaining water quality as it moves through the distribution system. This can be achieved by maintaining a residual of the primary disinfectant in the distribution system or by adding disinfectant to the distribution system.<sup>27</sup> Secondary disinfection can also alert water operators quickly to potential incidents of water quality degradation. Sudden drops of residual levels may be an indicator of a breach in a distribution system. Secondary disinfection also aides in the control of biofilm growth and inactivates some pathogens that may be present in the distribution system.<sup>27</sup>

<sup>e</sup> The BC Water & Waste Association list of community cross-connection control programs can be accessed at: [https://www.bcwwa.org/Services/WebFile.ashx?url=/resources2/CommunityCCCPPrograms\\_List.pdf](https://www.bcwwa.org/Services/WebFile.ashx?url=/resources2/CommunityCCCPPrograms_List.pdf).

During this reporting period, the Ministry of Health developed and published version 1 of the *British Columbia Guidelines (Microbiological) on Maintaining Water Quality in Distribution Systems*.<sup>27</sup> These guidelines provide provincial guidance to drinking water officers and water suppliers for making decisions related to implementing the multi-barrier approach to protecting and maintaining microbiological water quality in water supply distribution systems. This includes specific guidance for implementing the best risk management practice of secondary disinfection.

While the BC guidelines do strongly recommend that all water systems provide secondary disinfection, it is not a prescribed regulatory requirement. Drinking water officers and other issuing officials have the discretionary authority to require secondary disinfection for distribution systems that are at risk for pathogen contamination and/or significant biofilm/microbial growth. Water supply systems may be allowed to operate without secondary disinfection if they demonstrate, to the satisfaction of the drinking water officer, that the physical characteristics of the system and the other best management practices in place adequately protect water quality. According to the BC guideline, water suppliers should be able to say “yes” to the following questions and provide sound rationale (as confirmed by the drinking water officer) to demonstrate their ability to protect the water without secondary disinfection:

1. Does the system select or produce biologically stable water?
2. Do the physical characteristics (e.g., design elements) of the system, in conjunction with the use of a comprehensive set of other best management practices, provide the ability to proactively manage risks to the distribution system?
3. Does the system transport microbiologically safe water to system users as demonstrated by the water supplier’s monitoring records (e.g., no history of recurring or persistent indicator organisms)?
4. Does the system operator display an ongoing commitment to meet the best management practices, as demonstrated by the water supplier’s monitoring records, compliance with conditions on permit, annual reports, and inspection records?<sup>27</sup>

### 5.2.3 Distribution System Maintenance Plans and Procedures

Ensuring good operation of a water supply system requires that water system operators, regardless of their level of certification, develop and follow established operating procedures for their facilities. These procedures should be kept up to date, written down, and accessible to all operations staff so that the system can continue normal operations in the event that the regular or senior operator is not available.

As part of the project to identify indicators that align with the multi-barrier approach, the PHO and representatives from the regional health authorities and the Ministry of Health identified a few key maintenance plans and procedures that support the safe operation of a distribution system. These include having a cross-connection control program (discussed earlier), a leak and pressure detection plan, and plans for routine maintenance and repair (e.g., flushing programs, storage disinfection, valve and hydrant maintenance, and water line breaks and commissioning.) As mentioned previously, these data are currently unavailable, as the regional health authorities have not traditionally recorded this information in an accessible way for provincial reporting. The PHO will continue to work with the regional health authorities and the Ministry of Health in developing and implementing these new indicators.



60 inch conduit repair in progress.  
Photo credit: Black Mountain Irrigation District.

## 5.2.4 Corrosion Control

In 2009, Health Canada released *Guidance on Controlling Corrosion in Drinking Water Distribution Systems*.<sup>28</sup> According to this document, corrosion is a common issue in Canadian drinking water supplies. Corrosion is the deterioration of a material, usually a metal, that results from a reaction with its environment. In drinking water distribution systems, materials that could be affected by corrosion and could leach increased amounts of contaminants include metal pipes and fittings, cement in pipe linings and polyvinyl chloride (PVC) pipes. Corrosion in drinking water distribution systems can be caused by several factors, including the type of materials used, the age of the piping and fittings, the stagnation time of the water, and the quality of water in the system, including its pH.<sup>f,28</sup>

The main contaminant of concern that is caused by corrosion is elevated lead, which is commonly used as the trigger to initiate corrosion control programs. Under the DWPA, water suppliers are not specifically mandated to implement corrosion control treatment and/or programs. However, the outcome-based nature of the DWPA allows drinking water officers to require corrosion control where it is deemed necessary, through the placing of conditions on a water supplier's operating permit.

At this time, information on how many community water systems have implemented or require corrosion control is unavailable for reporting purposes, as it has not traditionally been recorded within health authority administrative databases. While the information exists, it requires an extensive manual search of individual files to compile the information. The PHO and representatives from the regional health authorities will continue to work together to develop a meaningful way of tracking and reporting on systems that require corrosion control as an indicator of distribution integrity.

## 5.2.5 Lead in Drinking Water

Ingestion of lead can be hazardous to human health, especially for young children and infants as they absorb lead more easily than adults and are more susceptible to its harmful effects. Even low-level exposure may harm the intellectual and physical development, behaviour, and hearing of infants and children. Lead can also cross the placenta during pregnancy to affect the unborn child and can be found in breast milk.<sup>29</sup>

The degree of harm from lead exposure depends on a number of factors, including the frequency, duration, and dose of the exposure(s) and individual susceptibility factors (e.g., age, previous exposure history, nutrition, and health). The degree of harm also depends on an individual's total exposure to lead from all sources in the environment—air, soil, dust, food, and water. Common sources of lead exposure for children are chips and particles of deteriorating lead paint found in house dust and soil; this typically accounts for 70 per cent of childhood lead exposure.<sup>30</sup>

The contribution of dietary lead intake from drinking water is typically quite low, except in cases where lead content is elevated due to factors such as inadequate corrosion control and lead service lines and leaded plumbing. People often consume water from numerous sources throughout the day (i.e., workplaces, schools, homes, restaurants); thus, the lead concentration in water from any one source may only represent a small portion of total daily intake.<sup>29</sup> Nonetheless, it is important to minimize lead intake from all sources as much as possible. In instances where a drinking water officer considers that the drinking water is at risk of having elevated concentrations of lead, it is important to take steps to reduce the lead in drinking water to levels as low as is reasonably achievable.

Since 1989, the BC Building Code has restricted the lead content in components in the construction of potable water lines and fixtures. This restriction reduces the amount of lead available to react with corrosive water and lowers the risk of lead leaching into drinking water supplies. In buildings constructed on or before 1989, there may be a greater probability of finding elevated lead levels in the water from plumbing, especially if the corrosiveness of the water entering the building and the water use patterns in the building are conducive to lead leaching. In 2012, the allowable lead content in plumbing was restricted further when the Canadian Standards Association revised their "lead-free" standards for plumbing supply fittings from eight per cent lead down to 0.25 per cent lead as a weighted average.<sup>29</sup>

<sup>f</sup> The most influential properties of drinking water when it comes to the corrosion and leaching of distribution system materials are pH and alkalinity. Other drinking water quality parameters of interest are temperature, calcium, free chlorine residual, chloramines, chloride, sulphate, and natural organic matter. Any change to the drinking water treatment process may impact corrosion in the distribution system and in household plumbing.

Under the DWPA, drinking water suppliers in BC are responsible for monitoring water they deliver to verify it is within acceptable limits for lead and other metals. The Canadian Guidelines suggest a maximum acceptable concentration of total lead in drinking water of 10 micrograms per litre ( $\mu\text{g/L}$ )<sup>g,31</sup> or 10 parts per billion (ppb).<sup>h</sup>

Most drinking water supply systems in BC deliver water that has lead levels well below 10  $\mu\text{g/L}$ . Lead is usually not found in drinking water when it leaves the treatment plant. Instead, lead tends to leach out of pipes and fixtures in buildings or homes, or service lines connecting homes to water mains.<sup>i,29</sup> The extent of leaching depends on the nature of the plumbing materials used, the corrosiveness of the water (i.e., the extent to which the water can cause a chemical reaction that will cause a deterioration in the material used in the pipes), and the length of time that the water is stagnant in the plumbing. The longer water remains in contact with leaded plumbing, the more opportunity there is for lead to leach into the water. As a result, older facilities with intermittent water use patterns (such as in schools, child care facilities, and office buildings) and older plumbing materials that pre-date the 1989 lead restrictions in the BC Building Code, may have elevated levels of lead in their drinking water. The water sits in the pipes of these facilities for long periods (overnight, weekends, and holidays), which allows the leaching of lead to occur. If the water entering the building is corrosive, the lead will leach more quickly. Corrosive water may sometimes be described as “acidic” or “aggressive”.<sup>29</sup>

The issue of who is responsible for lead in drinking water is complex given that lead in drinking water may come from the pipes and fixtures contained within private properties or services lines. Water suppliers are not responsible for the maintenance or replacement of plumbing beyond service lines and other fixtures upstream of the curb stop where water is delivered; that becomes the responsibility of the property owner. So while the water supplier may own the water supply system, property owners own the pipes and plumbing on their

property. This shared ownership also means a shared responsibility to mitigate excessive lead concentrations found at the tap. Property owners are responsible for the condition of their building’s plumbing and for taking any necessary remedial action to minimize lead exposure derived from the plumbing and fixtures in their property, such as replacing leaded plumbing and fixtures, installing treatment devices to remove lead, or implementing a flushing program. Where the characteristics of the water (i.e., the corrosiveness) are expected to significantly contribute to leaching of lead, the water supplier has the responsibility to take reasonable steps to help mitigate the hazard through corrosion control measures.<sup>29</sup>

Several statutes play a role in ensuring that drinking water does not pose a health risk for consumers. These include the DWPA, the BC Plumbing Code, the BC Building Code, the *Public Health Act*, the *School Act*, and the *Community Care and Assisted Living Act*. As these statutes apply concurrently, the overlap indicates a shared responsibility of all parties involved.

During the reporting period, testing of water within schools in the province found elevated lead levels within some schools, making the evaluation of policies around lead in drinking water a priority across government. Health officials in BC have been aware of the issues posed by lead for decades, and have done proactive work around the issue with school districts, including reminder letters to ensure that buildings with older plumbing implement flushing and/or testing programs, and offering support if any tests had high levels. Nevertheless, the extreme events that occurred in Flint, Michigan with elevated levels of lead in drinking water highlighted the need to have clear policies and requirements around testing and communication.<sup>32</sup>

<sup>g</sup> On March 8, 2019, outside of this reporting period, Health Canada lowered the maximum acceptable concentration (MAC) for lead in drinking water. The new MAC for lead is 5  $\mu\text{g/L}$ , based on sample taken at the tap using the appropriate sampling technique. Health Canada also recommends that lead concentrations in drinking water be kept as low as reasonably achievable as current science cannot identify a level under which there are no longer associated harmful effects.

<sup>h</sup> This guideline value may also be written as 0.010 milligrams per litre (mg/L) or 0.010 parts per million (ppm).

<sup>i</sup> Service lines connect individual buildings to the water supply system distribution main. Service line ownership is shared. The utility typically owns the portion up to the property line, and the home or building owner owns the portion on their property. Before the 1960s, service lines were commonly made of lead in some communities.

On September 26, 2016, the Ministry of Education released a policy on *Testing Lead Content in Drinking Water of School Facilities*,<sup>33</sup> which was developed in consultation with the Ministry of Health. This policy requires that public schools test for lead, report results, and take reasonable steps to resolve any identified water quality issues. In January 2017, after consultation with the Ministry of Health, the Ministry of Education released a similar policy for independent schools, *Testing Lead Content in Drinking Water of Independent School Facilities*.<sup>34</sup> Some differences in the policies exist, particularly around reporting of data back to the Ministry of Education, because the policies were developed by different divisions within the Ministry of Education. However, both policies direct schools to liaise with their respective regional health authority to establish a plan to evaluate and mitigate any issues.

In 2017, the Ministry of Health released the *Interim Guidelines on Evaluating and Mitigating Lead in Drinking Water Supplies, Schools, Daycares and Other Buildings*.<sup>29</sup> In addition to these guidelines, provincial health officials developed additional educational materials, including the 2016 HealthLink BC Health File<sup>35</sup> and a fact sheet<sup>36</sup> for child care facilities regulated under the Child Care Licensing Regulation of the *Community Care and Assisted Living Act*. At the regional level, many of the health authorities during the reporting period have also updated or developed educational information regarding lead in drinking water that includes health and sampling information specific to the general public, schools, and child care facilities.

The following sub-sections outline activities undertaken by the Ministry of Education and the regional health authorities to address concerns and carry out existing policies and guidelines pertaining to lead in drinking water in public schools, independent schools, and child care facilities.

### Lead in School Drinking Water

The 2016 policy on testing for lead in the drinking water of school facilities stipulates that

school districts must complete lead content testing on all public school facilities once every three years,<sup>33</sup> with the following exceptions:

- School was built post-1989.
- Pre-1989 school has had newly installed plumbing in past few years.
- Pre-1989 school is scheduled for closure soon.<sup>37</sup>

As per the policy, a minimum of one-third (33 per cent) of the public school facilities in a school district's inventory must be tested each year,<sup>33</sup> with an inaugural annual reporting deadline of March 30, 2017.

The 2017 independent school policy stipulates that independent schools must complete lead content testing on all school facilities once every three years, with the inaugural annual reporting deadline being December 15, 2017.<sup>34</sup>

As shown in Table 5.3 (pages 104-105), during the 2016/17 fiscal year, approximately 909 public school facilities were assessed.<sup>j</sup> Approximately 13,151 drinking water fixtures were tested for lead in the water, and 3,455 (approximately 26 per cent) exceeded the screening level of 10 micrograms per litre.<sup>k,37</sup>

When testing for lead, sampling protocols differ depending on the objective of the testing. For example, different methods are used whether the school is screening for problems, investigating the source of the lead within a building, or estimating the health risk from typical exposure to water within the school. Sampling protocols that use the "first draw" of water after a prolonged period of stagnation (e.g., overnight) tend to provide the worst-case scenario of lead levels, but are generally not representative of the concentration of lead within consumed drinking water throughout the day.<sup>29</sup> At this time, it is unknown whether the sample results that exceeded the maximum acceptable concentration in schools were "first flush" samples (i.e., worst-case scenario but not typical of exposure) or if the samples were taken after the water lines has been flushed.

<sup>j</sup> At the time of writing this report, data regarding lead testing results in schools were only available for public schools.

<sup>k</sup> Although the Ministry of Education used 10 micrograms per litre as their action level for re-testing and mitigation, the sample results that exceeded this limit do not necessarily mean that the drinking water at that school exceeded the maximum acceptable concentration (MAC) for lead. The MAC for lead is based on the average lead concentration consumed throughout the day. Screening results are often "worst-case scenario" or "first draw" samples that are not representative of typical exposures, on which the MAC level is based.



Children under the age of six are more susceptible to the harmful effects of lead.

*Photo credit: Joanne Edwards, Office of the Provincial Health Officer.*

According to the Ministry of Education, all school districts that had sample results above 10 micrograms per litre indicated that they have implemented some form of mitigation solution for affected water sources, in consultation with their regional health authority. Mitigation solutions have included the following:

- Plumbing upgrades;
- Installation of lead removal filtration systems;
- Deactivation of water sources and supplemental signage; and/or
- Flushing regimes to remove stagnant water with elevated lead.<sup>38</sup>

School districts may utilize available funding in the Ministry of Education's School Enhancement Program and the Annual Facilities Grant to cover costs associated with the testing and remediation of issues associated with elevated lead levels in drinking water at public school

facilities. The ministry also works with school districts to remind them annually of the need to revisit and update their water management plans and to track and report results.<sup>37</sup>

**Table 5.3: Test Results, Lead in Drinking Water, Public School Facilities, by School District, BC, April 2016 to March 2017**

School District #	Name	Number of Facilities Tested	Number of Fixtures Tested	Number of Fixtures Exceeding Limit	Percentage of Fixtures Exceeding Limit
5	Southeast Kootenay	6	21	0	0%
6	Rocky Mountain	17	23	0	0%
8	Kootenay Lake	22	143	68	48%
10	Arrow Lakes	6	11	1	9%
19	Revelstoke	5	5	0	0%
20	Kootenay Columbia	11	48	0	0%
22	Vernon	21	90	49	54%
23	Central Okanagan	41	80	16	20%
27	Cariboo-Chilcotin	11	47	0	0%
28	Quesnel	5	21	1	5%
33	Chilliwack	28	106	7	7%
34	Abbotsford	27	188	0	0%
35	Langley	10	23	0	0%
36	Surrey	64	8655	2572	30%
37	Delta	32	445	48	11%
38	Richmond	0	0	0	No Report
39	Vancouver	83	274	21	8%
40	New Westminster	8	18	0	0%
41	Burnaby	0	0	0	No Report
42	Maple Ridge - Pitt Meadows	27	48	4	8%
43	Coquitlam	16	53	0	0%
44	North Vancouver	32	64	0	0%
45	West Vancouver	17	17	0	0%
46	Sunshine Coast	13	14	0	0%
47	Powell River	6	36	3	8%
48	Sea to Sky	0	0	0	No Report
49	Central Coast	0	0	0	No Report
50	Haida Gwaii	6	12	0	0%
51	Boundary	4	8	1	13%

School District #	Name	Number of Facilities Tested	Number of Fixtures Tested	Number of Fixtures Exceeding Limit	Percentage of Fixtures Exceeding Limit
52	Prince Rupert	8	42	3	7%
53	Okanagan Similkameen	2	2	0	0%
54	Bulkley Valley	3	3	0	0%
57	Prince George	12	82	16	20%
58	Nicola-Similkameen	9	20	0	0%
59	Peace River South	16	21	1	5%
60	Peace River North	22	41	4	10%
61	Greater Victoria	46	589	304	52%
62	Sooke	11	22	0	0%
63	Saanich	9	65	0	0%
64	Gulf Islands	10	91	8	9%
67	Okanagan Skaha	21	21	5	24%
68	Nanaimo-Ladysmith	11	412	140	34%
69	Qualicum	6	43	2	5%
70	Alberni	1	16	2	13%
71	Comox Valley	11	12	3	25%
72	Campbell River	20	39	6	15%
73	Kamloops/Thompson	38	193	27	14%
74	Gold Trail	4	4	0	0%
75	Mission	13	149	53	36%
78	Fraser-Cascade	9	10	0	0%
79	Cowichan Valley	21	246	0	0%
81	Fort Nelson	4	8	0	0%
82	Coast Mountains	8	8	0	0%
83	North Okanagan-Shuswap	8	169	34	20%
84	Vancouver Island West	3	15	0	0%
85	Vancouver Island North	13	173	11	6%
87	Stikine	4	4	0	0%
91	Nechako Lakes	18	43	0	0%
92	Nisga'a	4	6	0	0%
93	Conseil Scolaire Francophone	26	152	45	30%
<b>Totals</b>		<b>909</b>	<b>13,151</b>	<b>3,455</b>	<b>26%</b>

Source: Source: BC Ministry of Education; Oct 2018.<sup>37</sup>

### Lead in Child Care Facility Drinking Water

Section 48 of the Child Care Licensing Regulation requires a licensee of a child care facility to ensure that safe drinking water is available to children.<sup>39</sup> In BC, licensing officers employed by the regional health authorities administer the Child Care Licensing Regulation. When matters pertaining to drinking water safety arise, environmental health officers within the health authorities support the licensing team to ensure appropriate actions are taken.

As children under the age of six are more susceptible to the harmful effects of lead, minimizing children’s exposure to elevated lead from drinking water within regulated facilities is a priority. In the fall of 2017, the PHO asked

the regional health authorities to summarize their activities and plans to address recent concerns raised over lead in drinking water in child care facilities since the 2017 release of the *Interim Guidelines on Evaluating and Mitigating Lead in Drinking Water Supplies, Schools, Daycares and Other Buildings*.

Table 5.4 summarizes those actions; however, further sampling and program planning has occurred since this time in some regions.

Table 5.4 demonstrates the level of work the health authorities are undertaking to engage with child care facilities in their region. While the matter has been given a lot of attention, some health authorities are further ahead in the level of engagement and screening of risk.

**Table 5.4: Regional Health Authority Plans and Activities to Address Lead in Drinking Water in Child Care Facilities, 2017**

Regional Health Authority	Education/Outreach Plan	Sampling Plan	Results	Sampling Method
Island Health <sup>40</sup>	Island Health has developed some materials for use through licensing but they are not yet in use.	None	None	Unknown
Northern Health <sup>41</sup>	In 2016, Northern Health sent an email and letter to all licensed child care and youth care facilities. The letter recommends testing but does not require it. Any new day care applicant is given education through this letter and if needed direct communication with an environmental health officer. During routine inspections, licensing officers review concerns around drinking water safety.	Recommending voluntary sampling by child care providers. To date, no sampling in child care facilities has been shared with the health authority.	None	Letter recommends taking a sample at time zero (pre-flush) and another sample after six hours of stagnation.
Vancouver Coastal Health <sup>42</sup>	Vancouver Coastal Health has been providing education and materials to child care providers about lead and the need for flushing since 2013. It is looked at during each routine inspection. All facilities must develop a plan to ensure safe water. Most recently, Vancouver Coastal Health updated their flushing advice to child care facilities based on 2016 sampling results of schools.	Operators are instructed to develop a plan to ensure the facility can meet the <i>Guidelines for Canadian Drinking Water Quality</i> . Baseline tests (pre and post flush) must inform this plan.	In 2012, 62 child care facilities were sampled. Twelve pre-flush samples exceeded the MAC. Materials were developed and education provided.	Operators are instructed to take a sample at time zero (pre-flush) and another at post flush (after five minutes or when the water turns colder).

Regional Health Authority	Education/Outreach Plan	Sampling Plan	Results	Sampling Method
<b>Interior Health</b> <sup>43,44</sup>	In 2017, Interior Health launched an outreach/ education initiative with licensed child care facilities. This initiative includes screening all child care facilities for lead, as well as developing educational resources and materials for licensing officers and child care providers.	Pre-purchased enough lead samples to screen all child care facilities as part of initiative.	Of the 443 facilities that have been tested as of October 2017, 29 had results exceeding the maximum acceptable concentration (MAC) for lead, which triggered follow up and further testing.	Random daytime sampling.
<b>Fraser Health</b> <sup>45</sup>	All child care facilities have been emailed the fact sheet developed by the Ministry of Health. Fraser Health is reviewing results and recommendations of a study by the BC Institute of Technology (BCIT) and BC Centre for Disease Control (BCCDC) that sampled water from and surveyed child care operators understanding of lead in a small sample of child care facilities operators within their region. Licensing officers will provide education on lead in drinking water during routine inspections.	BCIT/BCCDC research project took 91 samples from various fixtures at 16 child care facilities. No other sampling of child care facilities has been reported to the Provincial Health Officer.	Study findings: in general lead levels were below acceptable limits and flushing decreased levels. Lead content was higher in institutional settings than home settings.	Samples were taken at time zero (pre-flush), at one minute flush, at five minute flush, and after 120 minutes of stagnation time.
<b>First Nations Health</b> <sup>46</sup>	In 2016, First Nations Health Authority (FNHA) developed lead messaging that was provided to all First Nations communities, with information that all child care and school facilities on reserve would be tested. Additional educational materials were developed for child care and school facilities and households. The initial round of testing was completed by environmental health officers in FNHA in 2017. Facilities that had results that exceeded the <i>Guidelines for Canadian Drinking Water Quality</i> were notified and interim mitigation measures were provided. If the child care facility was licensed through another health authority, Indigenous Services Canada and the regional health authority were both notified of results exceeding the guideline.	FNHA developed a hybrid plan based on Health Canada and US Environmental Protection Agency guidelines. Samples were taken for both lead and copper.	Out of the 240 facilities/sample sites identified in 2017, 34 facilities exceeded the MAC for lead (with at least one of the samples). Results were shared with the facilities, and interim measures to bring down lead levels were provided. If a guideline was exceeded, the results were also shared with Indigenous Services Canada, and with the appropriate regional health authority if the facility was also licensed by that regional health authority.	Initial round: first draw after six to eight hours stagnancy, not exceeding 24 hours; second sample after a 30-second flush; and third sample taken after flushing until cold/ temperature change. Field notes on age of facility, time, temperature, and pH were also taken when possible.

### 5.3 Conclusion

This chapter has examined drinking water treatment and distribution, two of the three main pillars of the multi-barrier approach. Ensuring effective drinking water treatment through performance and design standards is important for the elimination of pathogens and physical and chemical compounds that could lead to waterborne illness. It is also imperative that adequate measures are taken so that no further contamination occurs as drinking water moves through the distribution system.

Since the launch of the *Action Plan for Safe Drinking Water in British Columbia*, the drinking water program at the Ministry of Health has developed treatment performance objectives for both surface water and groundwater supplies based on the *Guidelines for Canadian Drinking Water Quality* and up-to-date scientific evidence. The ministry has also developed guidance for maintaining microbiological water quality within distribution systems, as well as guidance for the evaluation of the risk of lead within older buildings attached to a water supply with corrosive water properties. These documents are found within the *BC Drinking Water Officers' Guide*, along with other information to inform decision-making and practice within the drinking water protection programs. While the province has successfully developed treatment objectives and guidance for primary and secondary disinfection, it remains difficult to quantify how many water suppliers are meeting these objectives because of database limitations, what information is currently collected by drinking water officers, and how log-removal credits are assigned by the regional health authorities. The new indicator project being undertaken by the Provincial Health Officer and the regional health authorities will help address this data gap, but disparities in the application of evaluation criteria remain. At this time, no provincial design guidelines or guidelines on how to assign log-removal credits for treatment plants exists. Each regional health authority has developed its own system for construction works approval, including evaluation of whether treatment objectives have been achieved, which allows for inconsistency in the process.

The new indicator project identified cross-connection control, secondary disinfection, plans for distribution maintenance and operations, and corrosion control as indicators of maintaining distribution integrity. Currently,

regional health authorities do not record information relating to these indicators in their databases in the format required by the Office of the Provincial Health Officer; therefore, changes in information management technology and practice need to occur before this information can be reported on fully.

Lead in drinking water, a problem associated with corrosive water and older plumbing, re-emerged as a public health concern in response to the drinking water crisis that began in Flint, Michigan in 2014. Concerns over lead in drinking water within schools and child care facilities in BC grew and the province responded by developing sampling requirements in schools and by developing educational materials and guidance for schools and child care facilities and the people who regulate them. While the risk of increased blood lead levels in children as a result of drinking water at schools and child care facilities has been shown to be low in BC, it is important to evaluate risks and mitigate them when they are found. The data collected from schools to date have exceeded the *Guidelines for Canadian Drinking Water Quality* in several communities, and mitigation measures are being implemented. However, inconsistencies in sampling and reporting methods still exist, which limits the conclusions that can be drawn from available data.

As discussed in this chapter, effective system performance and design are central components to well-functioning treatment and distribution systems. However, treatment and distribution systems must also be supported by total quality management—operations, management, monitoring, reporting, and abatement and enforcement programs—which is the focus of Part 3 of this report.

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# PART 3

## Total Quality Management

Once the key components are in place from source-to-tap, the next step in the multi-barrier approach requires that those components are monitored, managed, and operated effectively and consistently to provide a reliable source of clean and safe drinking water. Part 3 describes the necessary activities and programs for good operations and management of water supply systems to ensure the delivery of clean, safe, and reliable drinking water. The specific activities and programs discussed in Part 3 include operations and management (Chapter 6), monitoring and reporting (Chapter 7), and abatement and enforcement (Chapter 8).



# 6 Operations and Management

While design and performance standards provide some assurance of the capabilities of water supply systems, the production and delivery of clean, safe, reliable drinking water depends on the proper operation, maintenance, and management of the waterworks system.<sup>1</sup> This chapter consists of two sections. The first section describes some of the essential elements and indicators of good operations of a water treatment plant and distribution system. It covers the issuing of operating permits for waterworks systems and conditions placed on those permits; facility classification and operator certification; operator training and recruitment; and the development of written standard operating procedures.

Section 2 of this chapter discusses elements required for good management of a water supply system, specifically asset management and financial planning. It also provides an update on the activities of government and other agencies to promote and support good asset and financial management, full-cost accounting, and funding programs.

## 6.1 Good Operations

### 6.1.1 Operating Permits

Drinking water officers employed by the regional health authorities are responsible for issuing operating permits. Section 8 of the *Drinking Water Protection Act* (DWPA) prohibits a person from operating a water supply system unless the water supplier holds a valid operating permit. Under Section 8, drinking water officers can place terms and conditions on an operating permit for drinking water systems. Water suppliers must comply with these terms and conditions.<sup>2</sup>

The form an operating permit must take is not specified in the Act or the Drinking Water Protection Regulation; however, Section 8(3)

suggests examples of critical elements for terms and conditions for operating permits.<sup>2</sup> The *BC Drinking Water Officers' Guide* also offers guidance to issuing officials (i.e., the delegated drinking water officer) on the decision to issue an operating permit. At present, the form of an operating permit and what, if any, terms or conditions are applied varies across the health authorities. In 2017, the Ministry of Health put forward a draft project charter to explore the development of an enhanced operating permit template that could help facilitate a consistent, province-wide approach to drinking water approvals and inspections.

Table 6.1 lists the number of water systems, as of March 31, 2014, that are operating (a) with an operating permit; (b) with conditions attached to their operating permit; and (c) without an operating permit. The number of water systems operating without a permit has dropped 69 per cent since the last Provincial Health Officer's (PHO) drinking water report. While no water supply system in theory should be operating without a permit, in practice, occasionally health officials discover a system that has been operating without any approvals. These systems are usually quite small and it can take some time to gain enough regulatory compliance before an issuing official feels comfortable issuing an operating permit. The number of systems with terms and conditions on their permit has continued to increase slightly since our last report, indicating that more issuing officials are using terms and conditions as an operational compliance tool.

Since 2014, regional health authorities are no longer collecting data on the number of systems with or without permits or with conditions on permit, as other indicators were developed that more accurately reflect good

**Table 6.1: Number of Water Systems with Operating Permits, without Operating Permits, and with Conditions on Operating Permits, by Health Authority, BC, 2013/14**

Health Authority	Number of Systems with Operating Permits	Number and Percentage of Water Systems with Conditions on Their Operating Permits	Number of Water Systems without Operating Permits
Island Health	831	258 (31%)	0
Northern Health	1,170	999 (85%)	97
Vancouver Coastal Health	364	328 (90%)	32
Interior Health	1,852	187 (10%)	65
Fraser Health	460	178 (39%)	0
<b>Total</b>	<b>4,677</b>	<b>1,950 (42%)</b>	<b>194</b>

**Note:** Interior Health at the time was unable to reliably extract information regarding conditions on permits from their data system. There are likely more systems within Interior Health with conditions attached to their operating permits.  
**Source:** Regional health authorities; 2014.

operations of systems. Very few systems lack an operating permit, and those that do are usually water supply systems that are not yet in operation or newly discovered systems that have been operating without approvals and are in the process of being assessed.

### 6.1.2 Facility Classification and Operator Certification

In addition to requiring that water systems have an operating permit, it is imperative that the systems are classified and have certified operators. The Environmental Operators Certification Program (EOCP) classifies water and wastewater facilities and oversees the certification of water and wastewater operators. It acts as an agent of the Ministry of Health under a Memorandum of Understanding (MOU)<sup>3</sup> and is incorporated as a non-profit society with an elected board of directors. The following subsections describe water system facility classification, operator certification, and the strategic improvements made during this reporting period to both these functions carried out by the EOCP.



EOCP certified Operator, working at the Penticon Water Treatment facility.  
 Photo credit: Environmental Operators Certification Program.

### Water System Facility Classification

In BC, the EOCP classifies water systems and certifies operators using standards adopted by the Association of Boards of Certification. Water system facility classifications include the following: small water system, water distribution system (Levels I to IV), and water treatment system (Levels I to IV). Historically, classification levels were based on a system's operational complexity. The complexity was determined by an overall point score, where points were given based on 1) level of technical complexity; 2) capacity (size); and 3) the population served. Level IV represents the highest level of complexity for either water treatment or water distribution systems. A water system's facility classification determines the required certification level (i.e., the degree of knowledge and training an operator must have) for the operator of that system. Table 6.2 shows the number

of water treatment and water distribution systems at each classification level (I to IV) over the past five fiscal years. See Chapter 9 for small water system classification data.

In 2015, the EOCP revised the definition of a water treatment facility, for classification purposes, to include treatment that uses physical, chemical, or biological processes, including any method of primary disinfection<sup>a</sup>, to produce potable water. Prior to this change, water supply systems with only primary disinfection as their method of treatment were classified as distribution systems only, and the only level of certification required, under legislation, of the senior operator was distribution operator certification. This change recognized that a facility operator performing a process that is intended to accomplish primary disinfection must be certified as a water treatment operator.<sup>4</sup>

**Table 6.2: Number of Water Treatment and Water Distribution Facilities, by Level of Classification, BC, 2013 to 2017**

Year	Type of System	Classification Level				Total
		IV	III	II	I	
2013	Water Distribution	30	52	169	161	412
	Water Treatment	17	31	69	11	128
2014	Water Distribution	31	53	172	160	416
	Water Treatment	17	33	69	11	130
2015	Water Distribution	32	50	172	159	413
	Water Treatment	17	34	74	11	136
2016	Water Distribution	33	53	170	159	415
	Water Treatment	18	37	123	36	214
2017	Water Distribution	58	86	229	217	590
	Water Treatment	27	59	150	50	286

Source: Environmental Operators Certification Program; 2017.

<sup>a</sup> Primary disinfection includes chlorination, ultraviolet radiation, and ozonation.

This change led to an increase in the number of systems classified as water treatment facilities (Figure 6.1). As a result of the new definition, some water systems in the province that were formerly classified as “water distribution” only are now reclassified as both a water treatment and a water distribution facility. Water suppliers affected by this change must now ensure they have a senior operator certified to the level of classification for their treatment facility. This change impacted 96 water systems originally classified as distribution only.<sup>5</sup>

### Operator Certification

Water suppliers must ensure that the operators of the water supply system meet the necessary

training or certification requirements. The DWPA (Section 9) requires that a person not operate, maintain, or repair a prescribed water supply system unless he/she is qualified in accordance with the regulations or is under the supervision of a person who is qualified.<sup>2</sup> Under Section 12 of the Drinking Water Protection Regulation, a person is considered qualified to operate, maintain or repair a water supply system if the person is certified by the EOCP for the facility classification for that system unless the system is a small water system or a Level IV facility (i.e., the requirement applies to Level I to III facilities only).<sup>6</sup>

**Figure 6.1: Number of New Classifications or Reclassifications issued per year, BC, 2012 to 2016**

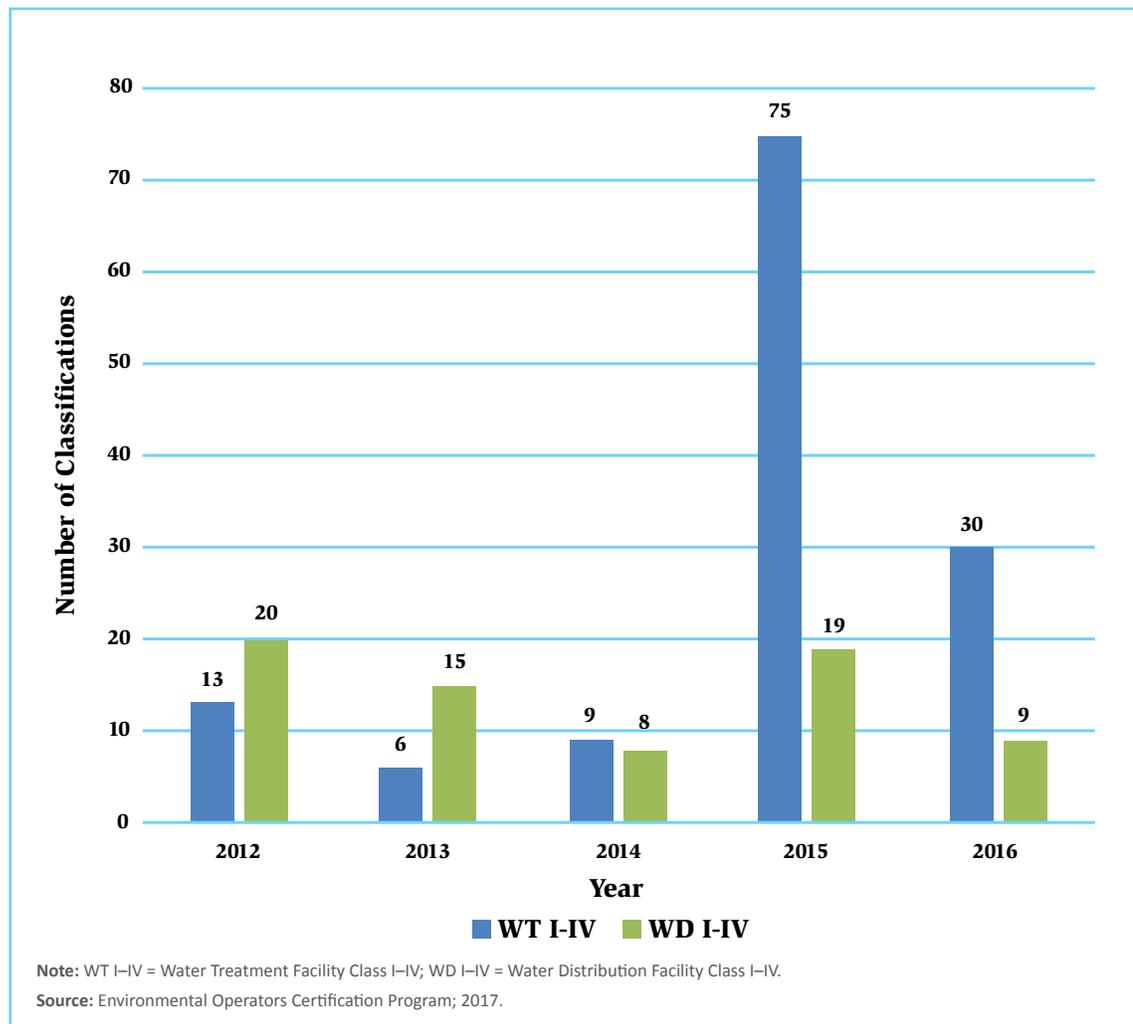


Table 6.3 shows the number of operators, by certification level, for water treatment and water distribution systems over the past five fiscal years of the reporting period. An increase in the number of certified operators (Levels I to IV) is notable after 2015 following the changes made to the definition of water treatment. As shown in Figure 6.2, there was also an increase in the number of operators completing water treatment certification exams to upgrade their skills after 2015 to meet the new certification requirements of their facility's classification.

While the data from EOCP provide the number of certified operators and the number of facilities by classification level, this does not give an accurate picture of the number of water systems that may be out of compliance with Section 9 of the DWPA (i.e., operator training and qualification requirements). This assessment is conducted by the drinking water operator for the system. At this time, data on water supplier compliance with certification and training requirements are not readily available within the data systems used by the regional health authorities. To address this gap, as part of the

new indicator project, the Office of the PHO and the regional health authorities identified—for systems serving greater than 500 people in a day—the need to have at least one operator certified to the level of classification for the system, as an indicator of good operations. For systems serving less than 500 people in a day (i.e., small water systems where certification is not required), please refer to Chapter 9.

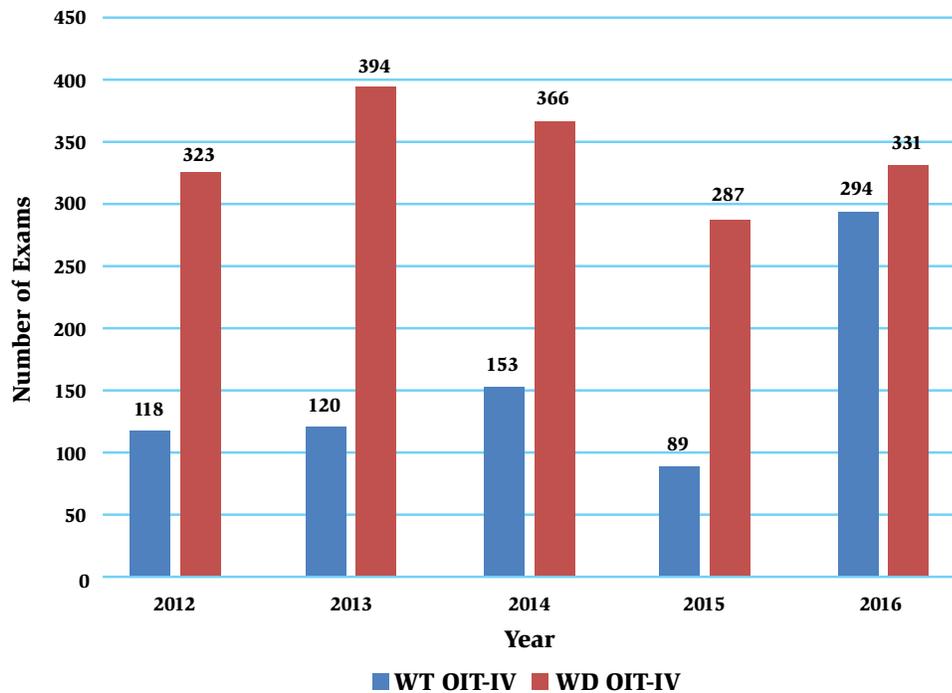
Work is currently underway at the health authority level to collect these data for future PHO reports. Only two health authorities were able to retrieve some information from their data systems on operator certification for 2014/15 and 2015/16. For both of those fiscal years, Fraser Health reports that 100 per cent of their large water systems serving greater than 500 people per day had an operator certified to the level of facility classification for each facility,<sup>7</sup> whereas Island Health reports that only 62 per cent of their large systems had an operator certified to the level of facility classification for each facility.<sup>8</sup> The comparability between Island Health and Fraser Health data is unclear due to differences in the method of data collection.

**Table 6.3: Number of Certified Water Distribution and Water Treatment Operators, by Certification Level, BC, 2013 to 2017 Calendar Year**

Year	Type of System	IV	III	II	I	Total
2013	Water Distribution	49	164	685	772	<b>1,670</b>
	Water Treatment	28	47	125	163	<b>363</b>
2014	Water Distribution	53	161	709	729	<b>1,652</b>
	Water Treatment	32	51	130	176	<b>389</b>
2015	Water Distribution	71	191	763	802	<b>1,827</b>
	Water Treatment	39	52	156	196	<b>443</b>
2016	Water Distribution	69	167	706	871	<b>1,813</b>
	Water Treatment	33	51	187	348	<b>619</b>
2017	Water Distribution	86	221	976	1,066	<b>2,349</b>
	Water Treatment	48	78	230	411	<b>767</b>

Source: Environmental Operators Certification Program; 2017.

**Figure 6.2: Operator Certification Exams Taken, BC, 2012 to 2016**



Note: WT OIT-IV = Water Treatment Operator in Training to Level IV Operator; WD OIT-IV = Water Distribution Operator in Training to Level IV Operator.

Source: Environmental Operators Certification Program; 2017.

### Strategic Improvements to Facility Classification and Operator Certification

In 2012, the EOCP, in partnership with the Ministry of Health, the Ministry of Environment, and Yukon Environmental Health Services, began a project to improve their capacity to support the career needs of operators; to help meet the training and staffing efforts of water suppliers; and to address government’s concerns regarding facility and system classification; roles of and relationships among managers, engineers, senior operators, and regulators; and broader issues of public health and environmental risk management. In 2015, the project steering committee released a Directions Report that outlined potential strategic opportunities and recommendations for improvements to the classification and certification program.<sup>9</sup>

In 2016, the Ministry of Health hired the consulting firm MNP to conduct a strategic review of the EOCP to identify means of

strengthening the facility classification and operator certification program for water systems in BC. In 2016, MNP released their final report with a list of recommendations and options for improving the overall efficiency, effectiveness, and sustainability of the EOCP, as well as for achieving the provincial government’s goals.<sup>10</sup>

Since the release of the Directions Report and the report by MNP, the EOCP has undergone a strategic planning process. Several of the recommendations in these reports have already been implemented, while others are underway or planned for the near future. The following sections highlight the actions taken by the EOCP within their mandate to address concerns raised in the Directions Report and the strategic review: development of new facility classification models; new guidelines on direct responsible charge; operators not in good standing; and operator recruitment and training (Section 6.1.3).

### Development of New Facility Classification Models

The 2015 Directions Report identified significant opportunities for improvement to the classification system currently in use in the province. Among the considerations were the following:

- De-emphasize population as a factor in the classification of systems and facilities.
- Make both the classification model and the related business processes more open and transparent.
- Update the classification model to better reflect current technologies.
- Consider the full scope of operator responsibilities when classifying a facility or system (i.e., watershed to tap, or drain to watershed).<sup>9</sup>

With these considerations in mind, the EOCP, along with engineers at the Ministry of Health and Ministry of Environment, initiated the development of a set of revised facility classification models. Use of the new facility classification models began in August 2017 (outside of the reporting period) and became available for online use in late 2018. As of June 2018, the EOCP has reclassified 96 water treatment and distribution systems using the new models: 64 per cent of those reclassified saw no change in their classification level; 11 per cent saw an increase in their classification level; and 16 per cent saw a decrease in their classification level. According to the EOCP, the increases and decreases in classification levels of these water systems may reflect the introduction of the new classification models or may have occurred regardless due to changes in the facilities or distribution systems since the systems were originally classified by EOCP.<sup>11</sup>

In 2018, the EOCP also implemented a requirement for facilities to update their classification every five years. This policy will help ensure that facility classification stays up-to-date as technologies and systems evolve.<sup>12</sup>

### New Guidelines on Direct Responsible Charge

Direct responsible charge refers to an operator who has responsibility for making or supervising system operations or process control decisions of a facility or a major segment of it.<sup>9</sup> Operators must accumulate direct responsible charge hours in order to write their certification exams to increase their level of certification. Up until recently, direct responsible charge experience was only earned by the senior operator or the operator standing in for the senior operator when he/she was away. This has made it difficult for less senior operators to acquire the direct responsible charge hours needed to increase their certification level.<sup>9</sup>

Recent changes implemented by the EOCP aim to address these concerns and will align BC with the model standards of the Association of Boards of Certification<sup>13</sup> and the best practices of the Canadian Water and Wastewater Operator Certification Committee.<sup>14</sup> These changes will enable more than one operator at a time to earn direct responsible charge experience, and encourage facilities/systems to make these opportunities available; enable Level I operators to begin accumulating direct responsible charge experience (currently restricted to Levels II, III, and IV operators); and require operators of water distribution or wastewater collection systems to have direct responsible charge experience in order to apply for Level III and IV operator certification.<sup>15</sup>

### Operators Not in Good Standing

A key issue that the EOCP needed to address after the strategic review in 2016 was the number of operators who were deemed to be “Not in Good Standing”. This term is used to describe operators for three reasons: they have not paid their membership dues; they have not completed their continuing education units; or both. If an operator is Not in Good Standing then his/her operator certification is no longer valid.<sup>16</sup> If the operator who is Not in Good Standing is the senior operator of a large water treatment or distribution system, then the water supply system may be in violation of its certification requirements under the DWPA and the Drinking Water Protection Regulation.<sup>2,6</sup>



A certified EOC Operator providing a tour of the analyzer/sampling room of the Seymour-Capilano Water Filtration Plant in North Vancouver. Water from different stages of the water treatment process are plumbed to this room for easy dedicated sample collection and to online analyzers for chlorine residual, pH, conductivity, and UV transmittance.

*Photo credit: Environmental Operators Certification Program.*

While the EOC has the authority to classify facilities and certify operators, it does not have any regulatory enforcement powers and cannot impose legally binding requirements on any party. As such, the EOC can identify an issue of regulatory non-compliance regarding certification but relies on the drinking water officers from the regional health authorities to enforce the operator provisions under the DWPA. Currently, the EOC maintains information on water supply systems that shows that some systems may not currently have a certified operator; however, there is no clear, coordinated process for the EOC to inform regional health authorities so they can pursue regulatory compliance where required.<sup>13</sup>

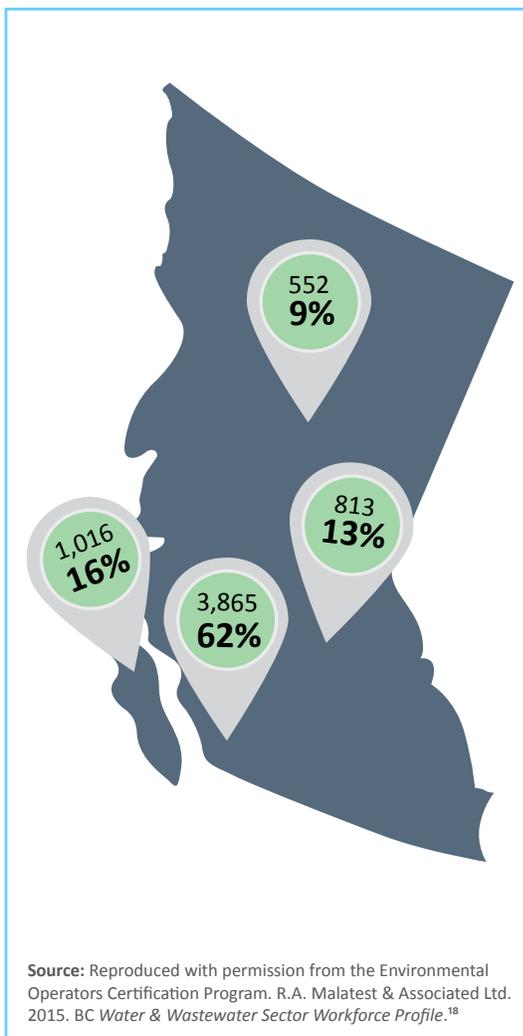
To address this gap and improve accountability and increase compliance around certified operators, the Ministry of Health, in partnership with the EOC and the regional health authorities, began a project through the Drinking Water Leadership Council. The project's purpose includes developing a process for information exchange between the agencies; identifying options for compliance and enforcement based on a graduated enforcement model; and improving the drinking water officers' understanding of the EOC classification criteria and operator certification requirements.<sup>17</sup>

### 6.1.3 Operator Recruitment and Training

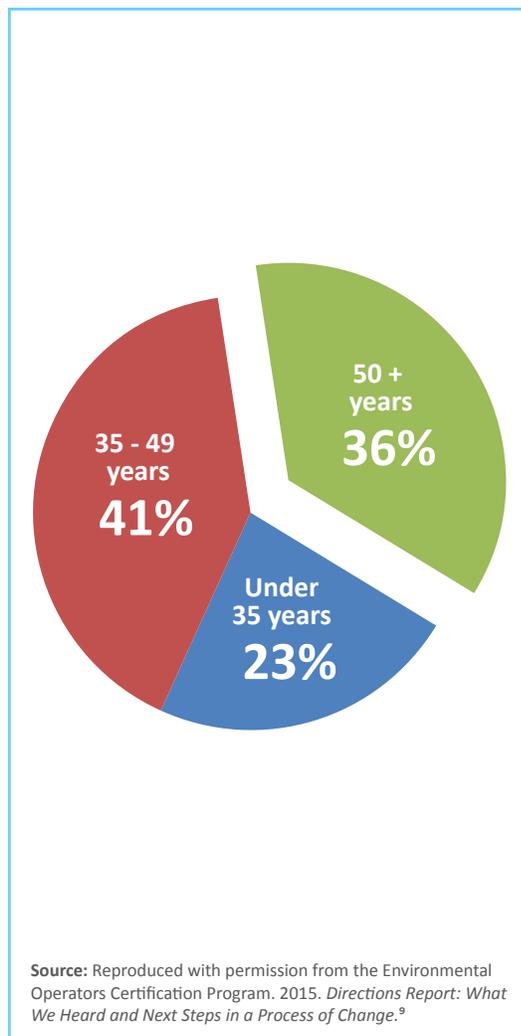
Research and statistics show that BC is facing a shortage of qualified water and wastewater operators. Municipalities are experiencing difficulty in recruiting qualified operators, particularly smaller, rural, and northern communities. The current size of the water and wastewater workforce is estimated to include 4,500 certified operators, with the

majority (62 per cent) concentrated in the lower mainland (Figure 6.3). Additionally, 36 per cent of the current workforce in water and wastewater are over the age of 50 (Figure 6.4). Having a competent and qualified operator—with the appropriate level of skills, knowledge, experience, and judgement—to oversee the operations of a water supply system is a key indicator in the multi-barrier approach to safe drinking water.<sup>1</sup>

**Figure 6.3: Size of the Water and Wastewater Workforce, BC, 2015**



**Figure 6.4: Water and Wastewater Workforce, Age Distribution, BC, 2015**



### Workforce Strategies Project

In 2015, the BC Water and Waste Association (BCWWA) and the EOCP released a comprehensive report called *BC Water & Wastewater Sector Workforce Profile* that highlighted these concerns. The three key conclusions of this report were as follows:

1. There is currently a shortage of skilled workers in the water and wastewater sector and demand for new workers will grow significantly in the next five years to 10 years.
2. There is a lack of educational opportunities available to maintain technical skills, meet certification requirements and satisfy the evolving industry needs.
3. Resources are required to define the competencies associated with the priority occupational groups and to create accessible pathways for new individuals to enter the various roles within the sector to fill the growing workforce gap.<sup>18</sup>

After the release of the workforce profile in 2015, the BCWWA and EOCP began a joint Workforce Strategies Project to address these concerns. In 2017, they released the *BC Water & Wastewater Sector Workforce Strategy*.<sup>19</sup> This report highlights the barriers to recruiting and retaining a competent workforce:

- Gaps in knowledge, skills, and abilities – The sector should conduct needs assessments, establish standardized competency profiles by occupational type, and update educational, certification, and accreditation requirements.

- Knowledge loss due to an aging workforce nearing retirement – About 1,150 current workers will retire within the next 10 years. But only 18 per cent of employers have taken action to implement programs for succession planning for senior management positions.
- Limited pathways for entry and advancement in operations – Post-secondary programs that prepare students for operational jobs in the water and wastewater sector are limited. Furthermore, there are no clear career pathways to advance from an operational role into a supervisory, management, or more technical role such as technician or engineer.
- Challenges in recruiting workers, especially younger workers and women – The water and wastewater sector workforce is aging, yet the industry is not attracting its share of younger workers compared with the overall workforce in BC.
- Lack of awareness of career opportunities in the sector – To meet the demand for new workers, the industry needs to promote employment opportunities in the sector.<sup>19</sup>

The next phase of the project—the implementation of the recommendations—will be conducted through a Water Workforce Commission working along with industry stakeholders. The commission will comprise the three main credentialing organizations: the EOCP, Applied Science Technologists and Technicians of BC, and Engineers and Geoscientists BC. The first step in implementing the strategy focuses on establishing structures to coordinate all implementation activities.

## Environmental Operators Certification Program – Customer Relationship Management System

It is important to ensure that information about educational and training opportunities for operators is easily accessible. The EOCP maintains a website that provides information on training opportunities available in BC for operators to advance their careers and obtain their required continuing education units in order to maintain or increase their certification level. In the fall of 2017, the EOCP launched an improved customer relationship management system to replace the existing training registry. The new system allows operators to easily track their continuing education units, and more readily search for courses based on a variety of parameters such as subject, location, format, number of continuing education units, etc.<sup>20</sup>

**Note:** The EOCP customer relationship management system is available at: <http://crm.eocp.ca/>.

### 6.1.4 Standard Operating Procedures

Every water supplier, regardless of their size of the population served, should have in place standard operating procedures specific for that water system. These procedures should be kept up to date, written down, and accessible to all operations staff so that the system can continue normal operations in the event the regular or senior operator is not available. Operating permits may require such procedures and drinking water officers will review operating procedures with operators during inspections or file reviews. The next section discusses the development of an emergency response and contingency plan, which is required under the DWPA.

#### Emergency Response and Contingency Plans

As part of the multi-barrier approach, every owner and operator of a water supply system must be aware of situations that could cause an operational interruption that could threaten drinking water safety, and have plans in place to respond to such events. Section 10 of the DWPA requires every prescribed water

system to have an emergency response and contingency plan in accordance with Section 13 of the regulation.<sup>2,6</sup> An emergency response and contingency plan helps protect the safety of the population served by a water system in several ways. It assists operators in responding rapidly and correctly to situations that may arise while preventing further complications. It outlines roles and responsibilities and ensures that proper notification of officials and the public occurs quickly. Emergency response and contingency plans cover everything from common operational incidents (e.g., line breaks, power outages, pump failure, etc.) to extreme emergency events (e.g., chemical spills into the source supply, floods, fire, etc.).<sup>1</sup>

The PHO and the regional health authorities identified the percentage of water systems with emergency response and contingency plans as an indicator of good operations, as part of the multi-barrier approach. Table 6.4 shows the number of systems within each health authority with an accepted emergency response and contingency plan.

**Table 6.4: Number and Percentage of Water Systems with an Accepted Emergency Response and Contingency Plan, by Health Authority, BC, 2012/13 to 2016/17**

Health Authority	2012/13	2013/14	2014/15	2015/16	2016/17		
	All	All	All	All	Large	Small	Total
Island Health	576 (72%)	747 (90%)	681 (76%)	681 (73%)	—	—	837 (90%)
Northern Health	509 (41%)	545 (43%)	—	570 (46%)	46 (92%)	624 (53%)	670 (54%)
Vancouver Coastal Health	248 (70%)	262 (72%)	272 (77%)	272 (78%)	—	—	276 (79%)
Interior Health	1,249 (65%)	1,265 (66%)	—	—	—	—	—
Fraser Health	472 (100%)	459 (99.9%)	432 (95%)	423 (93%)	41 (98%)	374 (91%)	415 (92%)
<b>Total:</b>	<b>3,054 (64%)</b>	<b>3,278 (68%)</b>	—	—	—	—	—

**Notes:** Interior Health was unable to provide data for 2014/15 to 2016/17 due to a changeover in the administrative data system. Northern Health was also unable to provide retrospective data for 2014/15. Beginning in 2016/17, health authorities were asked to report on the number of small and large systems in compliance with emergency response and contingency plan requirements. Fraser Health and Northern Health were the only health authorities able to distinguish between the different size systems for reporting purposes.

**Source:** Regional health authorities; 2012/13 – 2016/17.

As shown in Table 6.4, starting in 2016/17, health authorities were asked to report on the number of small and large systems in compliance with emergency response and contingency plan requirements. Northern Health's data for 2016/17 demonstrate better compliance with emergency response and contingency plan requirements among larger water systems compared to smaller water systems. This is not surprising, as larger systems tend to have better operational and management capacity compared to smaller systems.



**Flooding at Mission Creek intake.**  
Photo credit: Black Mountain Irrigation District.

During the reporting period, the Ministry of Health and the regional health authorities took a number of steps to improve small water system compliance with emergency response planning requirements. In 2016, the ministry updated and modernized the *Emergency Response and Contingency Planning for Small Water Systems guide*.<sup>21</sup> The document provides a step-by-step guide for small water system operators to create an emergency response and contingency plan. In 2016/17, Interior Health developed and delivered a course called “Introduction to Emergency Response Planning” to assist small water system operators in developing their emergency response and contingency plan. Interior Health offered the course 18 times in various locations within the health authority at no cost to small water systems owners and operators.<sup>22</sup> Island

Health also developed a course, “Writing an Emergency Response and Contingency Plan”, to educate small water systems owners and operators about the requirements for a plan and the necessary components. This course was not offered during the reporting period, due to demands on staff time.<sup>23</sup>

## 6.2 Good Management

In order to provide clean, safe, and reliable drinking water, water supply systems should not only have good operations, but also be effectively managed. This section describes some key elements of good management, including asset management, financial planning, and full-cost accounting for rate setting. Government must also support good management and governance of water supplies, by setting requirements, developing supporting materials and guidance, and developing funding programs to support communities. The development and progress of programs and initiatives to support good management developed over the reporting period are also described in this section.

### 6.2.1 Asset Management and Financial Planning

Many water supply systems in BC have infrastructure that is at, or nearing, its critical age of replacement or renewal. The maintenance, repair, and replacement of an asset during its lifecycle is integral for meeting and maintaining expected service levels and for projecting sufficient long-term capacity and service needs.

Drinking water programs in BC are becoming increasingly involved in providing awareness of and promoting asset management and financial planning. While not a traditional public health issue, these programs are fundamental to water supply systems being able to carry-out necessary system upgrades and replacements. In recent years, drinking water officers and other health officials have increased the dialogue with water system owners, local governments, and provincial partners about asset management and financial planning; in some regions, drinking water officers have required that water suppliers complete, as a condition on their operating permit, financial plans to facilitate the development of a reserve fund to pay for required capital upgrades.



Seymour falls dam and reservoir in North Vancouver.  
Photo credit: Metro Vancouver.

Asset management is a process that ensures the most value from assets, and the financial resources to renew them when necessary. It includes developing an asset inventory, which identifies the condition and life expectancy of the assets, their importance, the risk and criticality, and the projected cost of replacement. Once assets have been identified and prioritized, water suppliers can develop a plan and schedule for replacement. Asset management is a continuous quality improvement process. Long-term financial planning goes beyond just looking at repair and replacement; it also involves financial planning for system improvements, including accumulating the required funds for projected operating costs and improvement/replacement projects.<sup>24,25</sup>

Drinking water officials from the regional health authorities, the Ministry of Health, and the Office of the PHO identified having such plans as an indicator of good management for the multi-barrier approach to drinking water safety. At this time, data regarding the number of water systems with an asset management plan and a long-term financial plan are not available, as this type information is either not collected or recorded in health authority databases. The PHO will continue to work with the regional health authorities, the Ministry of Health, and the Ministry of Municipal Affairs and Housing (MAH) to refine what information should be collected and how it will be evaluated.

While data on asset management and long-term financial planning are unavailable at this time, data are available on local government water systems. These systems serve the majority of the

BC population and are required to submit annual financial statements to MAH. Funding programs administered by MAH require local governments to answer questions regarding the following:

- The current status of asset management in their organization.
- Whether they have a long-term financial plan
- How operation and maintenance will be managed and funded over the lifecycle of the infrastructure.
- Whether they will extend the life of the asset.
- Whether an asset inventory is complete and up to date.
- Whether condition assessments are complete.
- Whether plans for renewal/rehabilitation are in place or forecasted.
- What are the impacts to the level of service provided to consumers.<sup>26</sup>

The tripartite agreement between the federal and provincial governments and the Union of BC Municipalities regarding the federal gas tax fund<sup>b,27</sup> (i.e., the Gas Tax Agreement) requires local governments to demonstrate and report out on improvements to their asset management capacity over the lifetime of the agreement (2014–2024).<sup>25,28</sup> In May 2016, the Union of BC Municipalities launched a survey of all local governments in BC (*Phase 1 Asset Management Assessment Form Baseline Survey*), which led to the release of the *Status of Asset Management in British Columbia: Results from the 2016 Gas Tax Fund Asset Management Baseline Survey*.<sup>29</sup> The survey results reflect a growing awareness of the importance of asset management to support the long-term delivery of local government services. The survey also asked local governments to assess the condition of potable water assets. Results show that 20 per cent rated the condition of their potable water assets as very good, 40 per cent as good, 27 per cent as fair, 10 per cent as poor, and 3 per cent as very poor.<sup>29</sup>

### 6.2.2 Activities to Promote and Support Good Asset and Financial Management

During the reporting period, several initiatives were launched to build capacity in asset management and financial planning, in order to help water suppliers achieve financial sustainability. Some of these initiatives are highlighted in Table 6.5.

<sup>b</sup> The Administrative Agreement on the Federal Gas Tax Fund in British Columbia came into effect in April 2014. The agreement provides the framework for the delivery of federal gas tax funding to local governments and others in BC over 10 years (2014-2024).

**Figure 6.5: Asset Management for Sustainable Service Delivery: A BC Framework**



**Table 6.5 Activities to Promote and Support Good Asset and Financial Management**

<p><b>Asset Management for Sustainable Service Delivery: A BC Framework</b></p>	<p>In 2014, after signing the renewed Administrative Agreement on the Federal Gas Tax Fund in British Columbia, the Union of BC Municipalities engaged with the Ministry of Municipal Affairs and Housing and Asset Management BC to develop <i>Asset Management for Sustainable Service Delivery: A BC Framework</i>.<sup>30</sup> The framework (Figure 6.5) provides a high level overview of the continuous improvement process of asset management. It identifies the connections between asset condition, level of service, asset management plans and long-term financial plans. The integration is necessary for sustainable service delivery, and it links operation, maintenance, and capital costs for renewal and growth with available funding (including rates and reserves) to ensure that local governments develop robust plans to meet the lifecycle costs of their services.<sup>31</sup></p>
<p><b>Asset Management Planning Program</b></p>	<p>The Asset Management Planning Program was created in 2014 through a \$1.5 million grant from the then Ministry of Community, Sport &amp; Cultural Development (now the Ministry of Municipal Affairs and Housing). This program, administered by the Union of BC Municipalities, provides assistance to local governments as they pursue sustainable service delivery by extending and deepening asset management practices within their organizations.<sup>32</sup> “Under the 2017 Asset Management Planning Program, matching grants of up to \$10,000 [were] available to support activities that advance a local government’s asset management planning or practices, and that facilitate better integration of asset management planning with long-term financial planning.”<sup>33</sup></p>

<p><b>National Asset Management Systems Training Session</b></p>	<p>The National Asset Management Systems (NAMS) training session is a three-day course offered to local governments in BC provided by Asset Management BC, with support from the Ministry of Municipal Affairs and Housing and the Union of BC Municipalities. The training focuses on the development of an asset management plan, which provides the baseline information for assessing current rates, revenues, and ongoing lifecycle costs of the infrastructure. In 2016, Asset Management BC offered NAMS training in locations throughout the province. As of 2017, plans were in place for Asset Management BC to again host the NAMS training across BC in 2018.<sup>34</sup></p>
<p><b>The Community Lifecycle Infrastructure Costing (CLIC) Tool</b></p>	<p>Understanding the lifecycle cost implications of land-use decisions over time can help reduce future infrastructure costs. During 2014 and 2015, the Ministry of Municipal Affairs and Housing, in collaboration with local governments and other agencies including the Union of BC Municipalities, Asset Management BC, Fraser Basin Council, and the Government Finance Officers Association developed the Community Lifecycle Infrastructure Costing Tool and guides to assist local governments in estimating the lifecycle cost implications of different types of developments over a 100-year period.<sup>35,36</sup> The tool is excel-based and open source and has been piloted in six communities across BC.<sup>37</sup></p>
<p><b>Natural Assets</b></p>	<p>Significant progress has been made in advancing the concept of natural assets (e.g., water bodies, aquifers, and wetlands) in local government decision-making, regarding the management of infrastructure assets. Two organizations have played a key role in researching, developing, and piloting this concept in BC: the Municipal Natural Assets Initiative and the Partnership for Water Sustainability in BC. In 2017, the Municipal Natural Assets Initiative released <i>Defining and Scoping Municipal Natural Assets</i>.<sup>38</sup> The Partnership for Water Sustainability in BC has piloted the Ecological Accounting Process for watershed management to assess the worth of ecological services. Both approaches “...provide methodologies to support and guide local governments in identifying, valuing, and accounting for natural assets in their financial planning and asset management programs and developing...sustainable and climate resilient infrastructure.”<sup>38</sup> To highlight the linkages and benefits of these initiatives Asset Management BC published <i>Integrating Natural Assets into Asset Management - A Sustainable Service Delivery Primer</i>.<sup>39</sup> The work of all three organizations has been supported by the Ministry of Municipal Affairs and Housing.<sup>39</sup></p> <p><b>Example:</b> The Town of Gibsons on the Sunshine Coast of BC is an example of a community that has adopted the Municipal Natural Assets Initiative. In 2014, Gibsons deemed nature to be its most valuable asset and redefined infrastructure to include natural capital within their official community plan, strategic plan, and operations plan. This natural capital includes resources that are part of direct municipal services, such as the Gibsons aquifer, creeks, ditches, wetlands, and the foreshore. The town has also incorporated the management of these resources alongside the management of man-made infrastructure. The town released their eco-asset strategy (<i>Towards an Eco-asset Strategy in the Town of Gibsons</i>) in 2015.<sup>40</sup></p>
<p><b>Asset Management BC Roadmap</b></p>	<p>The Asset Management BC Roadmap predates the reporting period but is still a useful resource. In 2011, Asset Management BC released the <i>Guide for using the Asset Management BC Roadmap</i> as part of the Asset Management BC Roadmap Project.<sup>41</sup> The BC Roadmap assists organizations in implementing asset management practices. It uses a modular approach to guide local governments or other organizations that manage public infrastructure through the steps of implementing basic level asset management.<sup>41</sup></p>

<b>Financial Best Management Practices for Small Water Systems</b>	<p>In 2013, the Union of BC Municipalities and the provincial government (the Ministries of Health and Municipal Affairs and Housing) worked with the Sustainable Infrastructure Society to develop seven financial best management practices for small water systems in BC. These best management practices (See Chapter 9 for more detail) are tools and worksheets to help system operators develop a financial plan (including asset management plans and an asset inventory) by following practical and proven methods used by successful water supply systems to operate sustainably.<sup>42</sup> The objective behind developing the best management practices was to help address the financial management gap small water systems experience because they do not have the same level of financial oversight or capacity as local governments.</p>
<b>Small Water System Guidebook – Financial Management</b>	<p>In 2013, the Ministry of Health released the <i>Small Water System Guidebook</i> (See Chapter 9), which included a dedicated chapter on financial management. The guide provides basic information about setting rates and financial management for small water systems to consider. Specifically, it outlines components of financial management including financial controls, financial statements, budgets, capital plans, reserve funds, and debt. The chapter also covers revenue and rates and how to communicate with users and put the information provided into practice. The guide, which was updated in 2017, also provides information on governance and the varying business models and acts that apply to small water systems, and how they may influence financial decisions and business practices.<sup>43</sup></p>
<b>Financial Guidelines for Certificate of Public Convenience and Necessity Applications</b>	<p>In 2016, the Utility Regulation Section of the Ministry of Forests, Lands, and Natural Resource Operations updated the <i>Financial Guidelines for Certificate of Public Convenience and Necessity Applications</i>.<sup>44</sup> New utilities must meet these guidelines to ensure they are financially viable and that water rates are sufficient to pay for operating costs and future repairs and replacement of infrastructure. The guidelines and the requirements and oversight for private water utilities are described in detail in Chapter 3 and Chapter 9.</p>

### 6.2.3 Full-cost Accounting

An important aspect of financial planning is rate setting. Rates for drinking water should reflect true, long-term costs of water treatment and distribution and water system operation, maintenance, and monitoring. Principle 8 of the *Action Plan for Safe Drinking Water in British Columbia* reinforces this message, stating that “safe drinking water should be affordable, with users paying appropriate costs.”<sup>45</sup> The practice of pricing water below cost is a systemic problem in Canada and other developed nations, where critics argue that citizens have taken the abundance of rural water for granted and grown to expect low rates.<sup>46,47,48,49</sup> Infrastructure, operator training, materials and supplies, regular maintenance, water testing, and loan payments are all required in order to deliver drinking water, and they all have costs.

Historically, British Columbians have enjoyed some of the lowest rates for water in Canada and the world.<sup>50</sup> In many cases, these low rates continue to be a barrier for smaller systems to build capital, prevent infrastructure deterioration, invest in water system upgrades, or promote conservation. Rates for small systems are often far below the cost of providing the service. An illustration of this point involves a small 2007 survey of several BC small water systems conducted by the Small Water Users Association of BC. It found the average annual water fee paid by respondents was \$275 a year.<sup>51</sup>

## 6.2.4 Funding Programs

The Local Government Infrastructure and Finance Branch of MAH supports the development of sustainable drinking water infrastructure with two types of grants for local governments: infrastructure planning grants and capital grants. Local governments (municipalities and regional districts) are eligible to apply for grants. Improvement districts and other small water systems are not eligible to apply for grants as direct applicants; however, they can apply for infrastructure planning grants if sponsored by a local government. Additionally, water systems not owned by local governments are eligible for infrastructure capital grants on the condition that the system is transferred to a municipality or regional district.

Between 2014/15 and 2016/17, MAH provided over \$141 million in infrastructure funding, which was matched with over \$126 million in federal funding, for 143 capital projects for drinking water through four programs: the Clean Water and Wastewater Fund; the Gas Tax – Strategic Priorities Fund; the National Regional Projects; and the Small Communities Fund (Table 6.6).<sup>52</sup>

MAH continues to invest in its infrastructure planning grant program, which can provide

funding to local governments and non-local governments (so long as they are sponsored by a local government) to undertake feasibility studies, infrastructure assessments, long-range planning, etc.<sup>53</sup> The infrastructure planning grant program supports the advancement of asset management through infrastructure assessments and rate review studies for water systems moving to a sustainable financial model that reflects the full costs of the provision of the service.<sup>31</sup> As shown in Table 6.6, between 2014/15 and 2016/17, MAH provided \$454,615 in infrastructure planning grants for 47 projects. In the two previous fiscal years (2012/13 and 2013/14), MAH provided \$153,250 in infrastructure planning grants for 16 projects related to water.<sup>35</sup>

Although there are mechanisms for improvement districts and other non-local government water systems to apply for planning grants (with the support of local government) or for infrastructure grants (through improvement district conversion or small water system acquisition), the lack of funding options for such systems remains a barrier and point of frustration. Small water system challenges and local government acquisition and amalgamation are discussed further in Chapter 9.

**Table 6.6: Funded Drinking Water Projects, BC, 2014/15–2016/17**

Program	Number of Projects	Total Gross Project Costs	Provincial Share	Federal Government Share	Combined Provincial & Federal Shares
Clean Water and Wastewater Fund	105	\$432,183,993	\$100,716,441	\$152,600,689	\$253,317,130
Gas Tax–Strategic Priorities Fund	9	\$29,456,220	0	\$27,386,955	\$27,386,955
National Regional Projects	1	\$17,650,000	\$3,702,000	0	\$3,702,000
Small Communities Fund	28	\$141,276,009	\$36,838,708	\$36,838,708	\$73,677,416
Infrastructure Planning	47	\$1,310,557	\$454,615	0	\$454,615
<b>Totals</b>	<b>190</b>	<b>\$621,876,779</b>	<b>\$141,711,764</b>	<b>\$216,826,352</b>	<b>\$358,538,116</b>

**Note:** The data presented for the Gas Tax – Strategic Priorities Fund represent the first intake of the program. The approvals for the second intake occurred in March 2018, outside the reporting period. For the National Regional Projects, the federal government’s share of the program is not shown as it does not fall under a bilateral program; the federal government does have a parallel contract for this program.

**Source:** BC Ministry of Municipal Affairs and Housing; 2017.<sup>52</sup>

### 6.3 Conclusion

Good operations and management is a key supporting component of total quality management and the multi-barrier approach. This chapter provided an overview and update of activities relating to operating permits, facility classification, operator certification, operator training needs, standard operating procedures, and emergency response and contingency plans. It also highlighted the importance of asset management and financial planning, and described the activities to support good management, including educational resources, online tools, training, and funding programs.

Under the *Drinking Water Protection Act*, water suppliers must hold a valid operating permit to deliver water to customers. Terms and conditions for operating the system can also be applied. While very few water supplies lack an operating permit, the use of terms and conditions varies across the regional health authorities.

The *Action Plan for Safe Drinking Water in British Columbia* called for new legislation to outline new training and certification requirements for water system operators. While the certification requirements have been outlined under the DWPA, recent reviews of the facility classification and operator certification models identified areas where improvements were needed. In response, the Environmental Operators Certification Program, with the support of the Ministry of Health and the Ministry of Environment, initiated a number of projects including developing a new facility classification model, modernizing the definition of treatment for classification purposes, and revising the direct responsible charge guidelines to remove barriers to operators trying to advance their certification level. Access to operator training remains critical for good operations, as the performance of the treatment and distribution system is dependent on having competent and trained operators. Recruitment and retention continues to be challenging for the water sector in BC, especially in small, rural, and northern communities, but work is underway to address these challenges.

Good operations also depend on having standard operating procedures for operators that are up to date, written down, and easily accessible. An emergency response and contingency plan, which is required by legislation, is an example

of such written procedures. Compliance with the requirement varies across the regions and tends to be better among larger water systems. To address this issue, the Ministry of Health has updated its guidance for small water systems for emergency planning, and several regional health authorities have developed training to assist small water systems.

Asset management and financial planning with full-cost accounting is essential for effective management of a water supply system. Operation, maintenance, repair, and replacement of infrastructure require significant investment and planning to ensure the continued provision of clean, safe, and reliable drinking water. Asset management and financial planning, while not a traditional aspect of drinking water protection programs, has been identified as an indicator of good management under the multi-barrier approach. At this time, limited data exist regarding how many water systems have developed an asset management or financial plan; however, several agencies, including the Ministry of Municipal Affairs and Housing, the Ministry of Health, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Asset Management BC, and the Union of BC Municipalities have developed guidelines, best management practices, educational materials, training, and other initiatives to support better water system management in BC.

The *Action Plan for Safe Drinking Water in British Columbia* called for the identification and financing of infrastructure to ensure better treatment and delivery of drinking water. While infrastructure planning grants and capital planning grants continue to be made available through the Ministry of Municipal Affairs and Housing, this funding is primarily available to municipalities and regional districts. Improvement districts and other small water systems need to have a local government apply on their behalf for planning grants, or must commit to dissolve in order to access capital grants. This limited access to funding, coupled with inadequate asset management, financial planning, or rate setting among small water systems, continues to perpetuate small water system challenges to delivering clean, safe, and reliable drinking water (Chapter 9).

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## 7

# Monitoring and Reporting

The multi-barrier approach requires that drinking water systems are managed and operated in a holistic manner from source to tap, to ensure drinking water is kept clean, safe, and reliable over the long term. Proper monitoring and reporting demonstrate that proper management and operation have occurred. Holistic monitoring of drinking water includes source water quality monitoring, performance monitoring, and water quality compliance monitoring. This monitoring depends on the accuracy, reliability, and timely reporting of positive water quality sampling results from approved and accredited laboratories. Records of monitoring results must be kept and reported on regularly in order to keep water users and decision makers informed. Reporting often includes water system annual reports, public notification of water quality concerns, and waterborne disease surveillance. This chapter describes the monitoring and reporting activities that have occurred in BC during the reporting period.

## 7.1 Source Water Quality Monitoring

Source water quality monitoring is an important part of the multi-barrier approach. Knowledge of source water quality and the assessed risks to public health is invaluable to source water protection efforts and treatment requirements.<sup>1</sup> Source water quality data can serve as an early warning of source contamination or degradation. In BC, the Ministry of Environment and Climate Change Strategy is the lead agency responsible for source water quality monitoring and setting water quality guidelines and objectives for water bodies and aquifers. See Chapter 4 for further detail for source water quality guidelines, objectives, and monitoring.

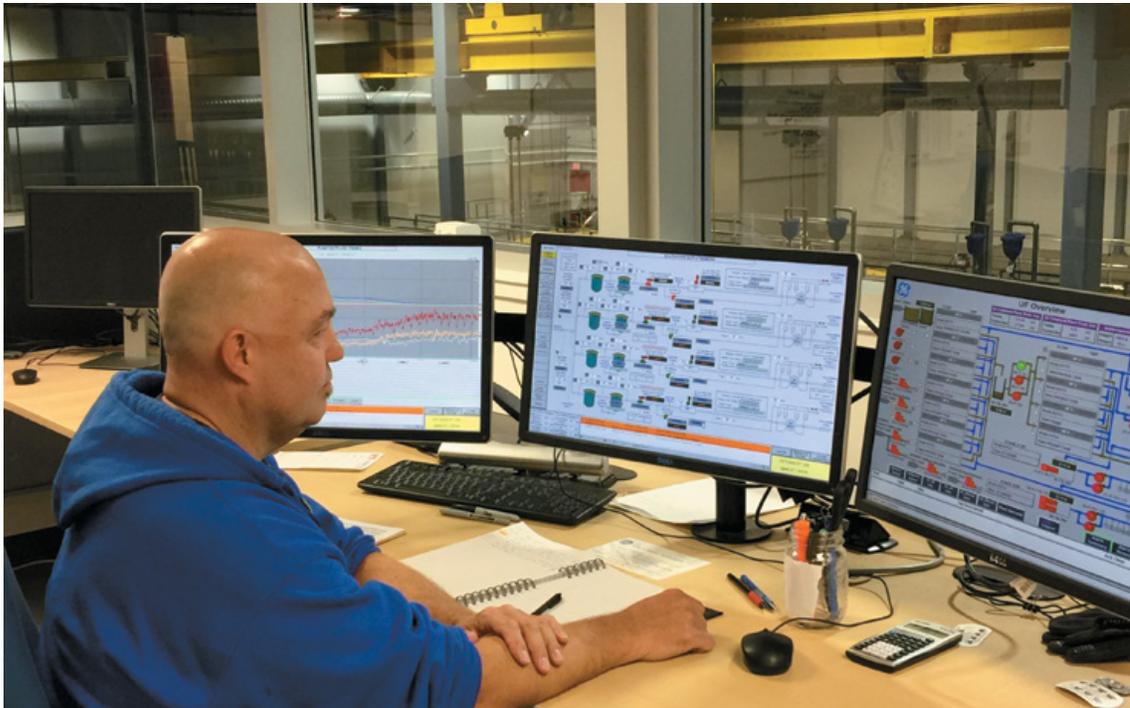
## 7.2 Performance Monitoring

Performance monitoring, also known as treatment system or process monitoring, verifies that treatment and operational processes are effective in providing safe drinking water.<sup>2</sup> It differs from regulatory compliance monitoring in that it involves more than what is legislatively required under the Drinking Water Protection Regulation (Schedules A and B), including frequent or continuous monitoring of disinfectant levels and conditions that could impact treatment including pH, alkalinity, temperature, flowrate, and turbidity. This type of monitoring verifies how well the multiple barriers are working and enables operators to make changes to treatment before water quality is compromised.<sup>1</sup>

Regional health authorities continue to support performance monitoring in their work with water suppliers. As a result, this is now conducted in many large water systems across the province. However, small water systems are somewhat limited in their implementation of performance monitoring for a variety of financial and capacity issues. These issues are discussed in more detail in Chapter 9.

### 7.2.1 Secondary Disinfectant Residual Monitoring

Monitoring the disinfectant residual in representative locations throughout the distribution system is an important component of the multi-barrier approach and is a type of performance monitoring. It confirms that an adequate amount of disinfectant residual is present to maintain water quality under normal operating conditions, and it also provides an early indicator of treated water quality degradation within the distribution system. A sudden change or absence of



An EOC certified Operator working at Nanaimo's South Fork water treatment plant Supervisory Control and Data Acquisition (SCADA) system.

Photo credit: Environmental Operators Certification Program.

residual disinfectant alerts operators to the possibility of a problem and allows them to take appropriate measures in real time.<sup>2</sup> Without disinfection residual monitoring, users could potentially be exposed to contaminated water for several days if monitoring relied solely on routine bacteriological testing. Secondary disinfection is not required for all water systems in BC (See Chapter 5).

As part of the new indicator project, the Office of the Provincial Health Officer (PHO) and the regional health authorities identified secondary disinfection and residual monitoring as a future indicator for performance monitoring as part of the multi-barrier approach. Currently, the data systems within the regional health authorities do not allow recording or reporting out on secondary disinfection and monitoring, but work is underway to be able to report out on this indicator in the future.

## 7.3 Water Quality Compliance Monitoring

### 7.3.1 Bacteriological Monitoring

Section 11 of the *Drinking Water Protection Act* (DWPA) mandates that water suppliers monitor

the drinking water source, the water in the system, and the water it provides for specific parameters established by the regulation (i.e., *E.coli*, faecal coliforms, and total coliforms) and by the system's operating permit.<sup>3</sup> The standards for routine water quality compliance monitoring for the indicator organisms are set out in Schedule A of the *Drinking Water Protection Regulation*, and the required sampling frequency is outlined in Schedule B.<sup>4</sup> In practice, only *E.coli* and total coliforms are required for routine bacteriological monitoring.

Water systems should meet their required sampling frequency for bacteriological monitoring 90 per cent of the time, a target established by the PHO and the regional health authorities. The target was not set at 100 per cent to account for samples lost due to transport delays or inadequate refrigeration, especially for systems in rural and remote areas that rely on couriers to deliver their samples to distant laboratories.

**Table 7.1: Number and Percentage of Water Systems Meeting the Sampling Frequency Requirement 90% of the Time, BC, 2012/13 to 2016/17**

Health Authority	2012/13	2013/14	2014/15	2015/16	2016/17		
					Small	Large	Total
Island Health	312 (39%)	349 (42%)	394 (44%)	362 (39%)	421 (50%)	62 (74%)	483 (52%)
Northern Health	—	—	—	—	346 (29%)	28 (58%)	372 (30%)
Vancouver Coastal Health	—	—	—	109 (31%)	80 (24%)	15 (83%)	95 (27%)
Interior Health	—	—	—	—	—	—	—
Fraser Health	450 (95%)	440 (95%)	436 (96%)	432 (96%)	385 (94%)	42 (100%)	427 (95%)

**Notes:** Reporting on the frequency requirement is averaged over the fiscal year. Data not available for Interior Health for the entire reporting period. Data not available for Northern Health from 2012/13 to 2015/16. Data not available for Vancouver Coastal Health for 2012/13 to 2014/15. Vancouver Coastal Health and Fraser Health data are based on an 80 per cent compliance rate. Vancouver Coastal Health classified large systems as greater than 300 connections, rather than using the definition of large system (>500 people served in a 24 hour period) in the Drinking Water Protection Regulation.

**Source:** Regional health authorities; 2012/13-2016/17.

Table 7.1 shows the number and percentage of water systems meeting the 90 per cent target for sampling frequency across the regional health authorities. The data shown demonstrate the current limitation of the health authorities to be able to report on this indicator. For some of the health authorities the data were not available in their data system, while for others the data were only available for an 80 per cent compliance rate. Nevertheless, the data available suggest that the compliance rates are low for water systems in Island Health, Northern Health, and Vancouver Coastal Health, especially among small water systems. The health authorities are currently working to improve their data systems to collect and report reliably on this sampling indicator in the future.

### 7.3.2 Chemical/Radiological Water Quality Testing

In BC, drinking water officials use the *Guidelines for Canadian Drinking Water Quality* to define potability for prescribed water systems. While drinking water legislation in BC does not specifically prescribe chemical sampling parameters or frequencies, Section 6 of the DWPA does require that all water systems

provide potable water, and Section 11 allows drinking water officers to prescribe sampling requirements on an operating permit.<sup>3</sup> As such, water suppliers must conduct chemical and radiological sampling at a frequency determined by the drinking water officer in order to assess whether the drinking water exceeds any maximum acceptable concentration for health. Chemical, physical, and radiological sampling is also typically required as part of the source approval process for new water systems. As a result, every water system should at a minimum have one chemical analysis on file that was taken upon approval of the source.

Chemical sampling may be routinely required as a condition on a water supplier's operating permit for specific parameters, in regions where source waters are identified as at risk of exceeding known chemical parameters from either a) naturally occurring elements (e.g., arsenic, manganese, uranium, etc.); b) land uses in the area (e.g., agriculture, industry, logging, recreation, and development); or c) by-products of disinfection or corrosion where source water chemistry is known to lead to their formation.

At this time, the PHO is unable to report on how many water suppliers have a completed chemical analysis on file, or how many water systems conduct routine chemical sampling, or how many water suppliers exceed the *Guidelines for Canadian Drinking Water Quality* for specific parameters. The current data systems used by the health authorities are unable to automatically upload the chemical sampling laboratory reports they receive, which means that any information received must be entered manually. This can be very difficult for health authorities to do, because of limited staff resources.<sup>5</sup> As a result, this information remains difficult to access, which makes it challenging to audit compliance with sampling requirements and accepted guidelines on a provincial basis. The only health authority that currently has complete access to these data is Fraser Health—100 per cent of their water supply systems have a chemical analysis on file.<sup>6</sup>

During the reporting period, staff at Vancouver Coastal Health, HealthSpace, and the Provincial Health Services Authority voluntarily undertook preliminary work to explore the potential for building an automated system to acquire and manage water quality data. At this time, no dedicated resources have been allocated to this project and results are incomplete.<sup>7</sup>

## 7.4 Approved Laboratory Testing

To ensure the accuracy and reliability of water quality data for compliance monitoring, it is important that water suppliers use approved and accredited laboratories.

### 7.4.1 Laboratory Approvals and Audits

Section 8(4) of the Drinking Water Protection Regulation requires the laboratories monitoring for *E. coli* and total coliform in water be approved in writing by the PHO.<sup>4</sup> This process ensures there are appropriate testing methods, reliable results, and a process in place to notify water suppliers, drinking water officers, and medical health officers if the required standard is not met. Technical experts in the Enhanced Water Quality Assurance Program review applications from laboratories and make recommendations to the PHO for approval of laboratories for drinking water testing. The Enhanced Water Quality Assurance Program also conducts

onsite laboratory inspections and audits for drinking water laboratories using a peer-auditor inspection model; and provides educational materials, workshops, and consultation services to laboratories to improve the quality of water testing.<sup>8</sup> Under the Enhanced Water Quality Assurance Program, the publication “Standard Methods for the Examination of Water and Wastewater” is the standard against which laboratories are examined.<sup>9</sup>

The list of approved laboratories is updated on a regular basis.<sup>10</sup> To maintain Enhanced Water Quality Assurance Program certification, PHO-approved laboratories must demonstrate ongoing satisfactory performance on external proficiency testing of drinking water samples.<sup>11</sup>

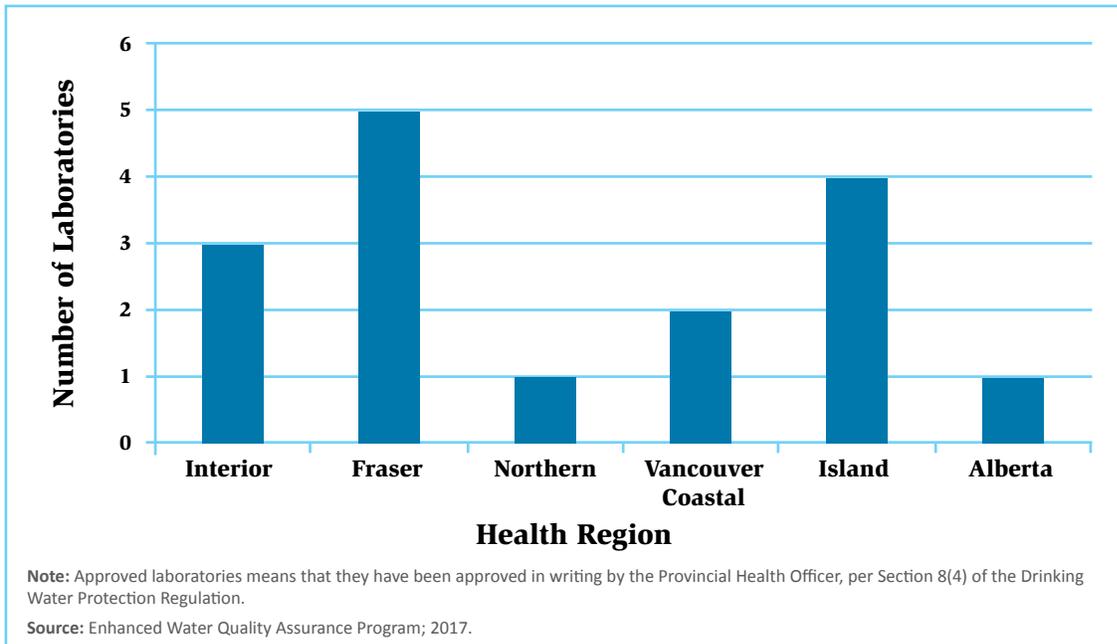
Since 2012 there has been slight fluctuation in the number of approved laboratories. As of March 31, 2017, there were 16 approved laboratories:

- One provincial/reference laboratory – BC Centre for Disease Control Public Health Microbiology Laboratory.
- Two municipal laboratories – Capital Regional District Water Services Laboratory and Metro Vancouver Water Laboratory.
- 13 private laboratories – 12 distributed across the five regional health authorities, and one in Alberta.<sup>11,12</sup>



Rinsing the filter housing for membrane filtration.  
Photo credit: BC Centre for Disease Control - Public Health Laboratory.

**Figure 7.1: Number of Approved Laboratories, by Health Region, 2017**



As Figure 7.1 highlights, there are approved laboratories in each health region in the province, with the majority in the lower mainland within the Vancouver Coastal and Fraser Health region. However, the number of approved laboratories has fluctuated in some regions. For example, during the reporting period, Interior Health gained an approved laboratory (Passmore Laboratory LTD in the Kootenays) while Northern Health lost an approved laboratory in Fort St. John.<sup>12</sup> Nevertheless, another municipal laboratory within Interior Health (City of Kelowna) is currently pending approval,<sup>a</sup> and in the past year of this reporting period the Enhanced Water Quality Assurance Program has received at least three inquiries from laboratories located within Northern Health that are interested in becoming PHO-approved.<sup>13</sup>

In previous PHO drinking water reports, it was recommended that the BC Centre for Disease Control (BCCDC) Public Health Laboratory, the Enhanced Water Quality Assurance Program, the Ministry of Health, and the regional health authorities continue to work together to improve access to laboratory testing for rural and remote areas across the province. A broader network and distribution of PHO-approved

laboratories could help minimize wasted samples and alleviate transport challenges for samples in northern and remote areas. Transport concerns in remote and rural communities highlighted during the reporting period resulted in the development of a planning process described in the following text box, led by the Enhanced Water Quality Assurance Program and the BCCDC Public Health Laboratory, to develop a framework to support decentralized water testing (i.e., Level C laboratories and/or point-of-use testing laboratories) for remote and rural sites.<sup>9</sup>



**Colilert testing - plate sealer.**  
Photo credit: BC Center for Disease Control - Public Health Laboratory.

<sup>a</sup> The City of Kelowna laboratory was approved in December 2017, which was outside of the reporting period.

## Level C and Point-of-Use Testing Laboratories

Level C laboratories are a proposed solution to help ease challenges around access to approved laboratories in rural and remote areas of BC. A level C laboratory would be an Enhanced Water Quality Assurance program (EWQA) approved laboratory that performs only enzyme substrate testing (or an equivalent approved method). The laboratory would be inspected by EWQA peer-auditors and would be required to meet accreditation criteria designed to ensure that testing staff were trained, competent, and following rigorous quality assurance and quality control procedures. Level C laboratories would undergo EWQA accreditation processes that are designed for laboratories using only enzyme substrate testing or an equivalent method.<sup>14</sup>

Point-of-use testing is another proposed solution to address challenges in accessing approved laboratories in rural and remote areas of BC. Point-of-use testing would take place in non-laboratories such as a health unit or other community location. It provides an alternative option for remote sites that cannot meet the 30-hour limit for water quality testing. Testing would be done by a trained individual, but the individual would not require specific microbiology or laboratory training. The competency of the non-laboratory professional who is performing point-of-use testing would be assessed by a tailored quality assurance and quality control program overseen by the EWQA. The selection of sites for point-of-use testing would be based on an assessment process agreed upon by the Provincial Health Officer, the regional health authority, and the BC Centre for Disease Control Public Health Laboratory.<sup>14</sup>

### 7.4.2 Laboratory Testing of Drinking Water Samples

As previously described, drinking water legislation requires operators of water systems to submit water samples for total coliform bacteria and *E. coli* testing on a regular basis. Total coliform bacteria and *E. coli* are indicator bacteria. Their presence indicates contamination in the water or changes in water quality.

The laboratory testing the water must immediately report if *E. coli* is found, except when the water is collected before treatment, when the water is not used for domestic purposes, or if the water system is already on a boil water notice. Under Section 12(1) of the DWPA, the laboratory is required to notify the water supplier, the drinking water officer, and the medical health officer that the system failed to meet the standard. The water supplier is also required to notify the drinking water officer that the laboratory has reported the adverse results to the supplier.<sup>3</sup>



Coolers containing drinking water samples arriving at the BC Centre for Disease Control - Public Health Laboratory.

Photo credit: BC Centre for Disease Control - Public Health Laboratory.

**Table 7.2: Number of Water Samples Submitted, and Number and Percentage of Wasted Samples and Positive *E. coli* Reports, BC, 2012/13 to 2016/17**

Fiscal Year	Samples Submitted	Samples Wasted	Positive <i>E. coli</i> Reports
2012/13	73,003	1,360 (1.90%)	447 (0.61%)
2013/14	72,601	1,474 (2.00%)	365 (0.50%)
2014/15	72,495	1,097 (1.51%)	355 (0.49%)
2015/16	72,660	1,255 (1.73%)	306 (0.42%)
2016/17	73,779	1,018 (1.38%)	245 (0.33%)

**Note:** These figures reflect only positive *E. coli* drinking water samples. Untreated, source water samples are not included. These data only reflect sampling or reporting done by the BC Centre for Disease Control Public Health Laboratory; it does not include sampling or report conducted by other approved laboratories. A sample is considered wasted if analysis of the sample does not begin within 30 hours of it being collected.

**Source:** BC Centre for Disease Control Public Health Laboratory; 2012/13-2016/17.

Table 7.2 shows the total number of samples submitted to the BCCDC Public Health Laboratory, how many were wasted (i.e., the sample had to be discarded), and how many were positive for *E. coli*. For each positive *E. coli* result, the laboratory met the critical reporting requirement<sup>b,3</sup> under Section 12 of the DWPA. The table does not include sampling or reporting information conducted by other approved laboratories; most routine samples for the purposes of complying with sampling requirements under the DWPA are sent to the BCCDC Public Health Laboratory, particularly for small water systems.

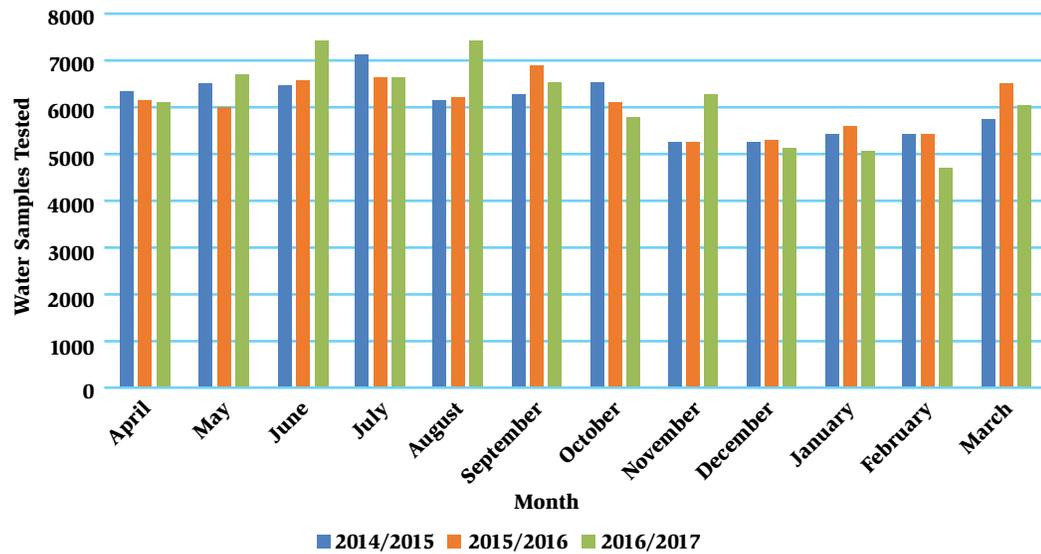
The volume of samples tested at the BCCDC Public Health Laboratory has remained relatively stable over the past five fiscal years, with a slight increase (1.54 per cent) from 2015/2016 to 2016/2017. As shown in Figure 7.2, the number of samples tested varied, depending on the time of year. With regard to the proportion of drinking water samples tested at the BCCDC Public Health Laboratory that were positive for *E. coli*, as shown in Figure 7.3, there was an

overall drop in the percentage reported during the reporting period, and there was variation in the percentages, depending on the time of year.

Analysis of water samples must begin within 30 hours of the samples being collected. If the samples do not arrive on time, they are considered wasted. For most of the province, this is not an issue; however, in remote areas such as the north, the central coast, and parts of the Kootenays, there are challenges in meeting the deadline due to long distances to the drop-off point, as well as periodic issues with bad weather and road conditions. For water systems on Vancouver Island, extreme weather events can affect ferry schedules, resulting in wasted samples. Other reasons for wasted samples include sample bottle leaks, incomplete paperwork, and improper sample bottles. Figure 7.4 shows the percentage of wasted samples between 2014/15 and 2016/17. Overall, the percentage of wasted samples has decreased since 2012/13, when it was 1.9 per cent (Table 7.2), and there was variation in the percentages, depending on the time of year.

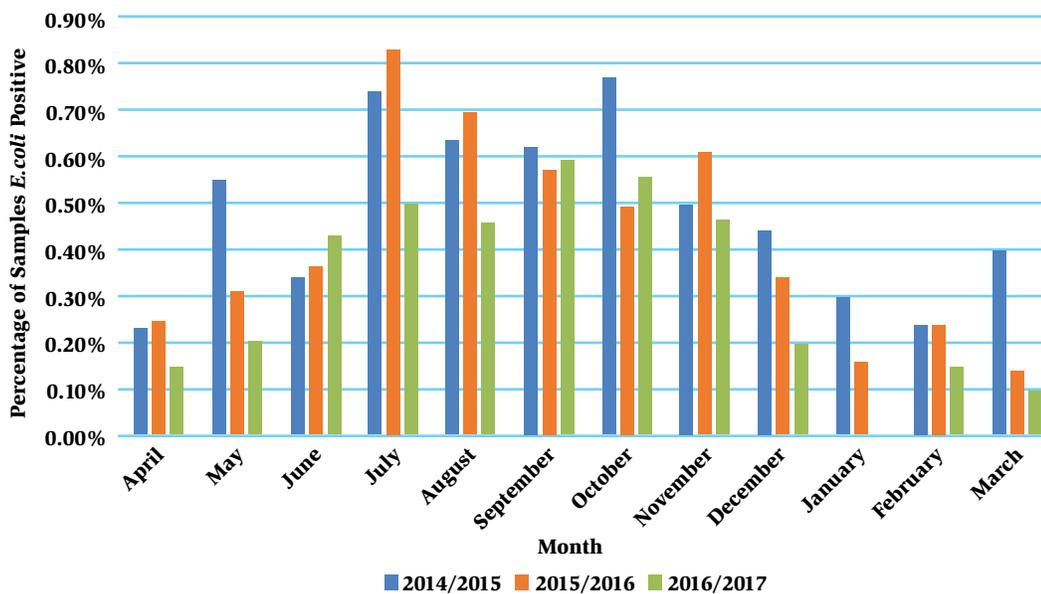
<sup>b</sup> According to Section 12(1) of the DWPA: "If a monitored parameter in relation to a water supply system fails to meet an established immediate reporting standard for that system, the laboratory conducting the analysis must immediately give note to (a) the water supplier, (b) the drinking water officer, and (c) the medical health officer."

**Figure 7.2: Number of Drinking Water Samples Tested at BC Centre for Disease Control Public Health Laboratory, by Month, 2014/15 to 2016/17**



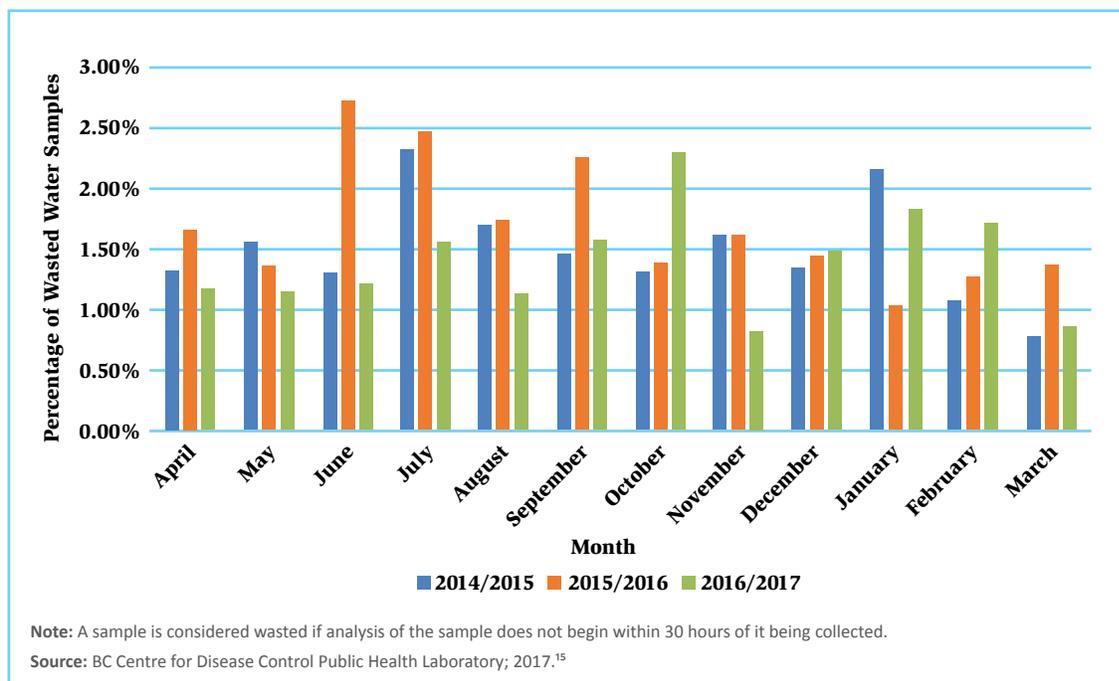
Source: BC Centre for Disease Control Public Health Laboratory; 2017.<sup>15</sup>

**Figure 7.3: Percentage of Drinking Water Samples Tested at BC Centre for Disease Control Public Health Laboratory that Were Positive for *E. Coli*, by Month, 2014/15 to 2016/17**



Source: BC Centre for Disease Control Public Health Laboratory; 2017.<sup>15</sup>

**Figure 7.4: Percentage of Wasted Drinking Water Samples Tested at BC Centre for Disease Control Public Health Laboratory, by Month, 2014/15 to 2016/17**



## 7.5 Drinking Water Quality Monitoring in First Nations Communities

During 2016/17, a total of 38,292 microbiological samples from water systems in First Nations communities were taken and analyzed. Approximately 95 per cent of the samples tested for bacteriological parameters were satisfactory; 4.53 per cent of the results were positive for total coliforms and 0.39 per cent were positive for *E. coli*.<sup>16</sup>

During 2016/17, a total of 1,589 samples from First Nations water systems were taken and tested for chemical and physical parameters. Approximately 92 per cent of the samples had satisfactory results and met guideline levels; results from eight per cent of the samples exceeded the maximum acceptable concentration levels outlined in the *Guidelines for Canadian Drinking Water Quality*.<sup>d</sup> Where results exceeded guideline levels, drinking water advisories were issued.

If the exceedance was in a private water system serving a single private connection, the individual household was notified.<sup>16</sup>

Both community water systems and public water systems as defined in Chapter 2 are routinely sampled every five years for comprehensive chemical, physical, and radiological parameters to ensure compliance with the *Guidelines for Canadian Drinking Water Quality*. The most recent results (2015) indicate that out of the 283 systems sampled, there were only two exceedances of guideline maximum acceptable concentration levels; there were no radiological parameters above guideline levels.<sup>16</sup>

In addition to regular sampling in communities, there may be special project sampling—such as nitrate or biosolids monitoring—that the community requests and/or First Nations Health Authority recommends. First Nations Health Authority also conducts lead and copper sampling in all school and child care facilities on reserve.<sup>16</sup>

<sup>c</sup> Exceedances of bacteriological parameters may be from samples taken from a system that is already under a boil water advisory, and do not necessarily indicate an additional public health threat.

<sup>d</sup> Some of the exceedances were from multiple samples taken from water systems that were under “do not consume” advisories.

The lack of accessible data in the regional health authorities and the differences in oversight and governance make it difficult to draw comparisons for compliance with sampling requirements and results between First Nations and non-First Nations drinking water systems of comparable size. Nevertheless, small water systems on reserve face many of the same water quality and treatment challenges observed off reserve.

## 7.6 Annual Water Supply System Reports

Water suppliers are required to prepare and make public an annual report under the DWPA (Section 15) and the Drinking Water Protection Regulation (Section 11).<sup>3,4</sup> The report must include results of the monitoring that is required by the legislation, the operating permit, or the drinking water officer. Other information that must be reported and made public under Section 15 of the DWPA includes the water supplier's emergency response and contingency plan, any assessments or plans made under Section 18 and 22 of the Act if applicable, or any other information required by the operating permit or the drinking water officer.

Annual reports provide an important opportunity for water users to learn about their water system and what investments may be needed to improve the safety of the delivered water. They also provide a means to educate users about drinking water safety and to share important information about the water supply system and significant recent events or user concerns. The reports can also update users on any public notices or threats to the quality and safety of the water supply.

The PHO and the regional health authorities, as part of the new indicator project, identified compliance with annual reporting requirements as a future indicator of reporting as part of the multi-barrier approach. At this time, only Fraser Health tracks compliance with annual reporting requirements in their data systems. Work is under way in the regional health authorities to be able to track and report this information for future reports. On March 31, 2016, Fraser Health reported that 100 per cent of their water supply systems meet the annual reporting requirements under Section 11 of the Drinking Water Protection Regulation.<sup>6</sup>

## 7.7 Public Notification of Drinking Water Quality Concerns

Under the DWPA, if a prescribed water quality standard is not met, or if the water supplier believes there is a threat to the drinking water, the supplier must notify the drinking water officer. The drinking water officer may request or order the water supplier to give public notice of the potential threat and what actions should be taken by the system users.<sup>3</sup>

Drinking water advisories communicate risk to the public and offer advice when conditions exist that could potentially expose individuals to health threats from their drinking water supply. While outbreaks of waterborne illness in Canada are rare, infections stemming from contaminated water supplies can result in serious health consequences, especially for those with weak immune systems. In Canada, the majority of documented waterborne disease outbreaks and sporadic cases of waterborne illness are associated with microbiological pathogens (i.e., bacteria, viruses, and protozoa).<sup>17</sup> The consequences of waterborne illness that results from consuming contaminated drinking water range from mild cases of diarrhea to severe infections, especially for vulnerable populations. Some infections may result in hospitalizations, secondary infections, chronic diseases (e.g., haemolytic uremic syndrome), or death.<sup>18</sup>

Officials issue boil water notices in emergency situations (such as bacteriological contamination, disruption of treatment, or disinfection failure) or as an administrative precaution when water supplies lack adequate treatment to protect users from potential microbial contamination. These boil water notices warn users and advise them to boil their water or use bottled water to protect themselves from becoming ill from their drinking water supply.<sup>19</sup> The other types of drinking water advisories may warn certain vulnerable populations when risks from microbiological agents are modest, or may inform users not to consume their water when boiling cannot remediate an identified contaminant. BC uses three levels of drinking water advisories: water quality advisories, boil water notices, and do not use water notices<sup>20</sup> described next:



- **Water Quality Advisory** – used when there is some level of risk but a boil water notice or do not use water notice is not required. This is often used when systems are experiencing dirty or turbid water during flushing of lines. The advisory will include what the risk is, what the supplier is doing to address the risk, and what the users can do to minimize their risk.
- **Boil Water Notice** – used when there is a health risk from consuming the water, and the risk can be addressed by boiling the water. The notice will give specific instructions on how long the water must be boiled, and what the supplier is doing to address the risks.
- **Do Not Use Water Notice** – used where there is a health risk from using or consuming the water, and boiling will not address the risk. This type of notice might be used where health parameters exceed the maximum allowable limits; or where there has been an incident of vandalism, or a chemical spill or natural event such as a flood. In some cases, the water may be used for hygienic purposes (e.g., bathing, showering, handwashing, etc.) but not consumption.<sup>e</sup>

Table 7.3 shows the total number of boil water notices, water quality advisories, and do not use water notices in effect as of March 31st, by health authority, for 2013 to 2017. This table only provides a snapshot of the water quality situation in BC. They do not reflect the fluctuations in the number of short-term drinking water advisories across the province. The water systems that have a boil water notice or water quality advisory in place may change significantly over the year. Some systems may be on a drinking water advisory for a short period of time due to a specific incident, such as an extreme storm event causing increased turbidity. Long-term drinking water advisories are usually in place because the water system lacks adequate treatment—if it has treatment at all—to provide safe drinking water. As a result, the drinking water advisory stays in place while they investigate options for treatment.

<sup>e</sup> In situations where exposure to a chemical contaminant does not pose a health risk from inhalation or dermal contact, a Do Not Consume Water Notice can be used. This type of Do Not Use Water Notice informs users that it is safe to use the water for hygienic purposes (e.g., bathing, showering, handwashing, etc.) but not for consumption.

**Table 7.3: Number of Drinking Water Advisories in Effect as of March 31, by Advisory Type and Health Authority, BC, 2013 to 2017**

Year	Advisory Type	Fraser Health	Interior Health	Northern Health	Vancouver Coastal Health	Island Health	Totals
2013	Boil Water Notice	9	358	-	36	42	-
	Water Quality Advisory	0	48	-	0	2	-
	<b>Total</b>	9	406	-	36	44	-
2014	Boil Water Notice	7	352	43	39	30	<b>471</b>
	Water Quality Advisory	0	47	1	0	2	<b>50</b>
	<b>Total</b>	7	399	44	39	32	<b>521</b>
2015	Boil Water Notice	6	357	54	45	14	<b>476</b>
	Water Quality Advisory	0	47	1	0	2	<b>50</b>
	Do Not Use Notice	0	1	1	0	1	<b>3</b>
	<b>Total</b>	6	405	56	45	17	<b>529</b>
2016	Boil Water Notice	8	361	52	49	21	<b>491</b>
	Water Quality Advisory	0	46	0	0	2	<b>48</b>
	Do Not Use Notice	0	1	1	0	0	<b>2</b>
	<b>Total</b>	8	408	53	49	23	<b>541</b>
2017	Boil Water Notice	7	398	54	52	30	<b>541</b>
	Water Quality Advisory	0	55	1	0	2	<b>58</b>
	Do Not Use Notice	0	1	1	0	2	<b>4</b>
	<b>Total</b>	7	454	56	52	34	<b>603</b>

**Note:** Data on do not use notices were not collected for 2013 and 2014. These notices were counted for this report beginning in 2015. Northern Health was unable to retrospectively provide data on drinking water advisories for 2013; therefore, totals for BC that year could not be calculated.

**Source:** Regional health authorities; 2012/13-2016/17.

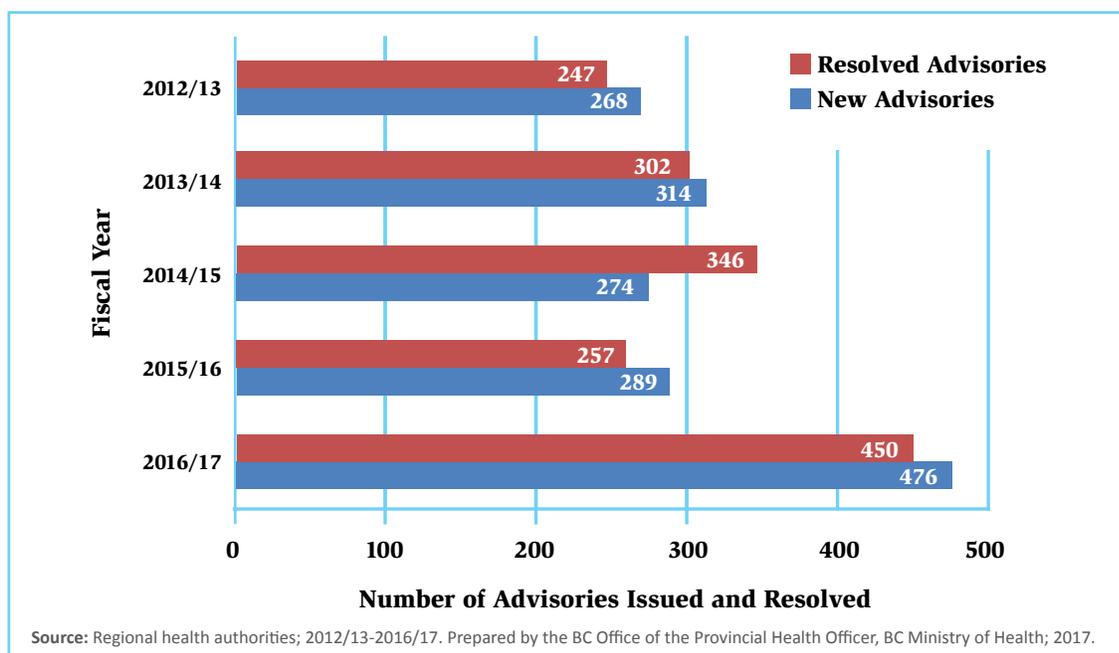
As shown in Table 7.3, the majority of drinking water advisories in place are boil water notices. There are few water quality advisories in use at any time, with the vast majority occurring within Interior Health, where water quality advisories are commonly used as a risk communication tool during seasonal turbidity events. Do not use water notices are also rare, with only a few in place across the province as of March 31, 2017: one due to elevated arsenic levels in a water system servicing a campground within Interior Health,<sup>21</sup> and another from high levels of manganese and moderate levels of arsenic in a water system servicing a community hall within Northern Health.<sup>22</sup> Island Health is the only other health authority reporting a do not use water notice; however, their data system does not currently track the reason that drinking water advisories are issued.<sup>23</sup>

Table 7.3 also demonstrates a growing trend of the number of drinking water advisories in place over the past few years, with the highest year being 2017, at 603 as of March 31<sup>st</sup>. Because the data reported are just a snapshot in time, it is difficult to draw conclusions about the increase in numbers. It may be the result of seasonal weather differences from year to year causing variations of the number of

short-term drinking water advisories in place at the time when the data are collected. The year 2017, in particular, saw many extreme weather events, especially within Interior Health, and this led to more drinking water advisories being issued than in other years.

The Office of the PHO recognizes these data limitations and continues to work with the regional health authorities to improve how data are collected and reported, including improving the quality of data on drinking water advisories. Future drinking water reports will include reporting on the length of the drinking water advisories, the reasons they are in place, and the type and size of the systems impacted. In the interim, the regional health authorities provided data on how many new drinking water advisories were issued and how many were resolved within the same fiscal year (Figure 7.5). Although the number of drinking water advisories resolved was close to the number of new drinking water advisories issued in most years, the number of new drinking water advisories exceeded the number being resolved in each fiscal year (except 2014/15) which indicates that several of the systems that were placed on a drinking water advisory in those years were not resolved in those years.

**Figure 7.5: Number of Drinking Water Advisories Issued and Resolved within each fiscal year, BC, 2012/13 to 2016/17**





A First Nations Operator takes a last look at the boil water sign before it comes down after a decade-long boil water notice.  
Photo credit: RES'EAU a Centre for Mobilizing Innovation.

The number of boil water notices in BC has drawn attention and criticism from several reports.<sup>24,25,26,27</sup> While BC health officials agree that the number of boil water notices remains a concern, they also point out the large number of small water systems that BC regulates and that the number of notifications also indicates drinking water officer involvement with oversight of those small water systems. As of March 31, 2017 there were 4,412 small water systems in BC. Many of these small systems have proven to be unsustainable financially and operationally and continue to struggle to provide potable water and meet regulatory requirements (Chapter 9). The extent of this continued non-compliance and inability to provide adequate treatment and infrastructure among small water systems is reflected in the relatively consistent large number of boil water notices across the province, particularly within Interior Health (See text box on next page).

Many small water systems in other jurisdictions may have experienced the same water quality issues and infrastructure shortfalls as small systems on boil water notices in BC; however, drinking water officials in those jurisdictions may not have recorded those issues or issued any public notifications to warn users of potential health threats, because those systems may not have been regulated as a

water supplier. For example, residential water systems with less than 15 service connections fall outside of the drinking water legislation of Nova Scotia<sup>28</sup> and the Yukon.<sup>29</sup> While these small systems may access health promotion materials and seek advice and sampling assistance from regulatory drinking water programs, their water quality issues would not be captured by any provincial/territorial water surveillance system or be counted in a cross-jurisdictional investigative report.

Tracking the number of water systems on a boil water notice can also mislead readers and users of the information, because the proportion of systems under notification does not reflect the proportion of the population affected. As stated in the 2008 PHO drinking water report, *Progress on the Action Plan for Safe Drinking Water in British Columbia 2008*, the majority of long-term advisories in BC persist among small water systems serving an estimated one per cent of the total population in the province.<sup>30</sup> BC health officials agree that boil water notices should not be used as an alternative to treatment or as a long-term management plan. Nevertheless, public notifications and risk assessments by drinking water officials help protect the health of the public, and are reflective of the level of engagement BC has with very small systems compared to other parts of Canada.

## Boil Water Notices in Interior Health Authority

Interior Health continues to have the largest number of boil water notices in BC (Table 7.3). This is in part due to the fact that Interior Health has the greatest number of water systems (1,860 in 2017), and over 90 per cent of those systems are small systems serving 500 people or less. As described in Chapter 9, small water systems face significant operational, financial, and governance challenges in providing potable water to their users. As a result, boil water notices and regulatory non-compliance are more likely to occur among small water systems. As noted in a 2014 newsletter from Interior Health, one in every six small water systems in that region was on a boil water notice. The two most common reasons for the boil water notice were positive coliform results and inadequate treatment.<sup>31</sup>

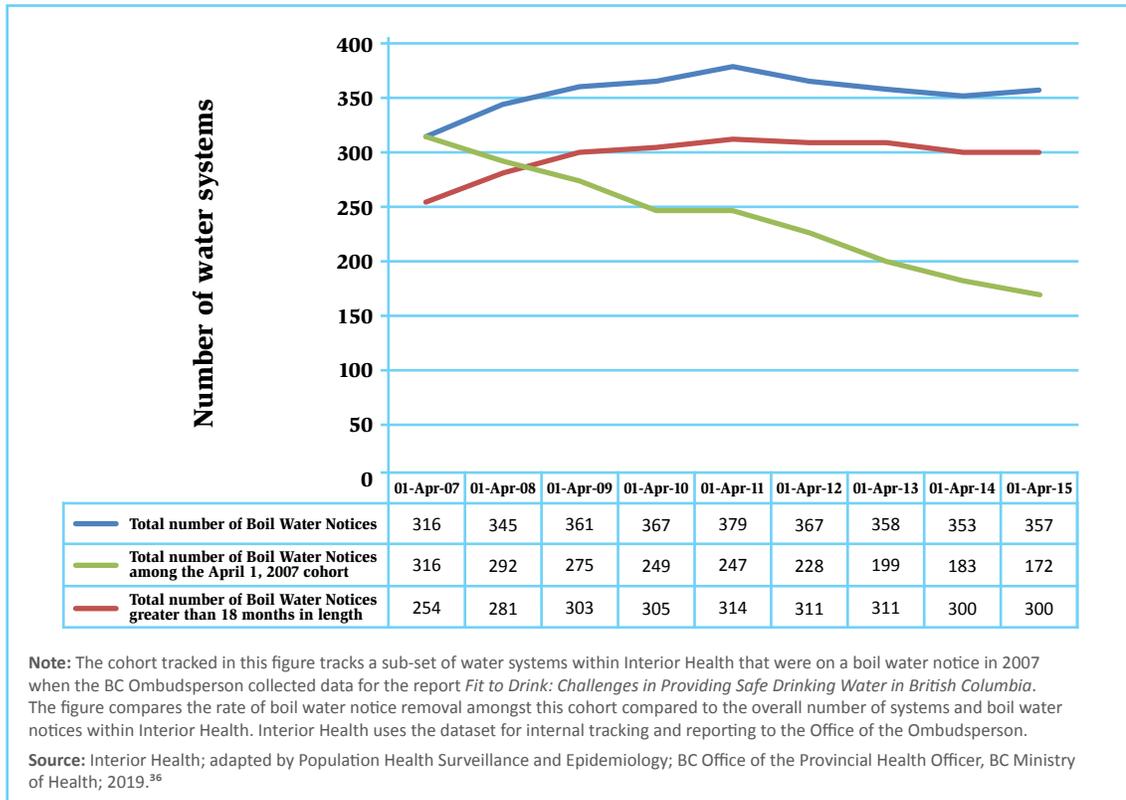
Since the release of the 2008 Report by the Office of the Ombudsperson entitled *Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia*, Interior Health has focused their efforts on reducing the number of boil water notices in their region, especially among small water systems. Early efforts included the Boil Water Remediation Program, which was launched in 2010 to improve drinking water quality among high-risk small water systems. This program used a standardized assessment tool to categorize water system risks. A management strategy that required small water systems to identify a governance structure and treatment options for remediation was applied to water systems categorized as high risk through standardized conditions on their operating permit. By the winter of 2012, 66 of 304 systems on a long-term boil water notice had been entered into the remediation program.<sup>32</sup> This approach proved difficult to manage given the limited number of environmental health officers compared to the number of small water systems in the region. As a result, the program was re-evaluated and eventually discontinued.<sup>f,33</sup>

Interior Health has continued to refine its approach to working with small water systems<sup>34</sup> and has developed a new strategy focused on capacity building. In 2014, Interior Health reorganized the water program to create a focused team of environmental health officers to implement their new small water systems strategy and provide services to over 1,200 small community water systems in the region. As a result of these ongoing efforts, Interior Health has removed long-term boil water notices at a rate of approximately 19 systems per year.<sup>31</sup>

Despite these efforts, the total number of small water systems and systems with challenges continues to grow and the number of boil water notices within Interior Health has increased since the release of the 2008 Ombudsperson's Report. Although the number of boil water notices has increased, Figure 7.6 documents the successes achieved in reducing the number of boil water notices among the cohort of water systems that were on an long-term boil water notice when the Office of the Ombudsperson collected their data in 2007. Since the release of that report, Interior Health has tracked the removal rate of boil water notices within that cohort both for internal tracking and for providing updates to the Office of the Ombudsperson. As the figure highlights, the number of boil water notices among the 2007 cohort had dropped from over 300 in 2007 to 172 in 2015. Due to an administrative database change in 2015/16, Interior Health was unable to provide numbers for the 2007 cohort for April 2016; however, as of November 2017, the number of boil water notices among the 2007 cohort had dropped further to 159.<sup>35</sup> In light of this information, we can conclude that slow, steady progress is occurring to address water quality concerns among systems that go on long-term advisory, despite the increasing number of new advisories.

<sup>f</sup> By December 2015, 96 small water systems were in the program.

**Figure 7.6: Water Systems on Boil Water Notice, 2007 Cohort, Interior Health, 2007 to 2015**



### 7.7.1 Drinking Water Advisories in BC First Nations Communities

First Nations Health Authority’s Environmental Public Health Services provides recommendations to First Nations on when a drinking water advisory is warranted. A drinking water advisory in a First Nations community can affect as little as one building—it does not always represent a community-wide drinking water issue. It is the responsibility of the First Nations Chief and Council to implement a drinking water advisory and take the necessary measures to rectify the issues that led to the advisory. Some issues can be fixed with routine maintenance procedures, while others, such as infrastructure improvements, may require significant infrastructure investments by funding agencies such as Indigenous Services Canada. Once remedial measures are completed, Environmental Public Health Services supports communities by verifying that the drinking water is safe and is protected from potential future problems.<sup>37</sup>

Drinking water advisories in First Nations communities in BC are posted and updated on a monthly basis on the First Nations Health Authority website. They also share information on drinking water advisories with the regional health authorities on a monthly basis, and collaborate on issues of joint interest.<sup>37</sup>

The information on drinking water advisories that is posted on the First Nations Health Authority website is current as of the date of posting. For example, on August 31, 2017, there were 20 advisories in effect in 18 First Nations communities in BC (14 boil water advisories and six do not consume advisories). These advisories include water systems with five or more connections and any water systems that have public facilities connected to them.<sup>37</sup> Of the 20 advisories in place on August 31, 2017, 13 were long-term (i.e., lasting longer than one year). Work continues to lift long-term advisories. During 2016, seven long-term boil water advisories were lifted.<sup>37</sup>

## 7.8 Waterborne Disease Surveillance

While the number of drinking water advisories in BC may be high, the number of documented disease outbreaks and confirmed cases of illness associated with drinking water supplies remains low for a variety of reasons, including underreporting and the challenges associated with detecting an outbreak associated with small and private drinking water supplies.

The Health Act Communicable Disease Regulation under the *Public Health Act* requires physicians and laboratories to report all known or suspected cases of waterborne illness to the regional medical health officer.<sup>38</sup> Health authority staff may follow up on individual cases through direct contact with the patient to request information on activities the patient had recently engaged in that may have resulted in the illness. Information collected relates to type of food and water consumed, contact with animals and ill people, travel outside of the country, etc. The medical health officer then reports information on all cases to the BCCDC. Regional health authorities and BCCDC review the data and identify any clusters of illness that may indicate the occurrence of an outbreak, and report trends in illness over time and space.

Cases of gastrointestinal illness (i.e., diarrhea and/or vomiting) are underreported for a variety of reasons listed in previous *Progress*

*on the Action Plan for Safe Drinking Water in British Columbia* reports. Researchers have estimated that for every case of acute gastrointestinal illness (enteric disease) reported provincially, an average of 347 community cases actually occurred in BC.<sup>39</sup> Similarly, another study of underreporting in Canada found that for each case reported in Ontario, an estimated 285 cases in the community went undetected.<sup>40</sup> Although acute enteric disease remains underreported, the enteric disease data reported by the BCCDC are representative of enteric disease trends in BC and play an essential role in identifying outbreaks.

Only one drinking water-related outbreak was reported in BC between 2007 and 2016. It occurred in 2014 in a rural Interior Health community served by a private well that drew from untreated surface water. Four individuals reported acute gastrointestinal symptoms, but the pathogen was not confirmed.<sup>41</sup> During this same time period, individual British Columbians were regularly affected by enteric, or gastrointestinal, diseases from pathogens that can be waterborne such as *Campylobacter*, shigatoxigenic *E. coli*, *Cryptosporidium*, *Giardia*, and non-typhoidal *Salmonella* (Table 7.4; Figure 7.7). Although outbreaks remain relatively uncommon, the public health risk from pathogens associated with consuming water from inadequately treated or poorly protected supplies remains a threat.<sup>42</sup>

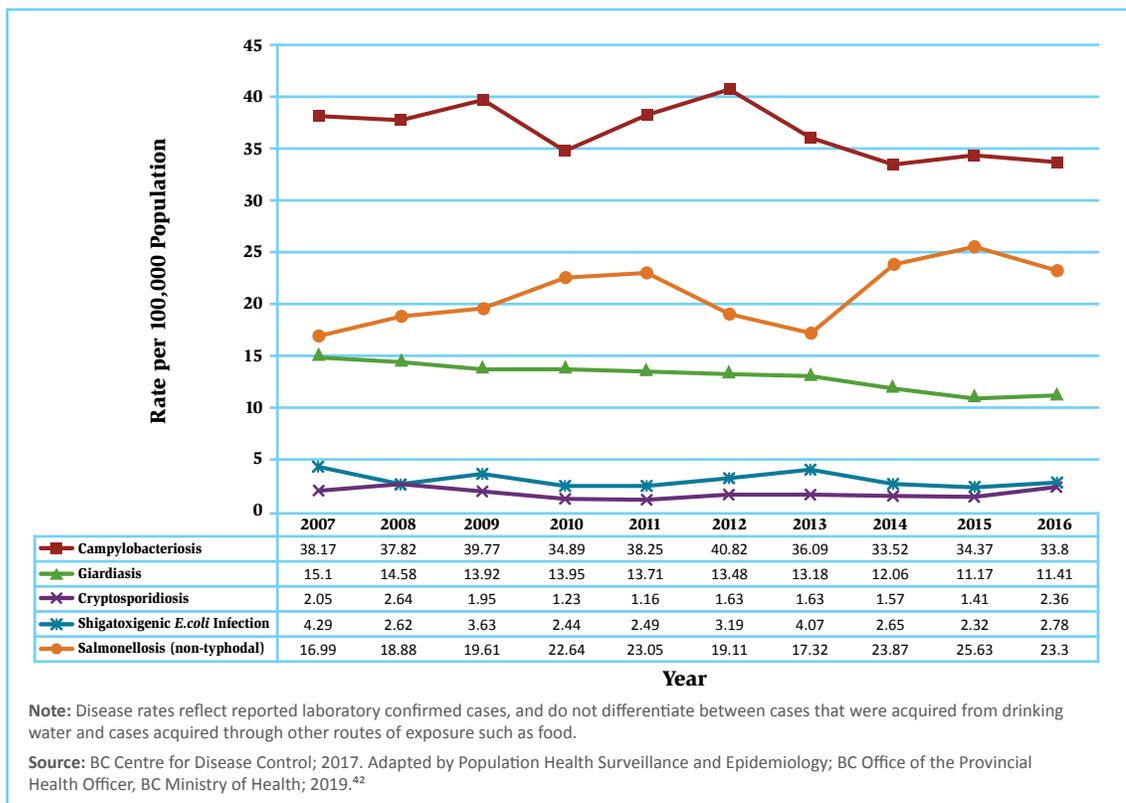
**Table 7.4: Reported Cases of Enteric Disease, BC, 2007 to 2016**

Enteric Disease	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Campylobacteriosis	1,638	1,645	1,754	1,558	1,721	1,856	1,656	1,557	1,613	1,606
Giardiasis	648	634	614	623	617	613	605	560	524	542
Cryptosporidiosis	88	115	86	55	52	74	75	73	66	112
Shigatoxigenic <i>E. coli</i> Infection	184	114	160	109	112	145	187	123	109	132
Salmonellosis (non-typhoidal)	729	821	865	1,011	1,037	869	795	1,109	1,203	1,107
<b>Total</b>	<b>3,287</b>	<b>3,329</b>	<b>3,479</b>	<b>3,356</b>	<b>3,539</b>	<b>3,557</b>	<b>3,318</b>	<b>3,422</b>	<b>3,515</b>	<b>3,499</b>

**Note:** Disease rates reflect reported laboratory confirmed cases, and do not differentiate between cases that were acquired from drinking water and cases acquired through other routes of exposure such as food.

**Source:** BC Centre for Disease Control; 2017.<sup>42</sup>

**Figure 7.7: Annual Enteric Disease Rates, BC, 2007 to 2016**



Campylobacteriosis remains the most commonly reported enteric disease in BC. Research estimates that 70 to 80 per cent of campylobacteriosis cases are foodborne. The number of reported cases has remained stable over the last decade (Figure 7.7).<sup>42</sup> *Campylobacter* infection can be transmitted via drinking water if the water is contaminated with animal or human fecal material and has not been adequately treated.

Cryptosporidiosis has caused waterborne outbreaks throughout North America, including two recreational water outbreaks identified in BC in 2003. No drinking water outbreaks have been reported in BC in the last decade. However, the majority of background (endemic) cases of cryptosporidiosis are likely waterborne. Since *Cryptosporidium* is resistant to disinfection by chlorine alone, cases may be linked to water supplies that are not filtered or treated with ultraviolet irradiation as these methods of treatment are more effective at protecting consumers from *Cryptosporidium* infection. The rate of cryptosporidiosis in BC remained

low between 2010 and 2015 and increased for unknown reasons in 2016 (Figure 7.7).<sup>43</sup>

Annual rates of shigatoxigenic *E. coli* infection in BC have remained relatively stable, with peaks in incidence often associated with foodborne outbreaks (Figure 7.7). Research estimates that 70 to 80 per cent of shigatoxigenic *E. coli* infection cases are foodborne. The rest are spread through contact with infected humans or animals or by ingestion of contaminated water.<sup>42</sup> The number of BC cases that could have been waterborne is unknown, although there were no outbreaks of waterborne *E. coli* infection reported in BC during the last decade.

Annual rates of giardiasis in BC have decreased gradually over the last decade (Figure 7.7). Giardiasis can be transmitted from person to person and from animals to humans, but the majority of cases are believed to be due to ingestion of contaminated water, both in BC and during travel abroad.<sup>42</sup> *Giardia*-contaminated water is often associated with lakes and streams, as opposed to groundwater sources.



Giardiasis, commonly known as "beaver fever" is caused when a person gets infected by *Giardia* cysts. *Giardia* is a parasite that infects the intestines of humans and animals, and is often associated with water that has not been properly filtered, treated, or boiled.

Approximately 80 to 90 per cent of salmonellosis cases are believed to be foodborne. Only a small proportion of cases are waterborne. The incidence of salmonellosis in BC rose between 2007 and 2011 and again between 2014 and 2016 (Figure 7.7), due to an ongoing *Salmonella* Enteritidis outbreak transmitted through contaminated eggs and poultry products.<sup>43</sup>

## 7.9 Conclusion

This chapter provided an overview of and update on activities relating to monitoring, laboratory testing, and reporting as supporting elements of the multi-barrier approach and total quality management. Holistic monitoring of drinking water includes more than just monitoring the finished water quality against allowable limits. It also includes monitoring the source and the performance of the treatment and delivery processes. While monitoring of source waters, treatment performance, and water quality for drinking water occurs in BC, the data remains decentralized and difficult to access. This makes it difficult to draw conclusions or analyze trends at the provincial level.

The new indicator project undertaken by the Office of the Provincial Health Officer, the Ministry of Health, and the regional health authorities identified new indicators for effective

monitoring that could be used in future reports. These indicators include meeting sampling frequency targets for bacteriological and chemical sampling, and secondary residual monitoring as an indicator of performance monitoring of secondary disinfection. At this time, the available data indicate that improvements are needed to compliance rates for bacteriological sampling, particularly among small systems. Data on the number of systems with a completed chemical analysis and secondary residual monitoring also remain unavailable until health authorities complete the work to modify their databases in order to collect and report on these new indicators.

Accurate, timely, and reliable water quality results depend on access to an approved laboratory for water quality monitoring. Previous drinking water reports by the Provincial Health Officer have called for a broader network of approved laboratories in order to improve access in rural and remote parts of the province. While the number of approved laboratories has increased slightly since 2012, accessibility and transport difficulties continue to challenge many northern, interior, and remote communities. In response, the BC Centre for Disease Control Public Health Laboratory is leading a project to support decentralized water testing for remote and rural sites.

Recordkeeping and reporting is also essential to total quality management. The Office of the Provincial Health Officer and the regional health authorities identified compliance with annual reporting requirements as an indicator for reporting as part of the multi-barrier approach.

Public notification of water quality concerns is another form of compliance monitoring and reporting, and this occurs through drinking water advisories (water quality advisories, boil water notices, and do not use notices). Most advisories in BC are boil water notices, and over 90 per cent occur among small water systems. The number of overall drinking water advisories in BC remains high; in fact, an annual count of advisories saw a spike in 2017. While the province has had success in resolving short- and long-term advisories, new advisories exceed the rate of resolution.

While the number of drinking water advisories overall remains high, the available data are limited and only provide a snapshot in time. The Office of the Provincial Health Officer and the

regional health authorities, as part of the new indicator project, have revised and expanded the type of information that will be collected regarding public notification, in order to better reflect the length of drinking water advisories and the reasons they are in place. Although the number of long-term boil water notices in BC remains troubling, it is reflective of the large number of small water systems in BC and the management and financial challenges such systems face. As BC regulates much smaller systems than other provinces, the number of long-term drinking boil water notices in place also reflects the level of public health involvement and risk messaging with drinking water suppliers at the most micro level.

Despite the large number of boil water notices in BC, the number of reported waterborne disease outbreaks remains low. However, underreporting of gastrointestinal diseases is common, which makes it difficult to detect outbreaks among small systems. Thus, the threat of illness from drinking contaminated water with inadequate treatment remains.

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# 8 Abatement and Enforcement

Effective regulatory drinking water protection programs require both abatement and enforcement programs. Abatement involves working collaboratively with system owners and operators to prevent and/or correct drinking water quality concerns. Enforcement involves taking appropriate action when violations of specific requirements occur.<sup>1</sup> The drinking water programs in BC focus primarily on abatement activities, which include regular inspections, education, and engagement. While enforcement of the *Drinking Water Protection Act* (DWPA) does occur when necessary, drinking water programs across BC use a progressive enforcement framework that focuses on hazard abatement and gaining compliance through collaboration and education.

Under the DWPA, the Provincial Health Officer (PHO) must prepare and deliver an annual report respecting activities under the Act for each year.<sup>2</sup> As part of the new indicator project being undertaken by the Office of the PHO and the regional health authorities, a number of resources and activities under the Act were identified for routine reporting. Program resources identified for routine reporting include an annual count of full-time equivalent positions within the regional health authority drinking water programs. Activities under the Act identified for routine reporting include health authority data on the number of inspections and water system engagement activities; Section 29 investigations and other complaint follow-ups; enforcement activities; and reconsiderations or reviews requested under the Act. This chapter presents an update on these program resources and activities for fiscal years 2012/13 through 2016/17.

## 8.1 Drinking Water Program Resources

To carry out their mandate under the DWPA, the regional health authorities must have sufficient resources and staff to implement abatement and enforcement activities to protect the public. In the regional health authorities, environmental health officers are delegated the authority of a drinking water officer (DWO), and they administer the DWPA and the Drinking Water Protection Regulation. Drinking water programs vary across the province; some regional health authorities have environmental health officer positions that are dedicated to drinking water, while others have environmental health officer positions that deal with all aspects of the environmental health program, including drinking water. The total number of DWO delegates and support staff varies in each regional health authority, and is based on a variety of factors, including the number of drinking water systems in the health authority, and the organizational structure of the health authority.

A full-time equivalent (FTE) is a measure of the amount of time spent by all of the people working on drinking water, based on how many people would have been involved if they worked full time on drinking water. It does not measure the total number of people who have a role in drinking water protection. For example, if a medical health officer spends one day a week working with drinking water issues, it would equal 0.2 FTE. If five environmental health officers each work one day a week on drinking water, that would equal one FTE. Table 8.1 shows the number of FTEs working on drinking water in each health authority by position (excluding clerical and administrative support) as of March 31, 2017.

**Table 8.1: Number of Full-time Equivalent (FTE) Staff Appointed or Delegated the Duties of a Drinking Water Officer under the *Drinking Water Protection Act*, by Health Authority and Position, BC, on March 31, 2017**

Regional Health Authority	Medical Health Officers	Environmental Health Officers (EHOs)			Public Health Engineers in Support of Drinking Water Program	Managers in Support of Drinking Water Program	Total
		Drinking Water-focused/Specialist	Generalist with Duties in Drinking Water	Supervisors of EHOs with Duties in Drinking Water			
Island Health	0.75	2.00	6.00	1.00	1.00	0.20	<b>10.95</b>
Northern Health	0.20	0.00	3.50	0.20	0.90	0.25	<b>5.05</b>
Vancouver Coastal Health	0.25	0.75	2.75	0.50	0.50	0.30	<b>5.05</b>
Interior Health	0.50	11.00	1.50	2.20	4.00	1.20	<b>20.40</b>
Fraser Health	0.50	6.00	0.00	0.00	1.00	1.05	<b>8.55</b>
<b>Total</b>	<b>2.20</b>	<b>19.75</b>	<b>13.75</b>	<b>3.90</b>	<b>7.40</b>	<b>3.00</b>	<b>50.00</b>

Source: Regional health authorities; 2017.

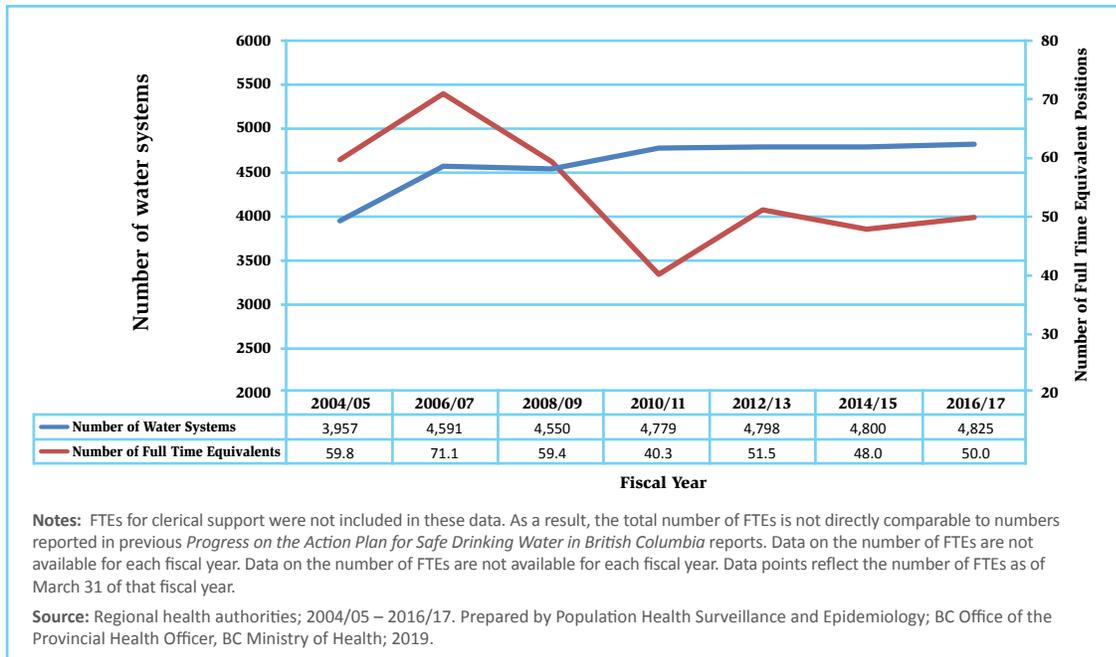
After the DWPA was proclaimed in 2003, the province gave the five regional health authorities a total of \$2 million to fund positions for DWOs, which led to an increase to approximately 60 FTEs in 2004/05.<sup>3</sup> By 2006/07 the number of FTEs (excluding clerical positions) had peaked at 71.1,<sup>4</sup> after which the number of FTEs began to decrease (Figure 8.1). This could be due to actual changes in the amount of time spent dealing with drinking water issues, changes in the way the health authorities counted their FTEs, actual reductions in the number of positions, or efficiencies achieved by reorganization of the programs. As shown in Table 8.1, in 2016/17, there were 50 FTEs across the regional health authorities that supported the drinking water program. This number is up slightly from the numbers in recent years during this reporting period

(48.5 FTEs in 2015/16, 48.0 FTEs in 2014/15, and 49.2 FTEs in 2013/14), but down slightly from the 51.5 FTEs in 2011/12 (excluding clerical) reported in the last PHO drinking water report.<sup>5</sup>

Over the same time period, the number of recorded water systems (3,957 in December 2003<sup>3</sup>) increased by 868 to 4,825 as of March 31, 2017. The number of systems changes as new systems are created, existing unregulated systems are identified, and other systems close or amalgamate. There are currently, on average, over 144 water systems per environmental health officer FTE. Similarly, there are, on average, 650 water systems per public health engineer FTE in the province.

This ratio of drinking water program FTEs to water systems (Figure 8.1) is troubling, given the complexities of issues surrounding governance;

**Figure 8.1: Number of Full-time Equivalent Positions Working Within Health Authority Drinking Water Programs Compared to the Number of Permitted Water Systems, 2004/05 to 2016/17**



financing and planning for source protection; and treatment, distribution, monitoring, and operation of water systems. The work of a public health engineer or an environmental health officer that has been delegated the duties of a DWO requires additional time and specialized expertise to ensure water suppliers are meeting public health expectations. In addition, the complexity of the issues around financing drinking water infrastructure means that drinking water program staff must spend considerable time educating water suppliers, communities, and politicians on the public health risks associated with their systems and why the expenditures, rate increases, or planning processes are necessary. Given the limited resources available in the regional health authorities, staff in the drinking water programs must prioritize how they engage with water suppliers and deliver their programs. It will be difficult to increase the frequency of engagement with water suppliers and the [level of/number of] compliance activities under the DWPA without significant increases in the resources available to drinking water programs at the health authority or provincial policy level.

## 8.2 Drinking Water Inspections and Investigations

### 8.2.1 Drinking Water System Inspections

Drinking water officers have the authority to conduct inspections of water supply systems under Section 40 of the DWPA.<sup>2</sup> This section in turn gives DWO delegates all the powers of a medical health officer under Part 4, Division 4 of the *Public Health Act*.<sup>6</sup> The *BC Drinking Water Officers' Guide* recommends each health authority develop inspection frequency policies that are based on risk and other relevant factors such as the quality and potability of the water supply, the probability and impact of an adverse event occurring, system complexity, and past performance history.<sup>7</sup>



View from the Kamloops Centre for Water Quality Operators Control Room where they have the Supervisory Control and Data Acquisition (SCADA) system and security monitors. Operators can conduct all process operations of the facility from this room.

Photo credit: Olsen Imaging.

At this time, there is variation in regional health authority policies for frequency of inspection of drinking water supply systems (Table 8.2). Despite these differences, all of the drinking water programs in the regions do use a risk based approach to prioritize inspections and engagement with water suppliers. These

inspection priority assessments determine for each system whether there is a low, medium, or high risk of a threat to public health. The inspection frequency is then based on the determined risk level. Higher risk water systems generally receive more frequent inspections than low risk water systems.

**Table 8.2: Drinking Water Inspection Frequency Targets, Regional Health Authorities**

<b>Island Health</b>	Based on a priority risk assessment: <ul style="list-style-type: none"> <li>• high priority – two inspections every year</li> <li>• moderate priority – one inspection every year</li> <li>• low priority – one inspection every other year</li> </ul>
<b>Northern Health</b>	Not available – policy under development
<b>Vancouver Coastal Health</b>	Based on hazard rating: <ul style="list-style-type: none"> <li>• high hazard – two inspections every year</li> <li>• moderate hazard – one inspection every year</li> <li>• low hazard – one inspection every other year</li> </ul>
<b>Interior Health</b>	Targeted approach
<b>Fraser Health</b>	One routine inspection per year for every water system

Source: Regional health authorities; 2017.

During the reporting period, Interior Health abandoned its priority assessment tool for small and large community water systems. In its place, a targeted approach to inspections was adopted over the traditional routine inspection model. With this new system, the drinking water program sets inspection targets based on the objectives of the annual operations plan. For example, the targets may involve addressing a particular issue with water systems, such as making sure all systems have or are working on

an emergency response plan. Given the very large number of water systems within Interior Health, this approach has allowed the drinking water program to focus its efforts and limited resources on issues that may have the greatest impact on minimizing risk and supporting community systems both large and small.<sup>8</sup>

Table 8.3 shows the percentage of water systems across the five regional health authorities that received an inspection or assessment

**Table 8.3: Percentage of Drinking Water Systems Inspected and Meeting Inspection Frequency Targets, by Health Authority, BC, 2014/15 to 2016/17**

Health Authority	Fiscal Year	Percentage of Water Systems Receiving an Inspection or Assessment	Percentage of Water Systems Meeting Inspection Frequency Targets
Island Health	2014/15	Not available	Not available
	2015/16	87%	85%
	2016/17	33.5%	71%
Northern Health	2014/15	16.5%	Not available
	2015/16	25%	Not available
	2016/17	39.5%	Not available
Vancouver Coastal Health	2014/15	54%	Not available
	2015/16	52.5%	Not available
	2016/17	47%	Not available
Interior Health	2014/15	Not available	Not available
	2015/16	Not available	Not available
	2016/17	71%	Not available
Fraser Health	2014/15	100%	100%
	2015/16	100%	100%
	2016/17	98%	98%

**Notes:** Data from Interior Health on the number of inspections for 2014/15 and 2015/16 are unavailable, due to the adoption of a new version of the health authority's data system in 2014, and the inability to extract these data during the transition to the new system. Island Health was unable to retrieve data on inspections for 2014/15 retrospectively for this report.

**Source:** Regional health authorities; 2014/15 – 2016/17.



Aerial view of the Seymour-Capilano filtration plant in North Vancouver.  
Photo credit: Metro Vancouver.

between 2014/15 and 2016/17. During these three fiscal years, only Fraser Health and Island Health were able to calculate the percentage of systems meeting inspection targets (Table 8.3). Because data are lacking on whether inspection frequency targets were met, it is difficult to draw any conclusions based on the percentage of water systems inspected. As the frequency of inspections is usually based on risk, not every water system requires an annual inspection. Therefore, the percentage of water systems receiving an inspection each year is usually not 100 per cent. However, the low percentages of systems receiving an inspection in some of these years, particularly in Northern Health, suggest a low inspection frequency. Staffing shortages at Northern Health continue to create challenges in providing inspection services to the large numbers of small water systems, which are often located in difficult to reach areas spread across the health authority.

For 2012/13 and 2013/14 the Office of the PHO asked the health authorities to calculate the percentage of systems meeting their inspection frequency targets based on the assessment

of risk used by each health authority. Only Island Health and Interior Health were able to report by risk category, and their results are shown in Table 8.4. The remaining regional health authorities are not included in Table 8.4 for a variety of reasons. Northern Health was unable to report on inspection frequencies due to limitations of its data system.<sup>9</sup> Vancouver Coastal Health is not included because at the time of the data request, it did not have an agreed-upon risk assessment tool for determining inspection frequencies. However, Vancouver Coastal Health did provide data on the percentage of water systems receiving an annual inspection (52 per cent during 2012/13 and 57 per cent during 2013/14).<sup>10</sup> Fraser Health is also not included in the table as it does not set its inspection targets based on risk. However, Fraser Health was able to report that 99.8 per cent of systems received an inspection in 2012/13 and 97 per cent in 2013/14.<sup>11</sup> As shown in Table 8.4, it was more difficult for regional health authorities to meet inspection targets for high-risk systems, which require more frequent inspections, than lower risk systems.

**Table 8.4: Percentage of Water Systems that Met Inspection Targets, by Risk Category, 2012/13 to 2013/14**

Health Authority	2012/13			2013/14		
	High Risk	Medium Risk	Low Risk	High Risk	Medium Risk	Low Risk
Island Health	34	78	88	35	74	122
Interior Health	58	104	95	59	108	77

**Notes:** Inspection frequencies at Interior Health between 2012/13 and 2013/14 were annual for high-risk systems, and every two years for medium- and low-risk systems. Inspection frequencies at Island Health for these fiscal years were twice per year for high-risk systems, annual for medium risk, and every two years for low risk. Fraser Health is not included in the table as it does not set its inspection targets based on risk. Northern Health is not included as it was unable to report on inspection frequencies due to limitations of its data system. Vancouver Coastal Health is not included because at the time of the data request, it did not have an agreed-upon risk assessment tool for determining inspection frequencies.

**Source:** Island Health and Interior Health; 2014.

**Table 8.5: Percentage of Water Systems Receiving an Inspection, by the Number of Connections, Vancouver Coastal Health Authority, 2012/13 to 2013/14**

Health Authority	2012/13			2013/14		
	> 300 Connections	299-15 Connections	< 15 Connections	> 300 Connections	299-15 Connections	< 15 Connections
Vancouver Coastal Health	63	69	46	68	67	53

**Source:** Vancouver Coastal Health Authority; 2014.

While Vancouver Coastal Health was unable to report on inspection frequency targets as shown in Table 8.4, they provided data on the percentage of water systems receiving an inspection by the number of connections served by the water system (Table 8.5). Although the health authority indicated that the larger systems are usually lower hazard facilities, they generally are a higher priority for inspection compared to smaller systems (i.e., those with less than 15 service connections).<sup>10</sup>

One of the biggest challenges to meeting inspection frequency targets, as they are currently determined, is the limited number of environmental health officers that have been delegated DWO responsibilities compared to the number of water systems in BC.

While water system inspections are a key component to any drinking water protection program, a straight count of the number of inspections does not accurately reflect the broad spectrum of work and water system engagement that happens throughout the year. The interactions that DWOs have with water suppliers, local governments, and system users are difficult to quantify, as the engagement is often ongoing. In addition to physical site inspections, DWOs engage with water systems in a variety of ways to move water systems forward in meeting the goals of the multi-barrier approach. For example, a DWO will review and approve a variety of plans, assessments, and sample results; develop and provide education and materials for water system owners, operators, and users; provide consultations and

advice; attend and present at public meetings and other forums; and follow-up on any other matter or concerns relating to drinking water.

## 8.2.2 Complaints and Investigations

In addition to routine inspection and monitoring work, drinking water officials receive and respond to a variety of complaints and concerns about drinking water quality. Some complaints are received in the form of a request for an investigation under Section 29 of the DWPA. Under Section 29, any person has a right to request an investigation by a DWO if they consider that there is a threat to their drinking water source. The DWO is obliged to consider the request and must advise the person on whether they will undertake an investigation and on the results of that investigation.<sup>2</sup> The *Drinking Water Officers' Guide* provides guidance to DWOs on responding to Section 29 requests.<sup>7</sup>

Investigations can use considerable health authority resources and time to follow up. As such, it is prudent that the number of requests received and investigated is recorded, regardless of whether they were substantiated or not. The PHO, in collaboration with the regional health authorities, identified tracking the number of Section 29 investigations as an important output indicator of program activities. At this time, data on the number of Section 29 investigations received and investigated are not readily accessible, but will be reported in the future once regional health authorities modify their data systems to record such information. Anecdotally, regional health authorities report that the number of Section 29 requests has steadily increased over the past few years, and this continues to strain available staffing resources, especially when complex assessments that are outside of the skill set of a DWO—such as a hydrogeological assessment—are required to determine the source of contamination.

## 8.3 Enforcement and Reviews

### 8.2.3 Enforcement Activities

Under the DWPA and its regulation, DWOs and their delegates have several different enforcement powers to ensure appropriate remedial action and monitoring requirements are implemented to protect drinking water quality. In BC, DWOs must consider the full



Flooded well pit/groundwater at risk of containing pathogens.

Photo credit: Laurie Lyons, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

range of options available when determining what action is necessary. The *Drinking Water Officers' Guide* describes specific preventive and enforcement options available to DWOs and lays out general considerations of the circumstances in which the different actions may be appropriate. In addition to the *Drinking Water Officers' Guide*, most of the regional health authorities also have developed their own operational policies and guidance around enforcement activities.

The drinking water programs within BC follow a progressive enforcement approach (sometimes referred to as a graduated enforcement or a progressive compliance approach). Progressive enforcement entails the implementation of progressively escalating enforcement actions to eliminate, reduce, or mitigate risk, considering the risks to public health and the context and history of the situation. There are several principles that govern progressive enforcement, including using a collaborative and consultative approach when implementing actions and ensuring transparency and consistency. Experts consider the progressive enforcement approach to be the best practice for achieving compliance with legislation and policy requirements.

**Table 8.6: Number of Enforcement Actions, by Health Authority, 2014/15 to 2016/17**

Enforcement Action	Fraser Health			Vancouver Coastal Health			Island Health		
	2014/15	2015/16	2016/17	2014/15	2015/16	2016/17	2014/15	2015/16	2016/17
Tickets	0	0	1	0	0	0	0	1	1
Orders	0	0	6	0	4	2	1	6	5
Injunctions	0	0	0	0	0	0	0	0	2
Prosecutions	0	0	0	0	0	0	0	0	0

Note: Data on enforcement actions in Interior Health and Northern Health are not currently tracked or available.  
Source: Regional health authorities; 2017.

Table 8.6 shows the number of enforcement actions taken by the regional health authorities between 2014/15 and 2016/17. Previous PHO drinking water reports did not track or collect these data. Table 8.6 shows that for the three reporting regional health authorities, enforcement actions are rarely used.

### 8.2.4 Reviews and Reconsiderations

Under Section 39.1 of the DWPA, a person affected by a decision of a DWO that is made under specific sections of the Act can request a reconsideration or review of that decision.<sup>2</sup> Reconsiderations and reviews differ in two significant ways. First, a reconsideration of a decision is typically made by the DWO who made the original decision, whereas a review of a decision is conducted by the PHO or the PHO’s delegate. Second, a request for reconsideration requires that the person affected present new evidence that he/she believes would justify changing, reversing, or varying the original decision. In contrast, a review is not based on consideration of new evidence; instead, it is conducted “on the record” using only the information available to the decision maker at the time of the decision.

The only decisions that can be reconsidered or reviewed under section 39.1 of the DWPA are those made under

- Section 19 [drinking water officer authority in relation to assessments].
- Section 25 [hazard abatement and prevention orders].
- Section 26 [orders respecting contraventions].

- Section 31 (4) [request respecting plan initiation].
- A decision resulting from a reconsideration of these decisions.<sup>2</sup>

The number of reconsiderations and reviews conducted under Section 39.1 of the Act has not been formally tracked in past PHO drinking water reports. The PHO, in collaboration with the regional health authorities, identified tracking of these data as an important indicator of compliance activities and utilization of such sections under the Act. At present, information regarding formal requests for reconsideration is not tracked within the various regional health authority databases or at the Office of the PHO. Only three health authorities (Island Health, Vancouver Coastal Health, and Fraser Health) were able to provide estimates of the number of reconsideration requests received during the reporting period. Vancouver Coastal Health and Fraser Health did not report any reconsideration requests during the reporting period; Island Health reported one request (in 2016/17), but it was subsequently withdrawn. Based on these limited data, it is clear that formal requests for a reconsideration of a decision under Section 39.1 of the DWPA are uncommon.

Requests for reviews of a decision by the PHO under Section 39.1 are equally uncommon. Between 2014/15 and 2016/17, the PHO received only four requests for a review (Table 8.7). Two of the requests were withdrawn, and the decisions of the DWOs in the other two requests were upheld based on the review of the record.<sup>a,12</sup>

<sup>a</sup> Information on how to request a review of a decision of a DWO is available on the BC Government website at <https://www2.gov.bc.ca/gov/content/health/about-bc-s-health-care-system/office-of-the-provincial-health-officer/laws-related-to-health-in-bc/drinking-water-protection-act>.

**Table 8.7: Number of Requests for a Review by the Provincial Health Officer under Section 39.1 of the *Drinking Water Protection Act*, 2014/15 to 2016/17**

Fiscal Year	Number Received	Decision upheld	Decision varied	Decision reversed	Request withdrawn
2016/17	1	1			
2015/16	2				2
2014/15	1	1			

Source: BC Office of the Provincial Health Officer; 2017.

## 8.4 Conclusion

This chapter provided an overview of and update on abatement and enforcement activities within BC drinking water protection programs between 2012/13 and 2016/17. Abatement and enforcement programs are key supporting elements of total quality management in the multi-barrier approach. Abatement programs provide an opportunity to review system vulnerabilities and the processes and infrastructure in place to manage and mitigate those risks. Enforcement actions are required when violations occur that endanger public health and when water suppliers fail to address a threat.

Abatement and enforcement programs for drinking water protection under the *Drinking Water Protection Act* are administered by the regional health authorities. Although the inspection frequency targets vary between regional health authorities, all regions use a risk-based approach to deliver services. At present, the ratio of drinking water officer full-time equivalents (FTEs)—to carry out inspections and enforcement activities—and water systems is approximately 144 water systems per environmental health officer FTE. Similarly, the ratio of public health engineer FTEs to water systems is approximately 650 water systems per public health engineer FTE. The challenges that water suppliers face are complex, and drinking water program staff are becoming increasingly involved in complicated, multi-jurisdictional source protection or governance issues. The complexity of these issues coupled with limited human

resources has created operational delivery challenges for the regional health authorities.

As part of the new indicator project being undertaken by the Office of the Provincial Health Officer, Ministry of Health, and the regional health authorities, a variety of abatement and enforcement activities to track under the *Drinking Water Protection Act* were identified. Part of this project includes identifying improved methods for tracking the complexity of abatement and enforcement work carried out by the drinking water programs to ensure that all water systems are assessed and risks are addressed.

Part 4 will discuss unique considerations for small water systems.

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# PART 4

## Small Water Systems in BC



# 9 Small Water Systems in BC

Small water systems are defined in BC as drinking water systems that serve 500 people or less in a 24-hour period. Small water systems in BC face many challenges in ensuring drinking water quality and complying with regulatory standards (operationally and financially). While these challenges are not new, awareness of them has grown since the implementation of the *Drinking Water Protection Act* (DWPA). Several prominent reports over the past decades<sup>1,2,3</sup> including past *Progress Reports on the Action Plan for Safe Drinking Water in British Columbia* by the Office of the Provincial Health Officer (PHO), have voiced concerns about the challenges small water systems face and have called for action. Despite efforts from drinking water officials, the provincial government, and local governments, to provide flexible options and support small water systems, many of the regulatory compliance challenges and drinking water quality concerns remain.

The limited financial, administrative, and management capacity of small water systems creates operational and management challenges that limit their ability to maintain and improve the system infrastructure, install adequate treatment to provide potable water, comply with regulatory standards, or appreciate the health risks associated with their water supply.<sup>1,2,4,5,6,7,8</sup> The manner in which many small water systems form and organize their respective governance and business structures only adds to these challenges.<sup>9,10,11</sup> Accordingly, small water systems are put on more drinking water advisories and receive more non-compliance violations than larger systems.<sup>6,9,12</sup> Experts highlight the disproportional risk of sporadic waterborne illnesses and outbreaks for users of small water systems.<sup>13,14,15,16,17</sup> Research also shows that the attempts to meet water quality standards often lead to unintended consequences for small water systems, such

as disproportionately high costs, operational strains, and community tensions.<sup>18,19</sup>

Despite these enormous challenges, progress is being made in BC. This chapter contains two sections. The first section describes the activities undertaken by key ministries, health authorities, and other organizations to address the challenges faced by small water systems. Specifically, it describes the progress of implementing flexible options for small water systems, efforts to build capacity, inter-agency coordination on a small water system strategy, and actions to ensure sustainable small water system development. The second section provides an overview of bulk water delivery and associated guidelines and training.

## 9.1 Supporting Sustainable Small Water Systems in BC

### 9.1.1 Flexible Options for Small Water Systems

Principle 7 of the *Action Plan for Safe Drinking Water in British Columbia* calls for flexible systems with safeguards for small water systems. Since 2001, the provincial government and the regional health authorities have made the legislation and operational practices governing drinking water protection more friendly to small water systems. In 2005, the Ministry of Health amended the *Drinking Water Protection Regulation* to differentiate between large and small systems in consideration of the needs of small water systems in the province, while continuing to protect public health.<sup>20</sup> With these regulatory changes, water systems that do not provide water for consumption or food preparation are not subject to the same potability requirements (e.g., water used for handwashing or toilet flushing in roadside rest stops). These amendments also include

exemptions that allow for **point-of-entry** or **point-of-use** treatment technology (Section 3.1, Drinking Water Protection Regulation).<sup>21</sup> When installed at every service connection, point-of-entry/point-of-use technology provides a treatment option for small water systems in a manner that meets regulatory requirements but remains affordable. Other amendments in the Drinking Water Protection Regulation include the discretionary authority of drinking water officers and public health engineers to determine certification requirements for small system operators (Section 12) and to waive requirements for construction permits (Section 6).<sup>21</sup> The Ministry of Health and the Drinking Water Leadership Council created the *Drinking Water Officers' Guide* to help guide these decisions. The progress with implementing these flexible options for small water systems is described in the sections that follow.

### Non-potable Water Systems

The Ministry of Health has made several amendments to the Drinking Water Protection Regulation to allow for non-potable water use and decentralized treatment if certain criteria are met. Section 6 of the DWPA requires a water supplier to supply water that is safe to drink and fit for domestic purposes without further

treatment and meets any requirements set out in the operating permit or regulations.<sup>22</sup> Section 3.1 of the Drinking Water Protection Regulation exempts water suppliers from this requirement if "...the system does not provide water for human consumption or food preparation purposes"—e.g., it supplies water for industrial processes, irrigation or other agricultural purposes— or "...the system is not connected to a water supply system that provides water for human consumption or food preparation purposes...."<sup>21</sup>

In March 2013, Section 3.1 of the Drinking Water Protection Regulation was amended further to ensure that if the water is not potable, the water piping and discharge points for non-potable water have permanent, distinct and easily recognized markings.<sup>23</sup> It is important to note that water supply systems that are exempted from Section 6 of the DWPA must still comply with all other sections of the Act, including Sections 7 and 8 pertaining to the need for construction and operating permits.

To date, health officials have classified very few water systems as "non-potable water systems". In 2016 and 2017, four reporting regional health authorities identified 51 and 54 non-potable water systems respectively in their regions (Table 9.1).

**Table 9.1: Exemptions for Non-potable Water Systems, by Health Authority, March 31, 2016, and March 31, 2017**

Regional Health Authority	Number of Approved Non-potable Water Systems	
	March 31, 2016	March 31, 2017
Island Health	17	19
Northern Health	4	4
Vancouver Coastal Health	2	2
Interior Health	Data not available	Data not available
Fraser Health	28	29
<b>Total</b>	<b>51</b>	<b>54</b>

**Notes:** Approved non-potable water systems per Section 3.1 of the Drinking Water Protection Regulation. Interior Health data were unavailable because the information is not yet available in their data system. Northern Health reports that its numbers are an estimate; many other systems in its region have non-potable portions of their water system that are not included in the data (e.g., work camps and other industrial sites may provide potable water for drinking but non-potable for showers and toilets).<sup>24</sup>

**Source:** Regional health authorities; 2015/16 – 2016/17.

In June 2016, the Ministry of Health released a draft guidance document for public consultation regarding using non-potable water for domestic purposes.<sup>25</sup> The objective of the draft document is to provide guidance to officials responsible for issuing permits under the DWPA to water supply systems that use non-potable water from ambient sources for domestic purposes. The document remains under development at the time this report was published.

### Point-of-Entry/Point-of-Use

The regulatory amendments to Section 3.1 of the Drinking Water Protection Regulation also exempt small water suppliers from the Section 6 requirement of the DWPA to deliver potable water for domestic purposes, if each recipient of the water from a small system has a point-of-entry or point-of-use treatment system that makes the water potable.<sup>21</sup>

Despite these amendments and the availability of resource documents to guide small water systems, very few water systems have been issued a construction permit and operating permit for point-of-entry or point-of-use treatment using the exemption under Section 3.1 of the Drinking Water Protection Regulation. In 2012, there were 13 residential point-of-entry/point-of-use water systems in BC, according to data from the regional health authorities.<sup>26</sup> As of March 31, 2016, four health authorities (except Interior Health)<sup>a</sup> reported that a total of 17 water systems had approved point-of-entry/point-of-use in those regions. By March 31, 2017, that number grew to 23 systems. A majority of these point-of-entry/point-of-use systems (52 per cent) were located within Vancouver Coastal Health. While Interior Health data are missing from the reporting, health officials from that region believe they only have a handful of small residential systems with approved point-of-entry/point-of-use.

Although the number of point-of-entry/point-of-use systems has nearly doubled since 2012, this is still low given the large number of small water systems across the province. Over this reporting period, resources were developed by the Ministry of Health and the health authorities to clarify the application requirements for point-of-entry/point-of-use and to guide small water systems through the process. These resources include a detailed section in the *Small Water System Guidebook*,<sup>27</sup>

and a project led by the BC Water and Waste Association (BCWWA) and funded by the Ministry of Health that developed terms and principles to guide agreements between users and water suppliers on point-of-entry/point-of-use systems. This project includes roles and responsibilities of the parties, legal requirements of the DWPA, and liability risks of the parties.<sup>28</sup> BCWWA is currently piloting the principles with two small water systems within Northern Health that expressed interest in point-of-entry/point-of-use.

Drinking water officials in the regional health authorities report a lack of guidance on several key issues regarding point-of-entry/point-of-use that make approving such systems problematic. Issues raised include clarity regarding sampling requirements for decentralized treatment systems; ownership of the units; access and maintenance; establishing agreements and the requirement for 100 per cent participation of users; and concern about methods to collect fees and payments. While point-of-entry/point-of-use may be a viable option for some small water systems, it is not a viable or cost-effective option for most given source water quality limitations, the added costs of multiple treatment units, and the sampling and maintenance costs of decentralized treatment. Work is ongoing in the Ministry of Health and the health authorities to address these concerns.

### Small Water System Facility Classification and Operator Certification

In BC, the small water system classification under the Environmental Operators Certification Program (EOCP) includes water systems that serve a maximum population of 500 people and have a relatively simple treatment system. The Ministry of Health amended the Drinking Water Protection Regulation to allow for flexibility and drinking water officer discretion around operator training and certification requirements for small water systems. The amendment removed the requirement for small systems to have an EOCP-certified small water system operator, unless this was included as a requirement on the small system's operating permit.

As a result of this discretionary flexibility, only a small proportion of small water systems require a certified operator. As shown in Table 9.2, there were 627 small water system operators with active certification as of 2017,

<sup>a</sup> Interior Health data were unavailable, because their data system was unable to retrieve that information, and there were too many small water systems within the region to review each file manually.



and the number of certified small water system operators has remained relatively consistent over the past few years.

In 2017, there were 940 water systems that were classified as small water systems (Table 9.2), up from 857 in 2016. While the number of small water systems classified by EOCP has increased over the years, this represents less than a quarter (21 per cent) of the 4,412 regulated small water systems estimated in the province as of March 31, 2017. As operator certification is not a legislative requirement of small water systems in BC, EOCP facility classification for these systems is not required.

Although the number of classified small water systems and certified small water system operators is low, this does not mean that all small water systems have inadequately trained operators, as EOCP certification is not required. The Office of the PHO has asked the regional health authorities to track if small water systems have an operator with appropriate knowledge and training for the system that they operate, as an indicator of good operations for small water systems. Currently, many of the regional health authorities cannot report on this information because the data are not yet captured within their data systems. Island

**Table 9.2: Small Water Systems Classified and Operators Certified by the Environmental Operators Certification Program (EOCP), BC, 2013 to 2017**

	2013	2014	2015	2016	2017
<b>Number of Small Water Systems Classified by the EOCP</b>	816	830	849	857	940
<b>Number of EOCP-Certified Operators</b>	612	634	634	627	627

**Note:** Data include First Nations water systems and operators that have been classified as a small water system and certified as a small water system operator by the Environmental Operators Certification Program.

**Source:** Environmental Operators Certification Program; 2017.

Health and Fraser Health currently record information on small water system training, and were able to provide data for 2014/15 and 2015/16. According to these data, 100 per cent of the 409 small water system operators within Fraser Health and 67 per cent of the 842 small water system operators within Island Health have appropriate knowledge and training. The large difference in these numbers reflects the challenges in assessing this indicator. The PHO, the Ministry of Health, and the regional health authorities are developing plans to report these data in a more consistent manner in the future as part of the new indicator project.

### 9.1.2 Capacity Building

The limited operational, management, and financial capacity of small water systems continues to limit their ability to comply with drinking water quality standards, treatment objectives, and other regulatory requirements under the DWPA. Various reports and recommendations have identified the need for a comprehensive inter-agency strategy to promote sustainable, well-managed small water systems, and a key component to any such strategy is capacity building. This section highlights resources, education, and training initiatives, available during the reporting period, that were aimed at building capacity and knowledge among small system owners, operators, and users.

#### Organizations and Programs Supporting Small Water Systems

##### Small Water Users Association of BC

The Small Water Users Association of BC is a non-profit society dedicated to serving the interests of small water systems throughout the province. The association supports small systems through educational workshops, newsletters, and links to resources through its website. The EOCP grants continuing education units to operators who attend these workshops. During the reporting period, the association held three small water system workshops. The 2013 workshop was held at Harrison Hot Springs and attracted 75 attendees (62 represented small water systems).<sup>29</sup> Many different agencies involved in drinking water protection—including the Ministry of Health and Fraser Health—participated and presented information. In 2014, the association held two workshops in the

Interior: one in Nelson (60 small water system representatives) and one in Kamloops (55 small water system representatives).<sup>30</sup> No association workshops have been held since 2014.

On July 21, 2017, the Small Water Users Association of BC issued its final newsletter to its members. After 15 years of providing support, information, and networking to small water systems, the society wound down its affairs. Since 2003, a total of 331 small water systems and 129 affiliates held membership with the association.<sup>31</sup> While the membership was small, it served an important function of supporting small water systems. The dissolution of the society will leave a gap in support for small water systems across BC.

#### Centre of Operational Excellence for BC Small Water Systems

To help fill the void created by the end of the Small Water Users Association of BC, Thompson Rivers University, Interior Health, and the Small Water Users Association of BC developed the concept of a Centre of Operational Excellence for BC Small Water Systems, to be managed by the Water & Wastewater Technology Program at Thompson Rivers University. In 2017, Interior Health provided \$30,000 to Thompson Rivers University to help create and establish a website and online resources to provide technical expertise and self-help tools to all small water systems by March 2018.<sup>32</sup> The EOCP also supported this work through additional financial and technical support. The mission of the Centre is to offer technical expertise and support to small water systems, leading to risk reduction, safe drinking water, and system sustainability.<sup>33</sup>

#### Building Sustainable Small Water Systems Pilot Project

During this reporting period, the BCWWA launched a pilot project with funding and support from the Ministry of Health to help small water systems plan for, achieve, and maintain compliance with drinking water standards. The ministry provided \$500,000 in funding in April 2015 to support the pilot project, and a further \$250,000 in 2016/17 and \$250,000 in 2017/18 to continue the work. The pilot project set out to achieve the following outcomes: (1) establish an ongoing structure to deliver information and resources

to small water systems, and (2) change the culture among small water system owners and their users, so that there is progress towards financial self-sufficiency and a clear understanding of responsibilities and risks.<sup>28</sup>

The capacity-building strategy for the pilot included developing and delivering one-day workshops across the province—*Taking Care of Your Water System*—with an accompanying reference guide, follow-up networking sessions and webinars, and one-on-one coaching. The one-day workshop was developed to introduce owners to their responsibilities, to have them self-assess the potential risk areas within their systems, and to point to additional tools and resources to address the risks. The reference guide<sup>34</sup> for participants was based on the Ministry of Health’s *Small Water System Guidebook*<sup>27</sup> and it incorporated changes to the regulatory and industry landscape over the reporting period.<sup>35</sup>

At the end of the reporting period, BCWWA had delivered nine one-day workshops to 217

participants from 99 small water systems, six regional districts, and other supportive organizations. The small water systems represented at the workshops ranged in size from fewer than 25 service connections to over 100.<sup>35</sup>

### Sustainable Infrastructure Society

The Sustainable Infrastructure Society is a non-profit society dedicated to creating and implementing programs that provide convenient and affordable access to products and services for community infrastructure organizations—mainly small water systems. The society maintains a website, which provides detailed information and resources for community water suppliers in BC.<sup>36</sup> The Canadian Water Directory, a website subscription service, financial best management practices, and insurance protection were the key resources delivered to community water suppliers during this reporting period.<sup>37</sup> These services are described in detail in Table 9.3, except for financial best management practices, which are described in Table 9.4.

**Table 9.3 Resources Provided by the Sustainable Infrastructure Society**

<b>Canadian Water Directory</b>	The Canadian Water Directory website helps <sup>38</sup> owners and operators of water supply systems and others find the products, services, and construction expertise they need. Users can search by region, which is of great benefit to owners, managers, and operators, as they prefer to deal with suppliers who are readily accessible and have a strong regional reputation.
<b>Website Subscription Service</b>	The Sustainable Infrastructure Society has developed an affordable website subscription service designed specifically for community water systems. <sup>36</sup> With this service, community water suppliers can easily and inexpensively build their own website to communicate effectively with customers, regulators, and others. The water system websites can be used to notify customers of an emergency, such as a main break, or a boil water notice. It can also communicate important information such as details of the emergency response plan, minutes of meeting of trustees, results of water testing, and current activities.
<b>Insurance Protection</b>	Access to affordable insurance can be a barrier to small water systems. The Sustainable Infrastructure Society’s insurance protection program provides access to affordable insurance coverage for community water suppliers. The program is operated in partnership with Aon Reed Stenhouse Inc. and Capri Insurance Services Ltd. Coverages include commercial general liability, directors and officers, property, boiler and machinery insurance, and contractor’s liability insurance. The program provides coverage for both water supply systems and for water system contractors. Information about the program can be found on their website. <sup>36</sup>

## RES'EAU WaterNET

RES'EAU is a strategic network funded by the Natural Sciences and Engineering Research Council of Canada, which works in partnership with many public and private organizations to deliver local solutions to drinking water issues faced by small, rural, and Indigenous communities.<sup>39</sup> Through the RES'EAU Community Circle Program, the network produces new knowledge derived from the perspectives of various actors (e.g. urban culture, rural culture, production culture, financial culture, Indigenous culture and academic culture). This problem-solving collaboration, called the Community Circle, attempts to systematically capture and weigh all relevant considerations within so that decisions can be made based on a deeper understanding of the issues the circle tries to solve. Under this community-centric approach, scientific, technological and academic communities play an integral role by re-examining underlying assumptions on which doubts about the viability of small water systems are built. RES'EAU, with the support of Indigenous Services Canada, collaborated with seven First Nations communities: Lytton, Siska, T'iq'et, Kluskus, ?aq'am, Boothroyd, and Tl'azt'en. RES'EAU reports that the community circle approach has led to the removal of three boil water notices on three reserves within the Lytton First Nation (two through the implementation of point-of-entry treatment systems). In addition to these First Nations communities, RES'EAU has worked with four non-First Nations (Cowichan Valley Regional District, Van Anda Improvement District, City of White Rock, and Cedar Creek).<sup>40</sup>

## Training for Small Water System Operators

To enhance the capacity of small water system operators, relevant training opportunities must be available, accessible, and affordable. The delivery of the training must also be flexible and include online or traditional hands-on learning. Small water system operators range in their academic and technical backgrounds and abilities. Often a small water system operator is a community volunteer or a maintenance person or business owner who may have no background in water system operations. These operators often have other jobs or duties, and it can be difficult to find the time or resources to get away for training, especially if there is no backup operator to cover for them while they are away.

Over the years the provincial government, regional health authorities, water supply associations, and other agencies have increased the availability and accessibility of training for small water systems. Many of the small water system courses available for training and/or continuing education units are listed on the EOCP online Career Management System. Many courses are now offered online as well as in various locations across the province to reduce the need for operators of small water systems to travel. The provincial government has contributed significant funding to develop courses targeted to small water system, such as the capacity-building workshops led by the BCWWA and a small water system source protection training course. The courses developed and offered by the regional health authorities within their regions (either free or at cost) have made a big impact in improving the affordability and accessibility of training, and in improving the relationship between the regulator and the regulated. Appendix C highlights some of the specific small water system training activities and initiatives that occurred during the reporting period.

In addition to being part of the courses and activities shown in Appendix C, drinking water experts from the regional health authorities and the provincial government frequently participate and present at conferences and workshops organized for small water systems and drinking water operators. This includes events organized by local government and water supply associations such as the BCWWA, the Small Water Users Association of BC, the Coastal Water Suppliers Association, the British Columbia Ground Water Association, the Water Supply Association of BC, and Southern Interior Local Government Association, among others. Drinking water officials participate in these educational events at no cost to organizers to build capacity and awareness among water suppliers and users.

## Guides and Online Tools for Small Water Systems

During the reporting period, the provincial government developed several tools and resources to assist small water system owners, operators, and users. These new resources are described in Table 9.4.

**Table 9.4 Guides and Online Tools for Small Water Systems**

<p><b>Water System Assessment User's Guide and Tool</b></p>	<p>In May 2012, the Ministry of Health released the <i>Water System Assessment User's Guide</i> and tool<sup>41</sup> for small water systems. This assessment tool lies between the Comprehensive Drinking Water Source-to-Tap Assessment and the Drinking Water Source-to-Tap Screening Tool in complexity. It helps small water supply system operators to identify safety and security issues and develop an action plan to deal with any risks identified. The tool can be completed quickly, usually within a day.</p>
<p><b>Small Water System Guidebook</b></p>	<p>The Ministry of Health released the <i>Small Water System Guidebook</i> in December 2013 (an updated version was released in 2017).<sup>27</sup> The guidebook helps small water systems find solutions to the challenges of providing safe drinking water, such as inadequate treatment, aging infrastructure, finding trained or certified operators, governance and financing, sampling for bacteria, and making infrastructure improvements.<sup>27</sup> The guidebook will help a small system assess and minimize health risks. It includes information on regulatory requirements, treatment objectives, governance, and financial management.</p>
<p><b>Emergency Response and Contingency Planning for Small Water Systems</b></p>	<p>In 2016, the Ministry of Health updated and modernized the <i>Emergency Response and Contingency Planning for Small Water Systems</i> guide.<sup>42</sup> The guide provides a step-by-step guide for small water system operators to create an emergency response and contingency plan. It helps small water suppliers understand their legislative responsibilities and provides information on actions they can take to identify potential hazards and risks associated with the water supply.</p>
<p><b>Financial Best Management Practices for Small Community Water Systems</b></p>	<p>In 2013, the Union of BC Municipalities released the <i>Financial Best Management Practices for Small Community Water Systems in British Columbia</i>.<sup>43</sup> These best management practices were prepared by the Sustainable Infrastructure Society on behalf of the Union of BC Municipalities, with support from the Ministry of Health and the Ministry of Municipal Affairs and Housing. It is important to support small systems to improve their financial practices for several reasons. Sound financial management helps reduce financial surprises to customers and ensures that the funds entrusted to the system managers are used effectively and efficiently.<sup>43</sup></p> <p>The best management practices are tools and worksheets to help system operators develop a financial plan by following methods used by successful water systems to operate sustainably. These practices include the following: creating a basic asset inventory; building an asset management plan; creating a five-year operating plan; establishing a long-term financial (capital) plan; determining sustainable water rates and charges; and developing a communications plan.<sup>43</sup> These tools build on each other, but several can be used independently. Users can choose to complete one or two to start, and then implement others when they have the resources available in the future.</p>

### 9.1.3 Inter-agency Collaboration Assistant Deputy Ministers’ Committee on Small Water Systems

During the reporting period, the Inter-ministerial Committee on Small Systems was disbanded. It was replaced by the Assistant Deputy Ministers’ (ADM) Committee on Small Water Systems in 2014/15, to respond to recommendations received from the Union of BC Municipalities on small water systems.<sup>44</sup> Membership included representatives from the Ministry of Health, the Ministry of Transportation and Infrastructure; the Ministry of Forests, Lands and Natural Resource Operations;<sup>b</sup> and the Ministry of Community, Sport and Cultural Development.<sup>c</sup> The committee

was chaired by the ADM of Population and Public Health in the Ministry of Health.<sup>45</sup>

The purpose of the committee was to develop a cross-ministry small water system strategy and work plan to deal with issues such as inadequate infrastructure, staffing, capacity, governance, and financing, and to develop strategies to promote sustainable small systems and prevent the creation of new, unsustainable small systems.<sup>45</sup>

In June 2015, the committee developed a short-term work plan that identified five deliverables for the committee members to explore. Table 9.5 below shows the five deliverables<sup>45,46</sup> and the progress made on each item.

**Table 9.5: Progress on the Deliverables of the 2014/15 ADM Committee on Small Water Systems**

Deliverable	Progress
Deregulating small water systems with less than five connections (lead: Ministry of Health).	This action item was not pursued as it was dependent on successful completion of other deliverables before it could be considered.
Developing a subdivision checklist for approving officers and local governments to prevent the proliferation of unsustainable small water systems (lead: Ministry of Transportation and Infrastructure).	The Ministry of Transportation and Infrastructure led work on drafting the subdivision checklist. The draft was distributed to the participating agencies; however, the document and stakeholder comment was never implemented or submitted to the ADM committee for review. <sup>47</sup>
Developing a loan guarantee program for domestic small water systems (lead: Ministry of Municipal Affairs and Housing).	The Ministry of Municipal Affairs and Housing facilitated the successful connection of a private sector banking institution with improvement districts, building the bank’s experience and comfort in providing loans to unconventional borrowers; the same banking institution was also introduced to the BCWWA to facilitate a connection with the small water systems participating in the association’s small water system outreach program. <sup>48</sup>
Registering information on property titles for domestic water systems under five connections (lead: Ministry of Transportation and Infrastructure).	The Ministry of Transportation and Infrastructure concluded, after holding discussions about posting water system information on title, that <b>restrictive covenants</b> provide a means by which water system requirements could be flagged on title. <sup>47</sup>
Developing a small water system outreach program to build capacity (lead: Ministry of Health).	The Ministry of Health funded the BCWWA to develop and deliver a small water system outreach program <i>Building Sustainable Small Water Systems Pilot Project</i> described earlier in this chapter (Section 9.1.2). <sup>28</sup>

<sup>b</sup> After a change in government in 2017, the name of this ministry was changed to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD). For the purposes of this report, the acronym FLNRORD is used to refer to activities of this ministry both before and after the name change in 2017.

<sup>c</sup> After a change in government in 2017, the name of this ministry was changed to the Ministry of Municipal Affairs and Housing. For the purposes of this report, the acronym MAH is used to refer to activities of this ministry both before and after the name change in 2017.



The MacArthur-Reedman water treatment plant and reservoir (Left), owned and operated by the Columbia-Shuswap Regional District. Inside the water treatment plant (Right). A small water system successfully achieving the BC surface water treatment objectives through two direct filtration pre-packaged plants, UV, and chlorination.

Photo credit: Columbia-Shuswap Regional District.

While there has been progress on some of the deliverables from the work plan, it appears that the ADM Committee on Small Water Systems has dissolved, as of the time this report was written. The last meeting of the committee occurred in the spring of 2016 and no progress reports exist.<sup>44</sup>

### 9.1.4 Sustainable Small Water System Development

Promoting sustainable small water systems begins with preventing the proliferation of unsustainable ones. When new small water systems are proposed for developments and subdivisions, the public interest must be weighed against the operational and financial needs of the small water systems. The focus should be on ensuring systems have the capacity (organizational and financial) to meet future challenges such as aging infrastructure, changes in water quality, increased demand, or the introduction of new drinking water requirements.<sup>49</sup>

In BC, the regulatory responsibility for approving subdivisions and the creation of new water systems is shared by the regional health authorities, the Ministry of Municipal Affairs and Housing, local governments, the Ministry

of Transportation and Infrastructure, and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) (see Chapter 2, Section 2.1). FLNRORD provides oversight for the creation and management of private utilities under the *Water Utility Act* and the *Utilities Commission Act*; approving the creation of new water users' communities under the *Water Users' Community Act*; and licensing surface and groundwater withdrawals under the *Water Sustainability Act*. The Ministry of Municipal Affairs and Housing provides policy relating to the Subdivision Regulations under the *Local Services Act*; promotes regional planning; and provides financing in some cases. Provincial approving officers within the Ministry of Transportation and Infrastructure approve subdivisions with proposed drinking water systems in unincorporated areas of the province. Local governments regulate land development and community growth in their regions; establish water system design, construction, and operation standards; and establish the level of service for community residents. Regional health authorities approve new waterworks through a construction permit process under the *Drinking Water Protection Act*, and provide comment from a public health perspective on subdivision or land-use

applications involving drinking water supplies to approving officers from local governments or from the Ministry of Transportation and Infrastructure. This includes recommending for or against an application because of concerns over the location or source of the water supply, sewage disposal, or the potential public health impact of the development on the community and built environment.

The diversity of regulations, bylaws, and players involved in the subdivision approval process presents complex challenges for health officials. Since the Subdivision Regulations only applies in unincorporated areas, the approval process for a subdivision can vary across the regional districts and municipalities in BC. In incorporated areas, a local government approving officer holds the approving authority, not the provincial approving officer with the Ministry of Transportation and Infrastructure. As a result of this complexity, the referral process to public health officials varies depending on which local or provincial authority has jurisdiction. Health officials also report that consultation with approving officers is inconsistent, and sometimes does not occur. Additionally, approving officers are not obliged to act on the recommendations provided by health

officials. For example, an environmental health officer may recommend against approving a subdivision that depends on the created lots sharing a communal water supply (thus creating a new small water system). Despite this recommendation, the approving officer may still approve the development as there is currently no regulatory requirement to avoid creating more independent small water systems, especially if the developer can show that the shared raw water supply meets potability standards and has less than five connections (i.e., the *Water Utility Act* would not apply).

On reserve, BC First Nations communities, First Nations Health Authority and Indigenous Services Canada work in partnership to support the creation of new water systems to meet federal and provincial guidelines.

### Actions to Prevent the Proliferation of Unsustainable Water Systems

Past progress reports on the *Action Plan for Safe Drinking Water in British Columbia* have included recommendations to address development concerns around the proliferation of unsustainable water systems. Table 9.6 highlights actions taken by the various ministries with responsibilities in this area.

**Table 9.6: Actions to Prevent the Proliferation of Unsustainable Water Systems**

**Best Practice Guidelines for Approving Small Water Systems**

The Ministry of Municipal Affairs and Housing and the Union of BC Municipalities contracted Urban Systems to develop best practices guidelines for local governments for approving small water systems. In August 2014, the document *Best Practice Guidelines for Approving New Small Water Systems: Setting the Stage for Sustainable Water Service Provision* was released.<sup>49</sup> The seven best practice guidelines for subdivisions outlined in this document are as follows: long-range land use planning; current planning regulations; design and construction standards; application information; water system acquisition policies (for newly developed water systems); financial sustainability; and coordinated communications.<sup>49</sup>

While the guidelines provide useful tools for local governments and approving officers, there are some concerns with how they are implemented; there is currently no obligation on local governments or the provincial approving officer to make the guidelines mandatory, which may lead to inconsistent implementation across the province. This issue reinforces the need for a regulatory backstop to make approval guidelines and best practices mandatory, especially if any changes to regulatory requirements under the *Drinking Water Protection Act* for small water systems with less than five connections are considered.

<p><b>Approving Officer Draft Subdivision Checklist</b></p>	<p>In 2015, the Ministry of Transportation and Infrastructure led work on developing a <i>Small Water System Checklist for Subdivision Approval</i>, as part of the work plan of the Assistant Deputy Ministers' (ADM) Committee on Small Water Systems. The checklist was to serve as an input for discussion of, and possible use after, potential deregulation of small water systems with less than five service connections. It provides a tool that approving officers could use when making decisions, to ensure that drinking water systems serving subdivisions start off on the right track and to create checks and balances to discourage the proliferation of small water systems. A draft was completed in 2016 in consultation with provincial approving officers, drinking water officers, the Ministry of Health, the Ministry of Municipal Affairs and Housing, and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD).<sup>47</sup></p> <p>The draft checklists, report, and the collected responses from the project participants have yet to be shared with the ADM Committee for direction on next steps. Considering that the ADM Committee has not convened since 2016, it is unclear if any further action on this project will occur.</p>
<p><b>Small Water System Guidance</b></p>	<p>The Ministry of Health continues to support initiatives around subdivisions led by the Ministry of Municipal Affairs and Housing or the Ministry of Transportation and Infrastructure. However, it lacks the legislative authority to prohibit the creation of small water systems at the subdivision stage.<sup>28</sup> The Ministry of Health has provided information for those considering the creation of a small water system in the <i>Small Water System Guidebook</i>. The guidebook encourages a strong governance structure, and discusses the pros and cons of the various ways to set up a small water system.<sup>27</sup></p>
<p><b>Utility Regulation Section Guidelines</b></p>	<p>To restrict the proliferation of non-viable small water systems, FLNRORD regularly reviews and updates policy guidelines that address the sustainability of small private water systems. The <i>Utilities Commission Act</i> is the primary legislation that gives the Comptroller of Water Rights the ability to grant and restrict approval for the creation of small water systems. Specifically, Sections 28 through 30 grant the Comptroller of Water Rights the ability to prohibit the creation of multiple private water systems and to require existing systems to extend service to nearby subdivision developments.<sup>50,51</sup></p> <p>The <i>Financial Guidelines for Certificate of Public Convenience and Necessity Applications</i> were revised in 2016 and are applicable to new private water systems as well as existing operators applying for an extension of service. These guidelines are used to ensure the short- and long-term economic viability of a water system, independent of the developer. The revisions limit the amount of annual operating losses and require that additional monies be set aside in new reserve funds. Specifically, developers for new utilities must now deposit 10 years' worth of required contributions as a loan to the utility, to ensure financial stability in the development's initial phase when lots are being marketed.<sup>50</sup></p> <p>The <i>Guide to Applying for a Certificate of Public Convenience and Necessity</i> was also revised in 2016. Under these guidelines, applicants for new private water systems and extensions to existing utilities must submit letters from nearby utility providers and local governments, confirming whether they intend to extend service to the proposed development. In addition to applying these more stringent guidelines, FLNRORD also conducted pre-application meetings with developers to discuss alternative water service arrangements. FLNRORD staff also provide advice and direction to utility owners wishing to transfer their private systems to local governments.<sup>50</sup></p> <p>These guidelines and policy amendments have resulted in a reduction in the number of new water utilities built, as the Comptroller has not received an application for a new private water utility since 2012.<sup>50</sup></p>

## Amalgamation and Acquisition

When small water system suppliers face irresolvable issues with water quality, infrastructure, or governance, they may create arrangements with local government to connect directly to their water system (i.e., amalgamation), or transfer the ownership, assets, and liabilities and have local government own and operate their system for them (i.e., acquisition). Local government amalgamation and acquisition provide many benefits for small water systems, including greater resources (financial and operational); eligibility for federal and provincial government grants, low interest loans, and insurance only available to local governments; and reduced liability issues for small water systems.<sup>2,52</sup>

Despite the advantages of amalgamation and acquisition, small water system owners, operators, or customers frequently oppose or resist giving up control of their respective water systems to local government. Perceived disadvantages include potentially higher water rates; loss of autonomy with a lower level of customer service; and high costs to cover the initial upgrade construction costs and start-up costs.<sup>2,52</sup> Small water system suppliers and users that do not treat their water supply may also object to amalgamation or acquisition because of the fear that local government will impose treatment (e.g., chlorination).

Although small water system suppliers can transfer assets to local governments, local governments may only agree to the takeover if treatment objectives are achievable and pose no liability. This presents a challenge to small water systems because they tend to lack the resources or viability to make expected upgrades before the transfer, and there is no dedicated fund to support local governments in the process of taking over and upgrading these systems.

Several local governments have acquired failed water systems in the past and many indicate they are amenable to continue doing so. Despite their experience acquiring systems, most local governments lack formal policies surrounding acquisition.<sup>53</sup> Without a formal policy in place, local governments operate reactively to failed water systems and expose themselves to increased liability.

Several local governments have taken progressive steps towards developing formal acquisition and amalgamation policies and strategies that serve as good examples for other parts of the province. For example, the Columbia-Shuswap Regional District is seen as a sound and successful model.<sup>54</sup>

While many local governments have acquired small water systems, some hesitate to do so due to the perception that small water system acquisition creates significant liability, costs, and administrative burdens on local governments.<sup>2,52</sup> As a result, many local governments place moratoriums on the number of systems they will consider for takeover. For example, the Thompson-Nicola Regional District placed a moratorium on small water system acquisitions that has remained in place for several years.<sup>54</sup>

## 9.2 Bulk Water Delivery

### 9.2.1 Bulk Water Haulers in BC

Trucks used for bulk water delivery are included in the definition of a domestic water system<sup>d,22</sup> under the DWPA. Given this definition, all tank trucks or vehicle water tanks that are used for the delivery of potable water for domestic use in BC must have an operating permit. As a result, one bulk water delivery company may have several permits to operate as each individual water truck requires its own, non-transferable permit. Bulk water haulers with a permit to operate must only fill their tanks from a fill station (i.e., a source water supply) approved by the drinking water officer. The construction and materials used for the tanks, fill stations, and loading facilities must be approved before a permit is issued. The majority of bulk water haulers fill their trucks from fill stations connected to an approved community water supply system. In rare situations where a community supply system is not available, a company or a local community may develop a stand-alone fill station on its own private water supply. If these fill stations are providing potable water for domestic use, they must be permitted as any other domestic water system.

Previous drinking water reports have not reported on number of bulk water haulers in BC. Since 2016, the Office of the PHO has requested

<sup>d</sup> Under the DWPA, a domestic water system "means a system by which water is provided or offered for domestic purposes, including...(d) a tank truck, vehicle water tank or other prescribed means of transporting drinking water, whether or not there are any related works or facilities...."

data from the regional health authorities on the number of bulk water haulers as part of the project to develop new indicators and track water systems by size and type of facility. This data request includes the number of bulk water hauler trucks in each region and the number of bulk water hauler fill stations on their own private water sources (Table 9.7). At present, not all of the regional health authorities track this information in their data systems. Most health authorities can report on the number of trucks, but are unable to identify private fill stations among the many water systems they regulate.

As shown in Table 9.7, in March 2016, regional health authorities reported 206 permitted bulk water hauler vehicles. In 2017, that number dropped slightly to 190. The majority (approximately 75 per cent) of bulk water haulers are found in the northern region of the province, particularly in the northeast region of Northern Health. In 2016, the Canadian Red Cross mapped the locations of bulk water haulers as an emergency response exercise<sup>55</sup> (Figure 9.1).



A bulk water hauler arriving at a remote location with drinking water in northern BC.  
Photo credit: Dionne Sanderson, Northern Health Authority (2008 – 2014).

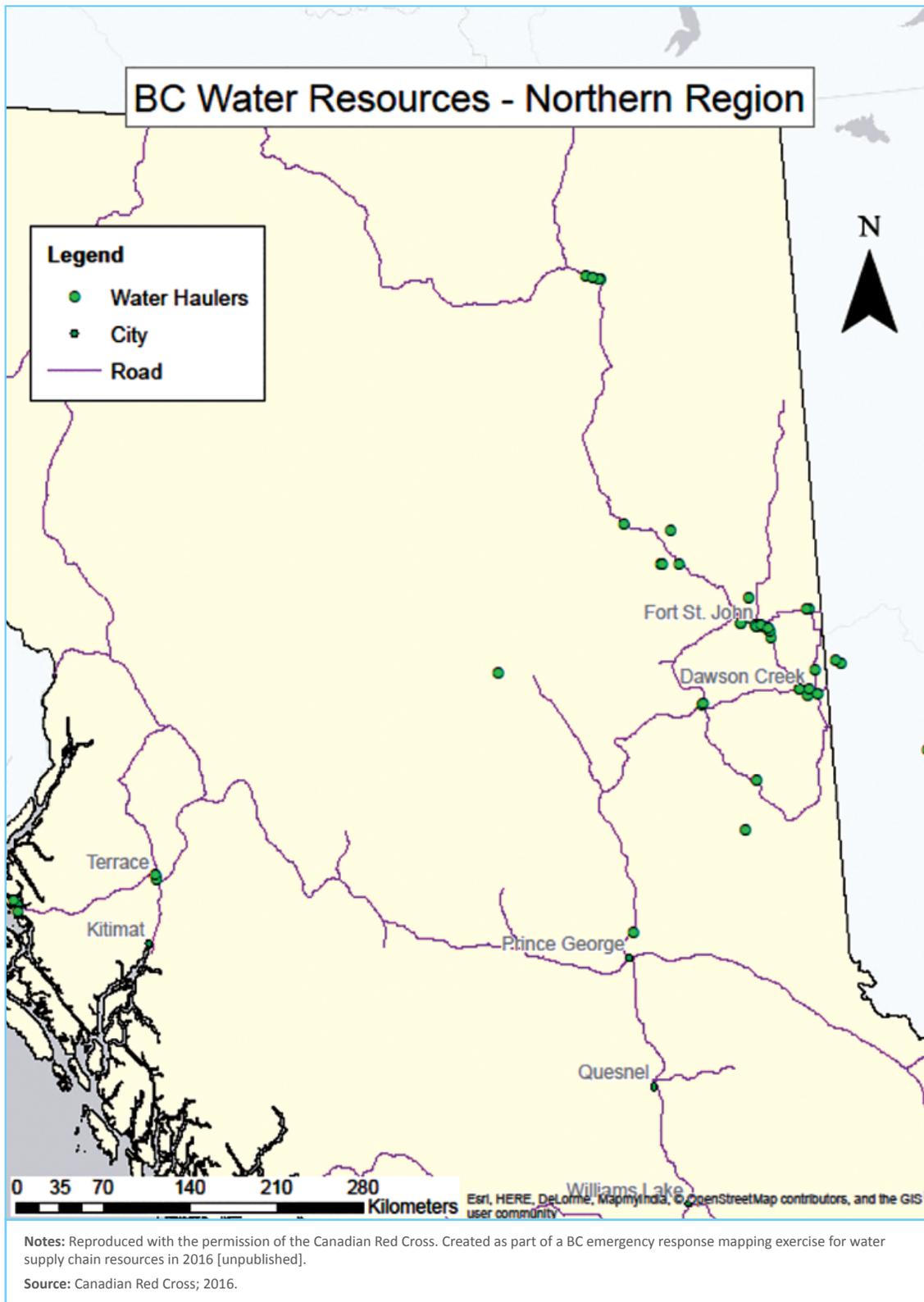
**Table 9.7: Number of Bulk Water Haulers and Private Bulk Water Delivery Fill Stations, by Health Authority, BC, 2015/16 to 2016/17**

Regional Health Authority	March 31, 2016		March 31, 2017	
	Permitted Trucks	Permitted Fill Stations with Private Stand-alone Water Source	Permitted trucks	Permitted Fill Stations with Private Stand-alone Water Source
Island Health	20	1	20	1
Northern Health	156	N/A	138	N/A
Vancouver Coastal Health	5	0	5	0
Interior Health	17	N/A	19	N/A
Fraser Health	8	1	8	1
<b>Total</b>	<b>206</b>	<b>N/A</b>	<b>190</b>	<b>N/A</b>

**Note:** At present, not all of the regional health authorities track information on permitted fill stations with a private stand-alone water source in their data systems.

**Source:** Regional health authorities; 2015/16 – 2016/17.

**Figure 9.1: Bulk Water Haulers, Northern BC**



This map of the northern region shows the concentration of bulk water haulers in and around Fort St. John and Dawson Creek. Drinking water officials from Northern Health report that cisterns and bulk water hauling for domestic use is common where a potable source of groundwater is not available for a private or community supply. Bulk water delivery is also common in northern work camps and industrial sites, particularly among those that are temporary, seasonal, or mobile.<sup>56</sup>

According to current estimates, there are few stand-alone bulk water fill stations with their own private source water supply. Fraser Health and Island Health report one within each of their regions. Northern Health estimates that there are several in the region (between five and 10),<sup>57</sup> but cannot provide an exact count at this time because of data system limitations.

### Bulk Water Delivery Guidelines

The legislation and the BC *Drinking Water Officers' Guide* offer no specific provincial guidelines for bulk water haulers. Prior to the DWPA being enacted, the province had a policy on bulk water hauling pursuant to the former Safe Drinking Water Regulation under the former *Health Act*<sup>58</sup>, but that policy was not updated when the new Act came into force, and was not incorporated into the *Drinking Water Officers' Guide*. However, operational requirements for bulk water haulers are outlined in operational guidelines and policies that have been developed by the regional health authorities. Vancouver Coastal Health, Fraser Health, Island Health, and Interior Health all have similar official guidelines or policies regarding bulk water hauling. Northern Health, where most of the bulk water haulers operate, has a dedicated application form for bulk haulers, guidelines for backflow prevention for water hauling trucks, and water system design guidelines for mobile camps supplied by bulk water delivery.<sup>57</sup> The Northern Health drinking water officer's field guide includes a dedicated section on approving and inspecting bulk water haulers and cisterns.<sup>59</sup> While these documents do provide regional guidance, a provincial guideline is still needed to provide consistency and identify current best practices.

### Bulk Water Operator Training

There are no specific training or certification requirements for operators of bulk water

hauling vehicles in the legislation, the *Drinking Water Officers' Guide*, or the health authority guidelines for bulk water haulers. Northern Health's field guide recommends that water haulers complete the BCWWA operator course on bulk water delivery.<sup>59</sup> Similarly, the bulk water hauling inspection checklist<sup>60</sup> developed by Interior Health asks if operator training has been provided by the employer for water tank maintenance and sanitation.

In BC, bulk water haulers, like small water systems, do not require a certified operator. Operators can be certified through the EOCP as a bulk water operator; however, very few operators in BC hold this certification. According to the EOCP, 68 operators currently hold active Bulk Water Delivery Operator Certification; four live in BC, one lives in Saskatchewan, and the rest reside in the Yukon where bulk water delivery certification is required.<sup>61</sup>

In addition to the training available for small water systems, there are bulk water delivery training courses available to bulk water haulers in BC. For example, both BCWWA and Thompson Rivers University offer training in bulk water delivery. Additionally, Northern Health's course on safe drinking water includes a module on bulk water hauling.<sup>57</sup> The EOCP training registry also lists bulk water delivery courses available for continuing education units. Similar to the requirements of any water supply system, the requirement for operators of bulk water haulers to have appropriate training and knowledge is an important part of the multi-barrier approach.

## 9.3 Conclusion

This chapter has examined the challenges faced by small water systems and the policies and programs aimed to address these challenges. Several reports, including the *Action Plan for Safe Drinking Water in British Columbia*, *Progress Reports on the Action Plan for Safe Drinking Water in British Columbia* by the Office of the Provincial Health Officer, and the 2008 Ombudsperson's report *Fit to Drink: Challenges in Providing Safe Drinking Water in British Columbia*, have called for flexible options and strategies to address the challenges small water systems face in providing clean, safe, and reliable drinking water. Some progress has been made in providing flexible options for small water systems, particularly with



RES'EAU's mobile water treatment pilot plant investigating options for a remote and off-grid community.  
Photo credit: RES'EAU a Centre for Mobilizing Innovation.

regulatory amendments allowing point-of-entry/ point-of-use treatment or non-potable water use for non-domestic purposes. While these amendments create options for some small water systems, the practicality of their implementation has limited their uptake.

While there are a number of capacity-building resources, guides, and activities occurring in BC that focus on small water systems, greater coordination of these programs and resources would prevent duplication of effort and ensure that the needs of small water systems are being addressed efficiently. Additionally, data need to be collected to evaluate the uptake and impact of these programs and resources. Training opportunities for small water system operators and suppliers continue to become more accessible, especially as more regional health authorities develop and offer free or at-cost training in their regions.

In order to make improvements to small water systems in BC, it is critical to strengthen inter-agency collaboration, as the legislation overseeing the formation, governance, and operations of these systems is shared between several ministries. Inter-agency cooperation is also necessary to ensure that land use and development decisions do not

result in the creation of unsustainable small water systems. Since 2016, the inter-agency committee tasked with addressing small water system challenges and unsustainable development concerns has not convened, and it is unclear whether its work will continue.

As highlighted in this chapter, small water systems often face irresolvable water quality and management concerns. The processes of amalgamation or acquisition of small water systems by neighbouring local governments or larger water suppliers can lead to cleaner, safer, and more reliable drinking water for users of the struggling small water systems. Despite these benefits, barriers to these mergers exist and many local governments lack a coordinated acquisition strategy for small systems.

Some communities and facilities in rural and remote areas of the province, where sources of potable water are not easily available, depend on bulk water haulers to deliver their drinking water. At this time, while training and certification is mandated in the Yukon, no provincial guidelines or training requirements for bulk water haulers exist in BC; however, the regional health authorities have developed or adopted varying levels of guidance for bulk water delivery in their regions.

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# PART 5

## Discussion and Recommendations



# 10 Discussion and Recommendations

British Columbians depend on safe drinking water every day. Access to clean, safe, reliable drinking water is essential for good health, and it is imperative that systems are in place to ensure the quality and sustainability of this essential resource. Drinking water protection depends on collaboration both within and outside of government. Across the province there are many types of water systems, ranging in size from small systems that serve as few as two households to large urban systems such as Metro Vancouver. These systems draw water from different types of water sources with different inherent risks and vulnerabilities. There are also a variety of governance models for water systems that serve many different types of populations and facilities. Overall, drinking water protection programs are complex and multi-faceted in their planning, implementation, and related partnerships.

The Provincial Health Officer (PHO) has responsibility under Section 4.1 of the *Drinking Water Protection Act* to report on activities under the Act. This report marks a transition in how the PHO will report on drinking water in BC. Previous reports have tracked progress towards the *Action Plan for Safe Drinking Water in British Columbia* (the Action Plan). Future reports will incorporate the eight principles outlined in the Action Plan within new indicators and water system categories developed by the Office of the PHO, the Ministry of Health, and the health authorities. These new indicators align with the key elements of a multi-barrier approach for drinking water protection, and will reflect the progress being made in BC to protect drinking water.

Source water protection, drinking water treatment, and distribution integrity are the three pillars of the multi-barrier approach, and together they contribute to the provision of

clean, safe, reliable drinking water. These pillars are supported by total quality management of the system, which includes good operations, proper management, and effective monitoring and reporting. Total quality management to support safe drinking water in turn relies on legislative and policy frameworks, guidelines, standards and objectives, research, science and technology, public involvement, and awareness. This multi-barrier approach framework also depends on strategic enforcement and abatement programs and policies that are well-resourced. Since 2002 when the Action Plan was developed, the multi-barrier approach has become accepted as the best practice for drinking water protection by drinking water industry and experts.

## 10.1 Summary of Progress on the Action Plan for Safe Drinking Water in British Columbia

### 10.1.1 Areas of Progress

According to the Action Plan, strong, effective legislation is central to the goal of having clean, safe, reliable drinking water. Since the Action Plan was established, there has been considerable progress in this area, including the introduction of the *Drinking Water Protection Act* and the *Water Sustainability Act*.

Another area where progress has been made is in monitoring requirements. Basic monitoring requirements for microbiological indicators have been established in the Drinking Water Protection Regulation, and the monitoring that the environmental protection and resource ministries are responsible for continues to grow. Considerable work continues to be done to improve facility classification and compliance



with training and certification requirements for drinking water operators. Treatment objectives for surface and groundwater systems are in place and many water system and source assessment guidance documents have been developed. Project focused inter-agency work continues to happen albeit in a limited way. The reporting and transparency of government actions and enforcement and abatement programs have improved. Government and health agencies continue to invest in outreach and education for water system owners, operators, and users, particularly for small water systems with limited capacity. Funding programs for infrastructure and planning are in place, but much of the funding is available only to select systems.

Since the release of the Action Plan, the provincial government has committed to additional goals and strategic priorities relating to improving water quality – “Lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management, bar none.” The province has also made progress in achieving this goal with development of Living Water Smart and the *Water Act* Modernization project.

### 10.1.2 Areas of Challenge

Despite the many areas of progress, challenges are ongoing. The Action Plan highlighted the need for clear responsibility within government for drinking water protection. While inter-ministry committees such as the Water Policy and Legislation Committee and the Drinking Water Leadership Council have helped create forums for advice on policy development, coordination of resources among ministries remains a challenge given the jurisdictional complexity. This has been compounded by changes in ministerial portfolios over time and the dissolution of bodies such as the Assistant Deputy Ministers’ Committee on Water and the regional drinking water teams.

Efforts have been made to address small water system capacity through flexibility in regulations, training programs, and the development of user-friendly resources. However, many challenges for small water systems still remain, largely due to resource and governance constraints. Transportation issues and access to approved laboratories continue to be a challenge in many rural and

remote areas of the province. Regulatory backstops to prevent the proliferation of unsustainable small systems at the subdivision and land development stage have not yet been developed, and in many areas of the province there is no strategy to incorporate failing water systems within a jurisdiction. Many small water system suppliers, operators, and/or users continue to resist basic disinfection of their water supply, which contributes to the disproportionate number of long-term boil water notices in place for small water systems.

Management of data on drinking water and source supplies remains decentralized and inconsistent, and as a result, the information is difficult to access. Provincial and regional resources for abatement and enforcement programs to protect drinking water and source water remain stretched, which makes it challenging for organizations to fulfil their mandates in this area. While many of the necessary legislative and policy tools have been developed to protect drinking water, many of these tools remain untested, and the conditions that must be met for the application of some tools (e.g., drinking water protection plans) limits their use.

## 10.2 Recommendations: Setting Strategic Priorities in Drinking Water Protection

Overall, most residents of BC consistently enjoy clean, safe, reliable drinking water; however, more can be done to improve the governance and protection of drinking water and source water. The Action Plan called for a strong, effective legislative framework and clear lines of accountability within government to protect drinking water. Considerable time has passed since the release of the Action Plan, and many of its recommendations have become dated. While several of the solutions proposed in the Action Plan have been achieved, areas where further progress is needed persist.

The following 32 recommendations are offered in order to advance drinking water quality across BC.

- Recommendations 1 through 3 are priority recommendations for the provincial government and pertain to the overall governance of drinking water.

- Recommendations 4 through 7 suggest actions to improve legislative and policy frameworks to protect drinking water.
- Recommendation 8 seeks to improve available data to strengthen program oversight and evaluation.
- Recommendations 9 through 12 suggest options for a strengthened strategic approach to improve small water system governance and sustainability.
- Recommendations 13 through 32 present actions to address specific areas of challenge with the multi-barrier approach to drinking water protection that were highlighted within this report.

The lead agencies for these recommendations are listed with each recommendation or group of recommendations. While some recommendations in this report have a clear provincial ministry or agency lead, others will require co-leadership and/or cross-ministry and cross-agency partnerships.

### 10.2.1 Governance of Drinking Water Protection

The governance of drinking water and source water supplies in BC is complex and involves many actors federally, provincially, and locally. The decentralized nature of the regulatory structure in BC has led to challenges when competing interests arise, particularly for source water protection. The Action Plan called for coordination of resources to ensure clear lines of responsibility within government for various aspects of drinking water protection, source protection, land-use planning, and infrastructure. The inter-agency group tasked with facilitating this coordination and implementing the Action Plan (i.e., the Assistant Deputy Ministers' Committee on Water) has disbanded; as a result, there is no inter-agency committee with this specific mandate. In addition, the signatory ministries of the Action Plan and the 2006 Memorandum of Understanding regarding inter-agency accountability and coordination on drinking water protection have changed, as have their portfolios, program responsibilities, and strategic priorities.

### Recommendation 1: Governance of Drinking Water Protection

Review the existing governance structure of drinking water protection to ensure clear lines of responsibility and accountability are defined.

### Recommendation 2: Action Plan and Memorandum of Understanding

Revisit and update the *Action Plan for Safe Drinking Water in British Columbia* and the 2006 Memorandum of Understanding regarding inter-agency accountability and coordination on drinking water protection, and recommit to modernized principles and actions across government.

### Recommendation 3: Inter-agency Collaboration and Coordination

Identify a new framework for inter-agency collaboration and coordination that aligns with current structures and issues.

*Leads (Recommendations 1–3): Ministry of Health and Ministry of Environment and Climate Change Strategy, with shared accountability and input from other ministries and agencies with responsibilities in drinking water protection. This would include but is not limited to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development; Ministry of Agriculture; Ministry of Energy, Mines and Petroleum Resources; BC Oil and Gas Commission; Ministry of Municipal Affairs and Housing; regional health authorities; and the First Nations Health Authority.*

### 10.2.2 Legislative and Policy Frameworks to Protect Drinking Water

The Action Plan called for the development of strong, effective legislation with clear lines of responsibility within government. Since the release of the Action Plan, the province enacted the *Drinking Water Protection Act* and its regulation as the primary legislation to protect drinking water. Other legislative developments and updates to protect water sources have included the development of the *Water Sustainability Act*, the *Groundwater*

Protection Regulation, the *Forest and Range Practices Act*, and the *Environmental Management Act*, among others. While a comprehensive legislative framework for drinking water protection exists, this report demonstrated that it is necessary to review the tools available to protect drinking water under the various statutes as well as how these tools overlap and coordinate with each other.

#### **Recommendation 4: Legislative Framework Review**

Evaluate the available legislative tools to protect sources of drinking water under the *Drinking Water Protection Act* and other acts to identify any gaps, areas of overlap or conflict, and triggers for enforcement action. Establish improved processes for coordinating actions taken to compel compliance to protect drinking water. The evaluation should include a review of the tools available under the *Drinking Water Protection Act*, *Public Health Act*, *Water Sustainability Act*, *Environmental Management Act*, and *Forest and Range Practices Act*.

*Leads: Ministry of Health, Ministry of Environment and Climate Change Strategy, and Ministry of Forests, Lands, Natural Resource Operations and Rural Development, in consultation with the regional health authorities and other agencies with responsibilities for protecting sources of drinking water.*

#### **Recommendation 5: Drinking Water Protection Plans**

Review the objectives and effectiveness of drinking water protection plans under the *Drinking Water Protection Act* as a source protection tool, to determine if changes to the Act could enable more collaborative and proactive source protection that would be legally binding.

*Leads: Ministry of Health and the Office of the Provincial Health Officer, in consultation with the regional health authorities.*

#### **Recommendations 6: Regulatory Conflict with the Water Sustainability Act**

Collaborate on policy options to address regulatory conflicts between the *Drinking Water Protection Act* and the *Water Sustainability Act* regarding protecting sensitive aquatic environments under the *Water Sustainability Act*

through the construction of joint intake waterworks and preventing the creation of new small water systems under the *Drinking Water Protection Act*.

*Leads: Ministry of Environment and Climate Change Strategy and Ministry of Health, in consultation with the regional health authorities and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.*

#### **Recommendation 7: Public Assent Processes and the Community Charter**

Review the waiver of public assent for borrowing processes related to the installation of treatment works for local government drinking water systems under the Municipal Liabilities Regulation in the *Community Charter*. Identify an alternate strategy to remove barriers to borrowing for necessary infrastructure improvements while also providing a streamlined opportunity for public assent. As part of this review, consider the liquid/solid waste management plans under the *Environmental Management Act* as a model.

*Leads: Ministry of Municipal Affairs and Housing and the Ministry of Health.*

### **10.2.3 Evaluation and Accountability of Program Activities**

In order to improve the oversight, evaluation, and reporting of the drinking water program in BC, it is necessary to have more data that are useful, consistent, and readily available. To address this data gap, the Office of the PHO, in consultation with the regional health authorities and the Ministry of Health, developed new indicators and categories of water systems to inform future reporting. These changes to data collection and reporting are intended to improve the understanding of where the current drinking water protection programs succeed and where more work must be done, as well as to assist in understanding the risks to drinking water systems in a more holistic way across the province. In order for this new reporting structure to succeed, further work and resources are required to implement the data system changes and to commit to a provincial strategy to ensure data collected are relevant, reliable, consistent, and accessible.

## **Recommendation 8: Information Management and Information Technology**

### **8a. Requirements for Reporting by the Office of the Provincial Health Officer**

Continue to adapt health authority data systems to align with the new indicators and water system categories developed collaboratively by the Office of the Provincial Health Officer, the regional health authorities, and the Ministry of Health, and be able to report out on such data within five years of the publication of this report.

*Lead: Regional health authorities, in consultation with the Office of the Provincial Health Officer and the Ministry of Health.*

### **8b. Provincial Information Management and Information Technology Strategy**

Develop a provincial strategy to ensure data collected are relevant, reliable, consistent and accessible and which builds on the indicators and water system categories developed collaboratively by the Office of the Provincial Health Officer, the regional health authorities, and the Ministry of Health.

*Leads: Ministry of Health and the regional health authorities, in consultation with the Office of the Provincial Health Officer.*

## **10.2.4 Small Water System Governance and Sustainability**

This report outlines the enormous financial and management capacity issues that small water systems face and the progress BC has made in trying to address these challenges. Despite efforts from drinking water officials, the provincial government, and local governments to provide flexible options and support small water systems, many of the regulatory compliance challenges and drinking water quality concerns remain. In addition to exploring the challenges faced by small water systems as a whole, this report highlighted some unique governance challenges faced by specific types of water systems, such as improvement districts, private water utilities, water users' communities, and "good neighbor systems".

## **Recommendation 9: Small Water System Strategy**

Recommit to an oversight body to develop a small water system strategy to (1) prevent the development of new unsustainable small water systems during subdivision development; (2) promote amalgamation and acquisition of small water systems; and (3) build capacity and sustainability of existing small water systems.

*Leads: Ministry of Health, with shared accountability from the Ministry of Municipal Affairs and Housing, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development, and the Ministry of Transportation and Infrastructure.*

## **Recommendation 10: Amalgamation, Acquisition, and Conversion**

**10a.** Develop and resource a strategic approach to encourage and facilitate the conversion of improvement districts, using established best practices.

**10b.** Develop best practices and guidance for local government for the development and implementation of an acquisition and amalgamation plan for small water systems.

**10c.** Identify resources required to develop dedicated funding to a) assist and provide incentive to local governments in the amalgamation or acquisition of small water systems; and b) support the conversion of improvement districts.

*Lead: Ministry of Municipal Affairs and Housing.*

## **Recommendation 11: Utilities and the Escheat Act**

Identify a strategy to ensure that customers of private water utilities that have fallen into escheat are provided with well-managed, safe, and reliable drinking water as quickly as possible.

*Lead: Ministry of Forests, Lands, Natural Resource Operations and Rural Development, in consultation with the Ministry of Municipal Affairs and Housing, the Ministry of Health, and the regional health authorities.*

### **Recommendation 12: Water Users' Communities**

Identify opportunities for greater collaboration on the approval and oversight of water users' communities, in order to improve capacity, accountability, and sustainability.

*Lead: Ministry of Forests, Lands, Natural Resource Operations and Rural Development, in consultation with the Ministry of Health and the regional health authorities.*

## **10.2.5 Elements of the Multi-barrier Approach – Specific Recommendations**

This report outlined the system of procedures, processes, and tools that collectively form the multi-barrier approach to ensuring the availability of clean, safe, and reliable drinking water. The three core elements of the approach are source protection, treatment, and distribution system integrity. These elements are supported by an integrated system of total quality management, which includes good operations and management, monitoring and reporting, and abatement and enforcement programs. This report highlighted where progress is being made within the multi-barrier approach and identified areas where improvements are needed. The following recommendations relate to specific areas of concern raised within each element of the multi-barrier approach.

### **Source Protection**

#### **Recommendation 13: Source and System Assessment**

Develop a work plan to ensure that all water suppliers have a source and system assessment on record that identifies potential risks and vulnerabilities; this assessment can then be used to develop a response plan for source and system protection.

*Lead: Regional health authorities.*

### **Treatment**

#### **Recommendation 14: Treatment Objectives**

Develop a process to uniformly review water systems to identify which systems do not meet the BC surface or groundwater treatment objectives. This review will inform the development of financial plans

and compliance processes to meet the treatment objectives, and will help identify where resources are best directed to achieve identified target dates for improvements.

*Leads: Ministry of Health, Ministry of Municipal Affairs and Housing, and the regional health authorities.*

### **Recommendation 15: Design and Performance Standards**

Develop provincial guidance for a) the assignment of log-reduction credits for the evaluation of treatment processes against treatment objectives; and b) the design of waterworks.

*Lead: Ministry of Health, in consultation with the regional health authorities.*

### **Distribution System Integrity**

#### **Recommendation 16: Distribution System Integrity and Maintenance**

Develop provincial guidance for drinking water officers for the review and assessment of distribution integrity, management, and maintenance that considers the varying sizes, capacities, and complexities of water systems.

*Lead: Ministry of Health, in consultation with the regional health authorities.*

### **Recommendation 17: Secondary Disinfection**

Systematically review all water systems to identify which systems do not provide secondary disinfection, and of those, which systems will require secondary disinfection as per the *British Columbia Guidelines (Microbiological) on Maintaining Water Quality in Distribution Systems*. Continue to promote secondary disinfection for all drinking water systems as best practice.

*Lead: Regional health authorities.*

### **Recommendation 18: Cross-connection Control**

Ensure water supply systems have appropriate plans/procedures in place to proactively identify and address cross-connections. Encourage all local government water purveyors to have an enforceable cross-connection control program.

*Lead: Regional health authorities.*

### **Recommendation 19: Lead in Drinking Water**

**19a. (Schools):** Establish a consistent sampling and reporting protocol for lead in drinking water for schools to follow. Continue to develop plans to implement measures to effectively reduce lead in school drinking water.

*Leads: Ministry of Health, Ministry of Education, and the regional health authorities.*

**19b. (Child Care Facilities):** Develop plans to promote screening for, and implement measures to effectively reduce levels of, lead in the drinking water of child care facilities, recognizing that children under the age of six are the most vulnerable to the harmful effects of lead.

*Leads: Ministry of Health and the regional health authorities, in consultation with First Nations Health Authority and the Ministry of Children and Family Development.*

### **Recommendation 20: Bulk Water Haulers**

Develop provincial guidelines for bulk water haulers to reflect current regulatory requirements and best practices.

*Lead: Ministry of Health, in consultation with the regional health authorities.*

## **Total Quality Management**

### *Good Operations and Management*

#### **Recommendation 21: Operator Certification**

Ensure that a satisfactory information exchange is occurring between the regional health authorities and the Environmental Operators Certification Program to identify water suppliers who are out-of-compliance with operator certification requirements.

*Lead: Ministry of Health, in collaboration with the regional health authorities and the Environmental Operators Certification Program.*

#### **Recommendation 22: Operator Training**

Develop a minimum recommended standard of training and competencies for a small water system operator and a bulk water hauler. Standards for small water systems should take into account the varying sizes, levels of complexity, water sources, and governance structures of these small systems.

*Leads: Ministry of Health and the regional health authorities.*

### **Recommendation 23: Emergency Response**

Ensure all water systems have an appropriate emergency response and contingency plan and have the necessary training and capacity to implement it when needed.

*Lead: Regional health authorities.*

### **Recommendation 24: Asset Management and Financial Planning**

Review training needs and develop guidance for drinking water officers on the required elements of an asset management plan and financial plans for different types of water systems.

*Leads: Ministry of Health and Ministry of Municipal Affairs and Housing, in consultation with the regional health authorities and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.*

## **Monitoring and Reporting**

### **Recommendation 25: Water Chemistry Data**

Develop and resource an action plan and strategy to make water chemistry data for water supply systems from private laboratories available online for reporting and evaluation purposes.

*Leads: Ministry of Health and the regional health authorities.*

### **Recommendation 26: Water Quality Data Sharing**

Identify effective ways to share water quality monitoring data across agencies with responsibilities in source water protection.

*Leads: Ministry of Environment and Climate Change Strategy, in collaboration with the Ministry of Health, the regional health authorities, and the First Nations Health Authority.*

### **Recommendation 27: Access to Approved Laboratories**

Develop a strategic approach to support improved access to water testing in remote and rural areas. This includes exploring Level C laboratories and point-of-use testing for microbiological indicators.

*Leads: BC Centre for Disease Control Public Health Laboratory and the Enhanced Water Quality Assurance Program, with support from the Ministry of Health.*

**Recommendation 28:  
Boil Water Notices**

Continue efforts to identify water systems that are on chronic, long-term boil water notices for reasons such as inadequate infrastructure and management, in order to inform a strategic long-term action plan to support improvements to these systems.

*Lead: Regional health authorities.*

*Abatement and Enforcement*

**Recommendation 29:  
Drinking Water Program  
Resource Requirements**

Review the resources needed by the Ministry of Health, Office of the Provincial Health Officer and the regional health authorities to effectively fulfil their roles under the *Drinking Water Protection Act*.

*Leads: Ministry of Health, Office of the Provincial Health Officer, and the regional health authorities.*

**Recommendation 30:  
Training Needs of Persons Acting  
as Drinking Water Officers**

Review the training needs of individuals who are acting as drinking water officers in BC, to allow them to carry out program responsibilities under the Act and to effectively support water suppliers to achieve clean, safe, and reliable drinking water through the multi-barrier approach.

*Leads: Ministry of Health, Office of the Provincial Health Officer, and the regional health authorities.*

**Recommendation 31:  
Investigating Threats to Drinking Water**

Develop guidance for investigating threats to drinking water under Section 29 of the *Drinking Water Protection Act*. These guidelines should clarify the scope of Section 29 investigations where assessments are required outside of the capacity of the health authority.

*Lead: Ministry of Health, in consultation with the regional health authorities and the Office of the Provincial Health Officer.*

**Recommendation 32:  
Tracking of Activities under the  
*Drinking Water Protection Act***

Develop a consistent and reliable method for tracking drinking water program activities under the *Drinking Water Protection Act*, including inspections, investigations, enforcement actions, reconsideration of decisions, and drinking water officer engagement and interactions with water suppliers, operators, local governments, and the public.

*Lead: Regional health authorities, in consultation with the Office of the Provincial Health Officer.*

**10.3 Conclusion**

This report has outlined the drinking water protection activities and programs that took place in BC between 2012/13 and 2016/17. These activities and programs ranged from source protection, treatment and distribution, to small water systems. Drinking water protection is an area where jurisdiction is shared between numerous ministries and agencies. In addition, regional health authorities, local governments, water suppliers, and drinking water system operators must be involved in the protection of drinking water. As a result, coordination and cooperation between all stakeholders is essential. This report has offered 32 recommendations to strengthen the systems in place that ensure the availability of clean, safe, and reliable drinking water in BC.



# Appendix A: Glossary

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- All-hazards approach** – a comprehensive strategy for public health emergency preparedness that integrates emergency management elements (mitigation/prevention, preparedness, response, and recovery) to address typical impacts across all types of hazards (natural and man-made), with targeted interventions to fill gaps as they are identified.<sup>1</sup>
- Ambient water** – untreated or minimally treated water from a source as it exists in nature, including either fresh water from a surface water source or groundwater.<sup>2</sup>
- Backflow** – a flow of solid, liquid, or gas from any source opposite to the normal direction of flow, back into the potable water supply or system. There are two types of backflow: backsiphonage and backpressure.<sup>3</sup>
- Blue baby syndrome** – See *Methemoglobinemia*
- Bulk water haulers** – water suppliers that distribute potable water by way of a water tanker truck.<sup>4</sup>
- Capture zone** – the land area corresponding to the portion of the aquifer supplying water to a pumping well.<sup>5</sup>
- Certificate of Public Convenience and Necessity** – “...a document granted by the Comptroller of Water Rights... *Water Utility Act* and *Utilities Commission Act*, that authorizes a private water utility in BC to construct and operate a water system to serve customers within a defined area. It describes the conditions under which the utility is established and under which it will operate. The [Certificate of Public Convenience and Necessity] is granted after a utility has secured a proven source of supply, provided an acceptable system design, and met the required administrative and financial conditions.”<sup>6</sup>
- Community water system** – a type of water system that includes local government water systems, development incorporated by the Comptroller of Water Rights, and independents.<sup>4</sup>
- Comptroller of Water Rights** – an independent, quasi-judicial regulator responsible for regulating private water utilities under the *Water Utility Act* and the *Utilities Commission Act*,<sup>7</sup> and incorporating and naming water users’ communities under the *Water Users’ Communities Act*.<sup>8</sup> Under the *Water Sustainability Act*, the Deputy Comptroller of Water Rights is authorized to exercise all the powers and perform all of the duties of the Comptroller.<sup>9</sup>
- Connection** – The Drinking Water Protection Regulation refers to a connection as the water line from the water main to a dwelling, campsite, or premises.<sup>10</sup> The number of connections therefore refers to a count of the number of dwellings, campsites, or premises served by a water supplier.
- Conversion** – the process by which improvement districts dissolve and transfer ownership and assets of a water system to a local government.<sup>11</sup>
- Cross-connection** – a connection (actual or potential) between a potable water system and any source of pollution or contamination. Every water system has cross-connections, and in large systems there are often hundreds or thousands of potential cross-connections. Wherever they occur there is the potential for backflow.<sup>3</sup>



**Cumulative effects framework** – is composed of policies, procedures, and decision-support tools that help the natural resource sector manage and identify cumulative effects; i.e., the combined environmental, social, or economic changes that result from past, present, or future human activity or from natural processes.<sup>12</sup>

**Distribution** – the physical works that carries drinking water from the sources to the intended end point or user, such as homes, businesses, schools, and other buildings. This delivery of water is typically achieved by way of pumps, motors, water mains, service pipes, storage tanks, reservoirs, and other related equipment in a closed system under pressure.<sup>13,14</sup>

**Drinking water** – water used or intended to be used for domestic purposes. Domestic purposes includes human consumption, food preparation, or sanitation; household purposes; or other prescribed purposes.<sup>15</sup>

**Drinking water officer** – “...mandated to apply and enforce the *Drinking Water Protection Act* and Drinking Water Protection Regulation. They monitor the operations of drinking water systems and act on any notices of threats to drinking water quality. Drinking water officers are responsible for issuing operating permits, and will work with water suppliers to help them achieve compliance with the legislation and the conditions on their permits.”<sup>16</sup>

**Drinking water protection plan** – a legislative source protection tool under the *Drinking Water Protection Act* that may provide special powers to local authorities to regulate activities in areas of concern for a community water supply system.<sup>17</sup>

**Escheat** – Transfer of a water supply system to the Crown when the water supply system is left without ownership.<sup>18</sup>

**Environmental health officer** – responsible for investigating and influencing “...conditions in the natural and built/physical environment that affect human health and well-being. They deal with the health impacts of contaminated air, water, land, and food, indoor and outdoor environments, and address biological, physical, chemical, and radiological hazards. Environmental health officers’ duties include inspection of and investigating complaints about food establishments, swimming pools, water supplies, and sewage disposal systems.”<sup>19</sup> Environmental health officers have delegated powers of drinking water officers under the *Drinking Water Protection Act*.<sup>15</sup>

**First-in-time-first-in-right (FITFIR)** – a priority scheme that gives priority to the water rights of senior licences to use water over junior licences. Users of groundwater in BC, when applying for a licence within the 3-year transition period following the coming into force of the *Water Sustainability Act*, will have to prove the date of first use to establish their date of precedence. The date of precedence is especially important in times of water scarcity and drought, as older licences have priority over newer ones.<sup>20,21</sup>

**Geothermal well** – taps into the natural geothermal energy beneath the earth’s surface. According to the *Geothermal Resources Act*, a geothermal well “...means a well in which casing is run and that the minister considers is producing or capable of producing a geothermal resource from a geothermal resource bearing zone.”<sup>22</sup>

**Good neighbour systems** – a group of neighbours that have constructed and connected to a shared water supply system (with or without any approvals from officials under the *Drinking Water Protection Act*).<sup>23</sup> These community water systems are jointly owned by the users of the system. They are unincorporated and have no formalized business model or governance structure to follow to make decisions and run their water systems.

**Groundwater** – water that has infiltrated or seeped into the ground and collected in aquifers.<sup>18</sup>

**Groundwater at risk of containing pathogens** – “...any ground water source that is likely to be contaminated from any sources of human disease-causing microorganisms (pathogens) including various types of bacteria, viruses, and protozoa (e.g., *Giardia* and *Cryptosporidium*). Contamination may be continuous or...intermittent.”<sup>24</sup>

**Health authority** – a regional body with the jurisdiction to govern, plan, and deliver health care services within their geographic areas. Regional health authorities are responsible for “...identifying population health needs; planning appropriate programs and services; ensuring programs and services are properly funded and managed; and meeting performance objectives.” There are five regional health authorities, a Provincial Health Services Authority, which coordinates delivery of provincial programs and specialized services, and a First Nations Health Authority, which aims to improve health outcomes for First Nations people in BC.<sup>25</sup>

**Improvement districts** – local authorities that provide specific services to landowners who have requested and pay for those services, such as drinking water. They are incorporated under a Letter Patent under the *Local Government Act*. Improvement districts are a type of community water system that varies in size from small subdivisions to larger communities, and they are generally located in rural areas in BC. Irrigation districts and waterworks districts are a type of improvement district and are included within the definition.<sup>26</sup>

**Independent water system** – a type of community water system. This type of system includes residential developments that have no administrative or financial oversight from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development or the Ministry of Municipal Affairs and Housing. Independents are not regulated as a utility, water users’ community, improvement district, regional district, or municipality. Examples include subdivisions, mobile home parks, shared interest properties, apartment buildings, and shared systems between neighbours.<sup>4</sup> This system type was created as part of the project undertaken by the Office of the Provincial Health Officer, the Ministry of Health, and the regional health authorities, to develop new indicators and water system categories.

**Local government water system** – includes all community systems that fall under the *Local Government Act*, including municipalities, regional districts, and improvement districts. These systems have governance and financial oversight provided by the Ministry of Municipal Affairs and Housing.<sup>4</sup> This system type was created as part of the project undertaken by the Office of the Provincial Health Officer, the Ministry of Health, and the regional health authorities, to develop new indicators and water system categories.

**Log reduction** – a mathematical formula for calculating the number of live pathogens in treated water in comparison to raw water. This indicates the effectiveness of the treatment system. One log is equal to a 10-fold reduction in pathogens.<sup>18</sup>

**Maximum acceptable concentration** – a health-based maximum acceptable concentration for a particular chemical or physical parameter for safe drinking water as defined by the *Guidelines for Canadian Drinking Water Quality*. “Health-based guidelines are established on the basis of comprehensive review of the known health effects associated with each contaminant, on exposure levels and on the availability of treatment and analytical technologies.”<sup>27</sup>

**Medical health officer** – “physicians who have public health training through post-secondary training and/or specialty training in Community Medicine. They use population health knowledge and skills to play leading and collaborative roles in the maintenance and improvement of health and well-being of their communities. They are responsible with the public health team, for monitoring, preventing, and controlling communicable and chronic diseases, investigating disease outbreak and hazards to health and coordinating public health responses to health threats.”<sup>19</sup> Medical health officers have legislated powers under the *Public Health Act* and the *Drinking Water Protection Act*.<sup>15,28</sup>

**Methemoglobinemia** – a condition caused by nitrates in drinking water, which results in the decreased ability of blood to carry oxygen around the body because of reduced levels of haemoglobin. It most commonly affects infants who may show signs of blueness around the mouth, hands, and feet, leading to its common name “blue baby syndrome.”<sup>29</sup>

**Multi-barrier approach** – “an integrated system of procedures, processes, and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health.”<sup>30</sup>

**Non-point source** – a source of groundwater contamination resulting from the cumulative effect of any number of distributed factors or activities, without a specific source. Examples include application of fertilizers on agricultural land; pesticides on agricultural land and forests; and contaminants in rain, snow, and dry atmospheric fallout.<sup>31</sup>

**Operator** – the people responsible for ensuring the safe and continuous operation and maintenance of water systems. This includes testing and treating samples, testing and fixing equipment, and monitoring and tracking equipment sensor data.<sup>32</sup> In BC, the Environmental Operators Certification Program certifies operators.

**Point-of-entry** – a treatment device located at the point where drinking water enters the premises. A point-of-entry treatment device ensures that all of the water entering the building is treated, which provides increased health protection to users at every tap.

**Point-of-use** – a treatment device located immediately before the point where drinking water is drawn for consumption, such as a kitchen tap.

**Point source** – a source of groundwater contamination coming from a single source or point such as a municipal landfill, leaks or spills of industrial chemicals at manufacturing facilities, or mill tailings in mining areas.<sup>31</sup>

**Potable water** – “...means water provided by a domestic water system that (a) meets the standards prescribed by regulation, and (b) is safe to drink and fit for domestic purposes without further treatment.”<sup>15</sup> BC uses the *Guidelines for Canadian Drinking Water Quality* set by Health Canada.

**Private water system** – a single-family residence on its own water supply system (i.e., a private well or surface intake serving only one single-family residence). These systems are not inspected or monitored by the regional health authorities as they do not meet the definition of a water supply system under the *Drinking Water Protection Act*.<sup>18</sup>

**Public health engineers** – professional engineers that work at the regional health authorities and are delegated powers under the *Drinking Water Protection Act* to approve construction permits for drinking water systems. They provide oversight to ensure compliance and safety of drinking water systems by approving construction permits before drinking water supply systems are built or altered.<sup>16,33</sup>

**Restrictive covenant** – is an agreement registered on the title of a given property between the property owner and a government agency that specifies restriction of activities or land-use that is applied to a portion of the subject property.<sup>34,35</sup>

**Small water system** – a water system that serves less than 500 people in a 24-hour period.<sup>10</sup>

**Source protection** – is “...based on watershed management [and] involves a coordinated approach among stakeholders to develop short- and long-term plans to prevent, minimize, or control potential sources of pollution or enhance water quality where necessary.”<sup>30</sup>

**Stand-alone facility water system** – a facility that owns and operates its own water supply system, where the public has access to drinking water. These facilities include industrial/commercial facilities, recreational facilities, public health facilities, schools (kindergarten to grade 12), civic and community facilities, and institutions.<sup>4</sup> This system type was created as part of the project undertaken by the Office of the Provincial Health Officer, the Ministry of Health, and the regional health authorities, to develop new indicators and water system categories.

**Riparian areas** – these areas link water to land. “They border streams, lakes, and wetlands. The blend of streambed, water, trees, shrubs, and grasses in a riparian area provides fish habitat, and directly influences it.”<sup>36</sup>

**Surface water** – water that has accumulated on the surface of the ground. This includes water from lakes, streams, or springs.<sup>37</sup>

**Treatment** – the processes by which drinking water is processed to ensure that it is potable and suitable for consumption. This includes the deactivation or removal of disease-causing agents and any necessary processes to remove harmful chemicals, metals or other parameters. Conventional treatment typically includes coagulation and flocculation, sedimentation, filtration, and disinfection.<sup>38</sup>

**Utilities** – water systems that are built by developers in areas where no existing water service is available. A utility provides water in exchange for compensation to five or more lots (i.e., properties) or a corporate facility (e.g., a ski resort).<sup>7</sup> A utility is regulated under the *Water Utility Act* and the *Utilities Commission Act* and may be set up under several different business/ownership models, including a strata corporation, a society, a corporation, an individual, or partnership.<sup>4</sup>

**Watershed** – the topographically defined area of land draining to the drinking water point of diversion of a surface water source.<sup>5</sup>

**Water supplier** – refers to the owner of a water supply system. These suppliers may be local governments, improvement districts, private utilities, water users' communities, corporations, strata corporations, societies, cooperative associations, individuals, or other forms of organization.

**Water supply system** – "...a domestic water system, other than (a) a domestic water system that serves only one single-family residence, and (b) equipment, works, or facilities prescribed by regulation as being excluded."<sup>15</sup>

**Water users' communities** – a group of six or more water licensees incorporated and named by the Comptroller of Water Rights, each with their own licence(s), who maintain and operate the works listed in the water licence incorporated in the Certificate of Incorporation.<sup>8</sup> The *Water Users' Communities Act* governs the incorporation and management of water users' communities.

**Water users' society** – a society created under the *Societies Act* that owns and operates a water supply system.<sup>4,39</sup>

**Water Supply System** – "...a domestic water system, other than (a) a domestic water system that serves only one single-family residence, and (b) equipment, works, or facilities prescribed by regulation as being excluded."<sup>15</sup>

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# Appendix B: Drinking Water Protection Program Committees

Committee	Description
<b>Federal-Provincial-Territorial Committee on Drinking Water</b>	The Federal-Provincial-Territorial Committee on Drinking Water has developed and published the <i>Guidelines for Canadian Drinking Water Quality</i> for over 20 years (See Chapter 4, Section 4.2.1). Health Canada provides scientific and technical expertise to the committee and coordinates its activities. The committee reports to the Federal-Provincial-Territorial Committee on Health and the Environment. Members represent the authority responsible for drinking water quality in their jurisdiction. The Manager of Drinking Water, Ministry of Health, is the representative from BC.
<b>Drinking Water Leadership Council</b>	Drinking Water Leadership Council is a forum established by the Ministry of Health to provide advice on the development of drinking water policy and technical guidance. Membership includes representatives from regional health authorities, the First Nations Health Authority, and other related government ministries (i.e., Ministry of Environment and Climate Change Strategy, Ministry of Municipal Affairs and Housing, and Ministry of Forest, Land, Natural Resource Operations and Rural Development). A primary objective of Drinking Water Leadership Council remains establishing coordinated discussions and cooperation among all the agencies involved in administering the <i>Drinking Water Protection Act</i> .
<b>Environmental Health Policy Advisory Committee</b>	In 2010, the Ministry of Health established the Environmental Health Policy Advisory Committee to provide provincial-level direction in the development, implementation, and review of environmental health policies in BC. The roles of the committee are to (a) support collaboration in and (b) set priorities for addressing environmental health issues in BC. Membership includes the Office of the Provincial Health Officer, the Ministry of Health, regional health authorities, First Nations Health Authority, and the BC Centre for Disease Control.
<b>Regional Directors of Health Protection Council</b>	The Regional Directors of Health Protection Council provides a means of communication and coordination between members to support the delivery of consistent and efficient health protection programs across the province. Membership includes regional directors or equivalents from the regional health authorities, First Nations Health Authority, and the BC Centre for Disease Control. The Ministry of Health participates as a non-voting ex-Officio member.



Committee	Description
<b>Health Authority Drinking Water Council</b>	In 2010, the Regional Directors of Health Protection Council established the Health Authority Drinking Water Council to promote collaboration between the drinking water program managers of the regional health authorities and First Nations Health Authority. The Health Authority Drinking Water Council also works collaboratively with the Ministry of Health and the Office of the Provincial Health Officer. The mission of the council is to support effective, efficient, and operationally consistent approaches to the delivery of the drinking water programs and the administration and enforcement of the <i>Drinking Water Protection Act</i> across the province.
<b>Health Authority Public Health Engineers' Council</b>	The purpose of the Health Authority Public Health Engineers' Council is to promote collaboration between the public health engineers of the regional health authorities; liaise in a collaborative manner with the Ministry of Health and other stakeholders; provide effective, efficient, and operationally consistent approaches to the delivery of public health engineering programs within the health authorities; and provide a technical forum for education and information exchange. Membership includes all public health engineers providing service to the regional health authorities in BC. The Ministry of Health participates as an ex-officio member.

# Appendix C: Training Programs for Small Water System Operators (2012/13-2016/17)

Training Program	Description
<b>BC Water and Wastewater Association</b>	<p>In 2012/13, the BC Water and Waste Association (BCWWA) provided 11 small water system courses to a total of 130 small water system operators. Four of the courses were in an online format. Seven of the small water system courses were run in conjunction with the source water protection course, through a grant provided by the Ministry of Environment and Climate Change Strategy. In 2013/14, there were four online courses with 76 participants. There were 15 in-person courses attended by 155 operators, including nine courses that were run in conjunction with the source water protection course (110 operators attended the source water protection course).<sup>1</sup> Since April 2014, BCWWA has offered the small water system course 43 times (29 scheduled sessions, 19 custom courses, and one online course) in varying locations to a total of 452 students. In addition to the small water system course, the BCWWA arranges a small water system symposium as part of the BCWWA annual conference. The symposium is a day-long session at the conference devoted to topics of interest to small water system owners, operators, and consultants.<sup>2</sup></p>
<b>Maintenance Training Solutions</b>	<p>Maintenance Training Solutions provides training and consulting services out of Vernon, BC, primarily to the municipal utility industry. The company's facility provides hands-on learning and contains a fully operational water distribution system, in-ground reservoirs, water treatment plant, supervisory control and data acquisition (SCADA) system, and laboratories. While most of the training is focused on larger water system operators, the facility also offers small water system training. Since October 2015, Maintenance Training Solutions offered the small water system course in Vernon on eight different occasions to a total of 71 participants. The company's trainers will provide the course outside of Vernon upon request.<sup>3</sup></p>



Training Program	Description
<b>Small Water System Source Protection Training - BCWWA</b>	<p>In 2013, the Ministry of Environment and Climate Change Strategy provided \$100,000 to BCWWA to develop training specific to small systems.<sup>1</sup> BCWWA developed a source protection course to assist small systems in preparing protection plans. The course was offered in conjunction with the small water system operator course in 12 locations in BC. The money provided by the ministry was used to reduce registration costs for water suppliers to attend the courses (an 80 per cent reduction for the source water protection course, and a 60 per cent reduction for the small water system operator course).<sup>4</sup> BCWWA reported that during 2012/13 and 2013/14, 98 and 110 people took the source protection course in those fiscal years respectively.<sup>1</sup> Since 2014/15, BCWWA has offered the source protection course for small water systems on three occasions to a total of 19 participants.<sup>2</sup></p>
<b>WaterSafe</b>	<p>WaterSafe is a distance education course for small water system owners and operators offered by Thompson Rivers University. The university first developed the course in 2006. The course includes information about water sources, monitoring, treatment, storage, and distribution, as well as the responsibilities of the owners and operators. Attendees are issued a certificate upon successful completion of the course.<sup>5</sup> Many health authorities require small system operators to have WaterSafe as a minimum training requirement. Thompson Rivers University reports that approximately 100 people or more per year participate in the distance course. For example, 110 people completed the course during 2016/17.<sup>6</sup></p> <p>Thompson Rivers University in 2016/17 also received \$14,000 in funding from Interior Health to update the course and the website. The work was scheduled to be completed in the fall of 2017.<sup>7</sup></p>
<b>Regional District of Nanaimo Water Purveyor Working Group</b>	<p>In 2010, the Regional District of Nanaimo developed the Water Purveyor Working Group<sup>13</sup> to provide small water system operators with networking and educational opportunities. This group provides opportunities to meet with other owners and operators to share ideas about sustainable operation of small water systems. Since 2010, the group—which ranges from about 30–60 purveyors who operate mobile home park water systems, improvement district waterworks, campground water systems, etc.—has met annually to share ideas and learn about financing and treatment options, water conservation plans, challenges for small water purveyors, and water quality testing and treatment.<sup>14</sup></p>
<b>Mayne Island Integrated Water Systems Society</b>	<p>The Mayne Island Integrated Water Systems Society is a non-profit volunteer organization that provides support to small water suppliers and private well owners on the Gulf Islands. The society hosts annual workshops and seminars and provides general information to its members. The workshops offer continuing education units and focus on issues of particular importance to the islands, including topics such as water conservation and rain water harvesting. The society maintains an active and informational website for its members and the general public.<sup>15</sup></p>

During the reporting period, several of the regional health authorities developed training courses and sessions aimed at small water systems. These courses are most often free or delivered at cost by the health authority and are offered in regions where small water systems are located. Most, but not all, of the courses are available for continuing education units<sup>a,8</sup> or are listed on the Environmental Operators Certification Program training registry.

Health authority-led courses are beneficial for several reasons: they provide affordable training where it is needed, and they help build the relationship and understanding between the regulated and the regulator. Unfortunately, the courses that have been developed to date have had limited offerings due to competing demands on limited health authority resources. Interior Health appears to be the only region that is currently offering regularly scheduled small water system courses.

<b>Drinking Water Courses Delivered by Health Authorities</b>	<b>Description</b>
<b>Microbes in your Water (Vancouver Coastal Health)</b>	This course was developed by Vancouver Coastal Health and the BC Centre for Disease Control. The course was developed with small water systems as the target audience, and it is intended to be offered on a cost-recovery basis. Vancouver Coastal Health ran the course twice in 2016 as pilots in Sechelt and Powell River. Due to increasing demands on staff time, Vancouver Coastal Health has yet to deliver the course as intended. <sup>9</sup>
<b>Introduction to Emergency Response Planning (Interior Health)</b>	Interior Health developed this course to assist small water system operators in developing their emergency response plan—participants actually leave the workshop with part of their plan completed. During 2016/17, Interior Health offered the course 18 times in various locations at no cost to small water systems. There were 180 participants representing 137 small systems within the interior. Thirty-four of the participants were certified as small water system operators by the Environmental Operators Certification Program. <sup>10</sup>
<b>Safe Water for Small Systems (Northern Health)</b>	Northern Health developed this course for small water systems in 2011 and has periodically offered the course in the regions since that time. Over 2016/17, the course was offered with a minimal cost on six occasions in locations such as Terrace, Fort St. John, and Dawson Creek to a total of 94 participants. This course has not been registered with the Environmental Operators Certification Program for continuing education units. <sup>11</sup>
<b>Writing an Emergency Response and Contingency Plan (Island Health)</b>	Island Health developed this course to educate small water systems about the requirements for a plan and the necessary components. Each participant will leave the session with a plan for their system that outlines possible adverse situations and appropriate solutions to protect the health of the system’s users. While the course has been developed, Island Health has not offered it yet due to time and staffing constraints. <sup>12</sup>

<sup>a</sup> All water system operators certified by the Environmental Operators Certification Program (EOCP) are required to complete continuing education units. Small system operators are required to complete 1.2 units every two years to maintain their certification.

<b>Drinking Water Courses Delivered by Health Authorities</b>	<b>Description</b>
<b>Small Systems Treatment Options and Financing (Island Health)</b>	This was a one-day course offered in 2012 by the Regional District of Nanaimo's Water Purveyor Working Group and Island Health for small water system operators/managers in Nanaimo and the surrounding area with less than 100 connections. Objectives of the course included increasing the participants' understanding of water treatment technologies and financing options. <sup>12</sup>
<b>Drinking Water Protection Act Water Quality Monitoring (Island Health)</b>	Island Health developed this course to provide small water systems with an understanding of water quality results, proper sampling techniques, and how to establish a water quality monitoring program as per the <i>Drinking Water Protection Act</i> . This course was offered in 2012, and a different version was offered in 2014 through the Regional District of Nanaimo's Water Purveyor Working Group. Island Health has not offered the course independently to small water systems elsewhere due to time and staffing constraints. <sup>12</sup>
<b>Source Protection Planning (Island Health)</b>	This course, developed by Island Health, provides the water supplier with a better understanding of the source protection planning process, and the steps required to develop an effective source protection plan. While the course has been developed, Island Health has not offered it yet due to time and staffing constraints. <sup>12</sup>
<b>Groundwater Protection and Vulnerability Mapping Workshop (Island Health)</b>	Island Health collaborated with other groundwater experts from the BC government to offer four half-day workshops on Vancouver Island during 2011 and 2012 on the use of DRASTIC groundwater vulnerability maps in land-use planning and source water protection. The workshops introduced participants to source protection, groundwater basics, protection strategies, and hands-on application of groundwater vulnerability maps to source protection. <sup>12</sup>

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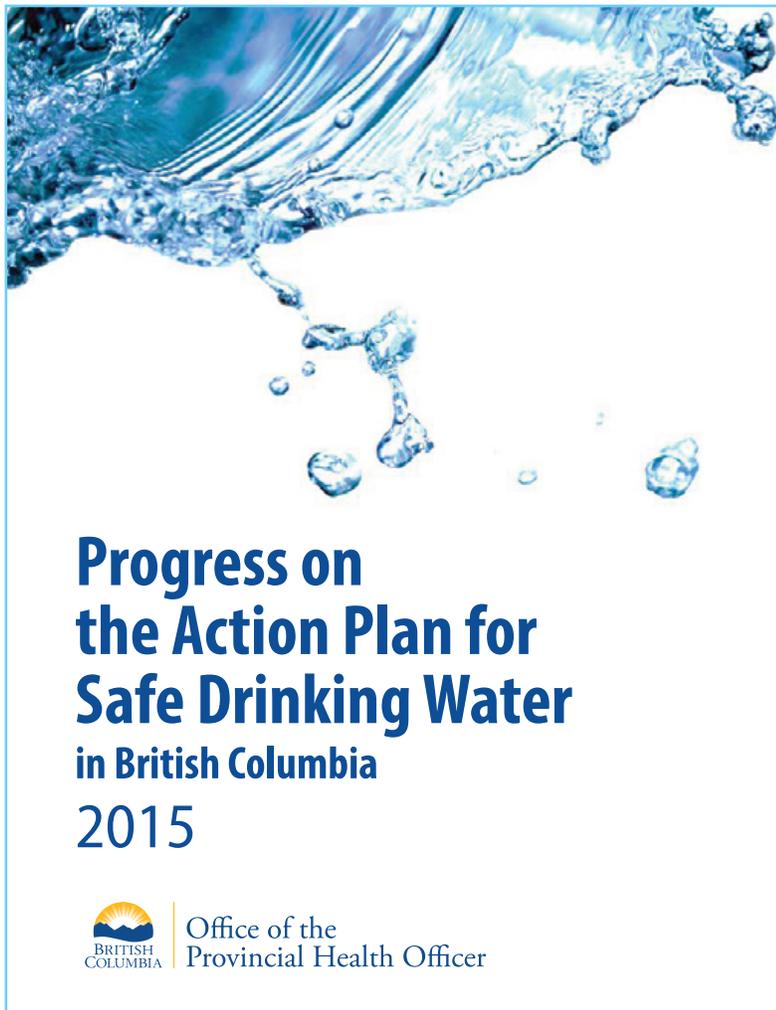


## Appendix D: Update on the 2015 Recommendations on the Action Plan for Safe Drinking Water in British Columbia

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This appendix provides an update on the recommendations put forward in the Provincial Health Officer's (PHO) report *Progress on the Action Plan for Safe Drinking Water in British Columbia 2015* (the 2015 progress report), which covered activities for fiscal years 2009/10 to 2011/12. Many of these recommendations pertain to topics discussed

in more detail in the body of this report; therefore, this appendix only provides brief summaries of these areas, and where possible refers the reader back to the more detailed descriptions in the chapters. The information provided in this update was collected from the responses to the PHO to the request for updates to the 2015 progress report.





2015 Recommendation	Update
<p><b>Recommendation 1</b> <b>Environmental Farm Protection</b></p> <p><i>Continue to increase the number of farms participating in programs to protect source water.</i></p> <p><i>(Leads: Ministry of Agriculture, Agriculture and Agri-food Canada)</i></p>	<p>The Environmental Farm Plan Program is funded through the five-year federal/provincial/territorial framework Growing Forward 2, which expired in 2018 and will be replaced by a new agreement called the Canadian Agricultural Partnership. The Ministry of Agriculture intends to continue the Environmental Farm Plan Program into the future, with a targeted focus on addressing water quality concerns, environmental sustainability, and climate change.</p> <p>While Environmental Farm Plans may be a good approach to encouraging farmers to protect source waters, the incentives connected to the plan and the self-regulated nature of the industry may not be enough in areas with intensifying agriculture and other land uses, especially those with vulnerable underlying water supplies (e.g., the Hullcar Aquifer in the North Okanagan).</p>
<p><b>Recommendation 2</b> <b>Source Water Protection</b></p> <p><i>The Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission and Ministry of Forests, Lands and Natural Resource Operations should continue to identify priorities for source water protection initiatives, ensuring action is coordinated across government agencies and regional health authorities.</i></p> <p><i>(Leads: Ministry of Health, Ministry of Environment, Ministry of Forests, Lands and Natural Resource Operations, Ministry of Energy and Mines, Oil and Gas Commission)</i></p>	<p>Inter-agency coordination and partnership is essential for source protection and the multi-barrier approach and should remain as a core principle for BC. Referral protocols need to be in place and followed so that drinking water officers can be consulted and continue to be made aware of any controversial land use decisions that may impact drinking water early in the approval process. While inter-agency work continues and project-focused committees have formed to address specific issues as described in Chapter 4, the inter-agency groups tasked with accountability for the <i>Action Plan for Safe Drinking Water in British Columbia</i> have dissolved.</p> <p>For more information on inter-agency collaboration for source protection, see Chapter 4, Section 4.4.</p>

2015 Recommendation	Update
<p><b>Recommendation 3</b> <b>Ground Water Management</b></p> <p><i>Where groundwater use, including use for geothermal energy or oil and gas exploration or production, threatens to contaminate or significantly deplete water supply sources, including drinking water sources, government should</i></p> <p><i>a) Continue to identify and characterize water resources and ensure they are documented in the Integrated Land and Resource Registry or in the Land and Resource Data Warehouse.</i></p> <p><i>b) Initiate water protection planning processes.</i></p> <p><i>(Leads: Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission)</i></p>	<p>The Ministry of Environment and Climate Change Strategy (ENV) continues to establish observation wells as part of the Provincial Groundwater Observation Well Network. In addition, the ministry monitors groundwater in aquifers to ensure that they are sustainable, and has developed aquifer mapping, classification, and water budgets. The ministry has also worked with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) to develop the <i>Water Sustainability Act</i>, with input from the Ministry of Health.</p> <p>The Ministry of Health, ENV, and FLNRORD meet regularly as part of the Groundwater Technical Team. The Ministry of Health has also produced a <i>Guidance Document for Determining Ground Water at Risk of Containing Pathogens</i> tool for identifying wells at risk of contamination.</p> <p>The Ministry of Energy, Mines and Petroleum Resources (EMPR) continues to work through the Northeast Water Strategy to characterize aquifers, conduct private well sampling, conduct water studies, and develop water decision support tools for water managers. Regulatory updates to protect groundwater from geothermal activity and oil and gas exploration are described in Chapter 4.</p> <p>In October 2014, the Oil and Gas Commission engaged Ernst and Young to conduct a focused assessment of the regulatory framework governing hydraulic fracturing in BC. Specifically, Ernst and Young was asked to</p> <ul style="list-style-type: none"> <li>• Assess the Commission’s current regulatory framework, including legislation, regulation, guidance, leading practices, policies, permit conditions, and industry standards.</li> <li>• Develop a detailed map of the relationship between existing regulatory instruments and the key issues presented by hydraulic fracturing.</li> <li>• Conduct a high-level scan of six selected jurisdictions with an industry and geology similar to BC.</li> <li>• Identify opportunities to improve the framework.</li> <li>• Based on a set of guiding principles, develop leading-practice recommendations.</li> </ul> <p>The report was presented to the Commission in March 2015. Ernst and Young determined in their review that the issues presented by hydraulic fracturing are being effectively managed by the Commission, within the current regulatory framework; however, some opportunities for improvement were described.<sup>1</sup></p> <p>For more information on groundwater management, see Chapter 4.</p>

2015 Recommendation	Update
<p><b>Recommendation 4</b></p> <p><b>Monitoring Effects of Resource Activity</b></p> <p><i>Government should continue to improve monitoring for potential impacts of resource activities on drinking water. Monitoring should either be undertaken by the parties conducting the resource activity or by government, and should focus on parameters specifically associated with each resource activity, such as sediment loading from soil.</i></p> <p><i>(Leads: Ministry of Forests, Lands and Natural Resource Operations, Ministry of Health, Ministry of Environment)</i></p>	<p>FLNRORD has continued to improve monitoring by converting the Forest and Range Evaluation Program Water Quality Effectiveness Evaluation from a paper assessment to a digital assessment form. The ministry has also developed a new protocol for identifying forestry resource management impacts on water quality.</p> <p>ENV leads the Provincial Groundwater Observation Well Network Program, which has approximately 186 wells to provide data on various aquifers, with seven new wells being added since 2015. It also co-leads the Canada-BC Water Quality Network, which has 40 monitoring stations; a new station was added on the Murray River in 2017. The ministry also examined sediment loading in resource development areas as part of the cumulative effects framework; developed the Provincial Lakes Network Monitoring Program; established water quality objectives on priority lakes, rivers, and streams; and managed authorizations in the Waste Discharge Regulation, under the <i>Environmental Management Act</i>.</p> <p>ENV, in collaboration with FLNRORD, also participates in the Northeast Water Strategy. As part of this, the Ministry of Health provides financial support for private well sampling in Northeastern BC.</p> <p>Monitoring data continues to come from a variety of sources and databases. Chapter 4 describes a vast number of data sources, some of which are integrated and others which are not (such as health authority data). While many improvements to monitoring tools have been made, further collaborative work between agencies is still needed to ensure statutory decision makers, policy makers, water suppliers, and water users have access to source water monitoring data from various sources.</p> <p>For more information on monitoring the effects of resource activity, see Chapter 4.</p>

2015 Recommendation	Update
<p><b>Recommendation 5</b> <b>Evaluating Land Use Management Practices</b></p> <p><i>Government should continue to evaluate the potential impacts of activities on source water quality, including the benefits and weaknesses of different land-use management practices, and should promote those practices that minimize water quality impacts.</i></p> <p><i>(Leads: Ministry of Forests, Lands and Natural Resource Operations, Ministry of Agriculture, Ministry of Health, Ministry of Environment, Ministry of Energy and Mines, Oil and Gas Commission, and research and granting agencies)</i></p>	<p>A multi-stakeholder partnership group, including industry (mining, forestry, oil and gas), EMPR, First Nations, ENV, FLNRORD, and local and regional governments, worked through the Northeast Water Strategy to produce the Murray River Surface Water Quality Cumulative Effects Framework. EMPR also worked through the Northeast Water strategy to support several studies, including but not limited to, permafrost and dugouts in the Peace River Region.</p> <p>The FLNRORD Forest and Range Evaluation Program collected water quality data during 2014–2016 in 23 of its districts. As part of this evaluation, 1,854 site assessments were completed where forest-related sediment could affect water quality.</p> <p>ENV developed the <i>Water Sustainability Act</i>, which was brought into force in February 2016. This Act allows the government to establish water objectives that can apply across the natural resource sectors. Additionally, water sustainability plans and drinking water protection plans can be developed in concert with each other. There are also strengthened tools within the Act that can be applied to drilling authorizations and individual water licences.</p> <p>ENV with support from the Ministry of Agriculture, is conducting a review to amend and update the Agricultural Waste Control Regulation. The Ministry of Agriculture has also evaluated post-harvest nitrate testing with producers in the Hullcar Valley as an indicator of effective nitrogen management, and as a tool to help producers monitor and prevent excess nitrogen use, which can impact water quality if it leaches into vulnerable groundwater.</p> <p>See Chapter 4 for more details land use management practice.</p>

2015 Recommendation	Update
<p><b>Recommendation 6</b> <b>Water Protection Planning</b></p> <p><i>To ensure that any planning efforts undertaken by a water supplier, including planning undertaken outside the scope of the Drinking Water Protection Act, can be implemented under the Drinking Water Protection Act, government should consider amending the Act to clearly enable elements of water suppliers' plans to be implemented through provincial regulation made pursuant to the Drinking Water Protection Act.</i></p> <p><i>(Lead: Ministry of Health)</i></p>	<p>The Ministry of Health is leading a System Risk Management Plan project to enable communities to use a more holistic approach in improving the way water systems work and to help stakeholders better manage risk. This work is still in the development stage and it is too early to determine its effectiveness.</p> <p>The ministry is also working with the Environmental Operators Certification Program to (a) develop a new classification model that considers the complexity of the system for operator training; (b) create detailed operator competencies to support certification and training programs, and; (c) develop better defined regulatory processes in partnership with health authorities.</p> <p>The ministry is also working in partnership with the BC Water and Waste Association, the Engineers and Geoscientists BC, and the Applied Science Technologists and Technicians of BC to facilitate development of a water workforce strategy, to address the impending shortage of workers in the water sector.</p> <p>While these projects represent good work towards creating a more robust system, the applicability of drinking water protection plans and other sections of the <i>Drinking Water Protection Act</i> when inter-jurisdictional source protection issues arise continue to be a challenge, as highlighted in Chapter 4.</p> <p>For more information on water protection planning, see Chapter 4.</p>

2015 Recommendation	Update
<p><b>Recommendation 7</b> <b>Information Management</b></p> <p><i>In the absence of a province-wide drinking water information management system, regional applications should be improved to allow standardized reporting across the province. At a provincial level applications should be enhanced to allow government staff, health authority staff, water suppliers and their agents, and the general public to access all provincial government and health authority data relevant to drinking water systems or drinking water protection, where that data is not subject to protection of privacy requirements.</i></p> <p><i>(Leads: Ministry of Health, health authorities)</i></p>	<p>Decentralized information management and access to data continues to be a challenge for reporting on drinking water quality and protection programs. In response, the health authorities have worked to improve their information management systems for drinking water and to improve the accessibility of this information for suppliers, government and health authority staff, and the general public, with the support of the Ministry of Health. Health authorities also continue to work with the Office of the Provincial Health Officer (PHO) to modify their data systems to align with the new categories and indicators developed as part of the new indicator project (See Chapter 1, Section 1.5). This project will help provide consistency in data gathering and access for evaluation and policy development purposes.</p> <p>Vancouver Coastal Health is working with HealthSpace Data Systems Ltd. to develop a proof of concept for uploading chemical and physical water quality parameters. If this is successful, other health authorities that use HealthSpace (Fraser Health, Northern Health, and Island Health) could adopt this technology. Vancouver Coastal Health and Fraser Health have also been working with the information management provider HealthSpace to modernize and improve the system to include the new PHO indicators.</p> <p>Interior Health continues to improve the data it stores on Hedgehog.Net, and is aligning the data it collects with the new PHO indicators. This site has new, near real-time updating of water system advisory information that is available to the public.</p> <p>In addition, the Ministry of Health is reviewing the operating permit template in the <i>Drinking Water Officers' Guide</i>, and is considering an enhanced template for municipal drinking water systems that would include consistent reporting requirements.</p> <p>For more information on the new indicator project see Chapter 1. For information on management of source water data see Chapter 4.</p>

2015 Recommendation	Update
<p><b>Recommendation 8</b> <b>Cross-government Referral Protocols</b></p> <p><i>Regional drinking water teams established under the Memorandum of Understanding for Inter-Agency Accountability and Coordination on Drinking Water Protection should continue to evaluate and improve protocols to ensure decisions that affect the safety of drinking water involve the appropriate health officials, either within the Ministry of Health or within the regional health authority. The Ministers previously involved in the Directors Inter-Agency Committee on Drinking Water need to ensure they commit to having the appropriate staff available to support the regional drinking water teams. The format for meetings may need to be updated to provide effective consultation and action.</i></p> <p><i>(Leads: Regional drinking water teams)</i></p>	<p>Oversight for regional drinking water teams was lost after the Assistant Deputy Ministers' Committee on Water disbanded. Regional drinking water teams in Island Health, Vancouver Coastal Health, and Fraser Health have ceased to function, and Island Health works with ministries and regional districts on an individual basis to move forward on the MOU (see Chapter 4, Table 4.5).</p> <p>Interior Health transferred the functions of the regional team to their regional managers committees in 2014, and they use these groups to address outstanding concerns with land use and contamination across the region.</p> <p>Northern Health's regional drinking water team continues to meet, although irregularly, and it reports challenges stemming from the dissolution of the Assistant Deputy Ministers' Committee on Water.</p> <p>Health authorities note that due to changing priorities, there seems to be a lack of interest or time on the part of the ministries to meet on a regular basis as they had under the regional drinking water teams.</p> <p>For further information and analysis on inter-agency coordination, see Chapter 4.</p>
<p><b>Recommendation 9:</b> <b>Inter-agency coordination</b></p> <p><i>The directors involved in the Directors' Inter-Agency Committee on Drinking Water should monitor regional decision makers with all resource ministries to ensure an integrated approach to providing safe drinking water is being used, outlined in the Action Plan for Safe Drinking Water in British Columbia.</i></p> <p><i>(Lead: Ministry of Health)</i></p>	<p>The Ministry of Health no longer coordinates meetings under the Directors' Inter-Agency Committee on Drinking Water. However, when issues arise the ministry has assembled relevant ministries, local governments, and stakeholders with interests and responsibilities to address the issue of concern. Examples of this approach include the cross-government team formed to address nitrates in the Hullcar Aquifer, the inter-agency drought working groups, or the Northeast Water Strategy. This project-focused approach aligns groups across government and allows for more flexibility to tailor solutions to specific needs. This approach has been more effective in some cases (i.e., the inter-agency drought working groups) than in others (i.e., preventing contamination of the Hullcar Aquifer). In the case of Hullcar, the response and formation of the working group was reactionary and the inter-agency coordination came too late to proactively address the issue.</p> <p>For more information inter-agency coordination, see Chapter 4, Section 4.4.</p>

2015 Recommendation	Update
<p><b>Recommendation 10</b>  <b>Consistent Policy Across Government</b></p> <p><i>Government needs to ensure that mechanisms are in place to ensure that policy direction across government is consistent with government’s eight principles outlined in the Action Plan for Safe Drinking Water in British Columbia.</i></p> <p><i>(Lead: Ministry of Health)</i></p>	<p>The Ministry of Health has committed to lead the development of drinking water policy, in consultation with stakeholders within and outside of government.</p> <p>Inter-agency coordination for policy direction and operations among the drinking water protection programs is described in Appendix B. Inter-agency coordination among agencies with a role in source water protection is described in Chapter 4.</p> <p>For policy development that aligns with the principles of the <i>Action Plan for Safe Drinking Water in British Columbia</i>, the Ministry of Health depends on the technical advice and feedback of the Drinking Water Leadership Council. The council meets monthly and conducts its work through sub-committees and project teams. The terms of reference and functions of the council are currently under review to ensure the structure and work of the committee continues to meet its desired goals.</p> <p>For more information on inter-agency collaboration for drinking water program policy, see Chapter 2, Section 2.1 and Appendix B. For information on inter-agency collaboration for source water protection, see Chapter 4, Section 4.4.</p>
<p><b>Recommendation 11</b>  <b>Water System Assessments</b></p> <p><i>All water suppliers need to undertake thorough assessments of their systems and develop assessment response plans. Health authorities need to ensure that all water suppliers have established time frames to complete the assessments. In evaluating assessment response plans, health authorities should require water suppliers to meet all applicable provincial treatment objectives. Where appropriate, sampling frequencies should be included on operating permits. Efforts should be made by stakeholders to reduce the number of systems on long-term boil water notices, while ensuring the health of the community through improvements in water quality delivered to citizens.</i></p> <p><i>(Leads: Health authorities, drinking water suppliers, local authorities)</i></p>	<p>The regional health authorities continue to work with water suppliers to ensure that they meet provincial treatment objectives, reduce the number of systems on long-term boil water notices, and make improvements in drinking water quality.</p> <p>Several health authorities have noted that there are significant financial resource challenges for small water systems in meeting this recommendation. They also suggest that strict timelines imposed by the health authorities may not be the most effective way of ensuring that suppliers conduct assessments and develop assessment response plans.</p> <p>Northern Health has begun by phasing in assessments, starting with large water systems. It has also placed conditions on operating permits where infrastructure or operating procedures require upgrading.</p> <p>The status of source and system assessments and response plans are described in Chapter 4. The provincial government has developed a range of assessment and planning tools of differing levels of complexity, but at this time it is difficult to assess their use or impact. The new indicators for the multi-barrier approach include source water assessments and source protection plans. Future PHO drinking water reports intend to report out on the number of water suppliers meeting source assessment and protection plan requirements.</p> <p>For more information on source assessments and protection plans, see Chapter 4. For information on treatment objectives and distribution requirements, see Chapter 5. See Chapter 6 for information on financial plans and infrastructure funding.</p>

2015 Recommendation	Update
<p><b>Recommendation 12</b>  <b>Small Water System Financing</b></p> <p><i>Government should continue to work with small water supply system owners to access financial resources through transfer of ownership to local government, and should consider the development of loan or grant programs for small systems with an associated fiscal accountability framework.</i></p> <p><i>(Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health)</i></p>	<p>The Ministry of Health does not provide financial resources to water supply systems. However, the ministry is facilitating this recommendation by providing funding for the BC Water and Waste Water Association to develop and implement an outreach program for small water systems that promotes financial best management practices and encourages the sharing of strategies for successful small water system financing.</p> <p>The Ministry of Municipal Affairs and Housing (formerly the Ministry of Community, Sport and Cultural Development) has some funding for small water systems; however, water systems not owned by local governments are only eligible for capital infrastructure grants on the condition that the system is transferred to a local government (regional district or municipality) should the grant application be successful. The transfer is not required to occur prior to application. The ministry also facilitated the successful connection of a private sector banking institution with improvement districts, which gives the bank more experience in providing loans to unconventional borrowers; the same institution was also introduced to the BC Water and Waste Association’s small water systems group.</p> <p>For more information on activities to support small water systems and financial management, refer to Chapters 6 and 9.</p>
<p><b>Recommendation 13</b>  <b>Water System Performance Monitoring</b></p> <p><i>Based on the needs identified by assessments and the requirements stipulated on operating permits, most water suppliers should implement or expand treatment performance monitoring to include variables such as disinfectant contact time, filtration performance, turbidity, UV performance, pH, and pressure regimes as appropriate.</i></p> <p><i>(Leads: Water suppliers, drinking water officers)</i></p>	<p>Health authorities continue to support performance monitoring. As a result, this is now conducted in many large water systems across the province. However, the health authorities note that small water systems are somewhat limited in their implementation of this recommendation given financial constraints. Interior Health has developed a course to educate and inform small water suppliers about what is required for sampling.</p> <p>At this time, data on performance monitoring are not available from health authority databases. The new indicator project identified residual monitoring for secondary disinfection, as a performance monitoring indicator for future reports.</p> <p>The Ministry of Health is also leading a project to review current operating permits and associated operating conditions. This work promises to explore performance monitoring needs and gaps.</p> <p>For more information on water system performance monitoring, see Chapter 7, Section 7.2.</p>

2015 Recommendation	Update
<p><b>Recommendation 14</b> <b>Water Testing</b></p> <p><i>To ensure all public water supply systems have improved access to laboratory testing of water samples, a broader network of approved laboratories should be encouraged. The use of on-site test kits by water suppliers as a quality assurance tool to augment testing at approved laboratories should be promoted.</i></p> <p><i>(Leads: BC Centre for Disease Control, Ministry of Health, health authorities)</i></p>	<p>As discussed in Chapter 7, Section 7.4, the number of approved laboratories in the interior has increased slightly, but access to an approved laboratory in the north and other remote regions of the province remains a challenge. A broader network and distribution of PHO-approved laboratories can help minimize wasted samples and alleviate transport challenges faced in northern and remote areas of the province. Transport concerns for remote and rural communities during this reporting period has resulted in a planning process, led by the Enhanced Water Quality Assurance Program and the BC Centre for Disease Control Public Health Laboratory, to develop a framework to support decentralized water testing for remote and rural sites. Currently, site checklists and procedures are being developed. The framework will include a training program, competency assessment tools, proficiency testing procedures, a rural/remote quality program, and an approval process. During 2017/18, the BC Centre for Disease Control Public Health Laboratory will outline the key elements required for decentralized water testing (e.g., Level C laboratories and/or adoption of point-of-use testing). The proposed approach will build on the lessons learned from the existing First Nations Health Authority water testing processes.</p> <p>For more information on water testing, see Chapter 7.</p>
<p><b>Recommendation 15</b> <b>Inventory and Assessment of Small Water Systems</b></p> <p><i>Health authorities and the provincial government should continue to develop an accurate inventory of BC's small water supply systems and obtain all of the data that was identified as part of the drinking water information management project core data set.</i></p> <p><i>(Leads: Health authorities, Ministry of Health)</i></p>	<p>Health authorities continue to identify small water systems through permit applications or through complaints.</p> <p>Vancouver Coastal Health is working to develop a digital map to geo-reference all water systems under their jurisdiction and to improve understanding of drinking water issues.</p> <p>The new water system type and size categories (described in Chapter 3) developed as part of the new indicator project promise to bring consistency in how small water systems are counted. The health authorities have committed to adapting their data systems to be able to capture data using these categories for future reports.</p> <p>For more information, see Chapter 3, Section 3.1.</p>

2015 Recommendation	Update
<p><b>Recommendation 16</b> <b>Small Water System Amalgamation</b></p> <p><i>Government should pursue legislative change to allow decision makers with the Ministry of Transportation and Infrastructure, Ministry of Forests, Lands and Natural Resource Operations and Rural Development, health authorities, and local governments to</i></p> <p><i>a) Prohibit the creation of multiple small water supply systems where one larger system could be developed.</i></p> <p><i>b) Facilitate extensions of local government boundaries to allow expansion of local government-owned water supply systems.</i></p> <p><i>c) Provide authority to require developers to connect new properties with existing adjacent water supply systems.</i></p> <p><i>All local governments should be required to address the issue of non-viable small water supply systems in growth management strategies.</i></p> <p><i>(Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health, Ministry of Transportation and Infrastructure)</i></p>	<p>Chapter 9, Section 9.1.4, describes the actions that government agencies have taken during the reporting period to promote sustainable development of small water systems, prevent the proliferation of multiple small systems during the subdivision approval process, and encourage amalgamation and acquisition. These actions include the development of best practice guidelines for approving small water systems (the Ministry of Municipal Affairs and Housing and the Union of BC Municipalities); a draft approving officer’s subdivision checklist (Ministry of Transportation and Infrastructure); small water system guidance (Ministry of Health); and utility regulation section guidelines (FLNRORD).</p> <p>The Ministry of Municipal Affairs and Housing, where and when applicable, promotes and encourages development densification and the leveraging of existing infrastructure and service delivery over the creation of new systems.</p> <p>Despite these efforts, many of the concerns and challenges surrounding the development approval process remain, as discussed in Chapter 9. In 2014/15, an Assistant Deputy Ministers Committee on Small Water Systems was formed to respond to recommendations received from the Union of BC Municipalities. While some projects from the committee’s work plan have begun or been completed, the committee no longer meets.</p> <p>For more information see Chapter 9, Section 9.1.4.</p>

2015 Recommendation	Update
<p><b>Recommendation 17</b> <b>Full Cost Accounting</b></p> <p><i>Government should continue to develop assistance for small water supply systems to help them plan for ongoing maintenance and system upgrades. Suppliers should be required to proceed with upgrades through conditions on their operating permits.</i></p> <p><i>(Leads: Ministry of Health, Ministry of Community, Sport and Cultural Development, health authorities)</i></p>	<p>All health authorities actively encourage small water systems to pursue maintenance and system upgrades. Many use conditions on operating permits to ensure that such upgrades are made.</p> <p>Health authorities have also created educational programs to support best management practices for small water systems. While educating suppliers on the need for planning and upgrades is a positive step, health authorities note that there is no specific funding for water system upgrades, and this creates barriers for small water systems.</p> <p>Chapter 9, Section 9.1.2 highlights the capacity-building efforts directed at small water systems that have been undertaken by government and supporting agencies. Actions include the development of resources such as a small water system guidebook and financial best management practices for small water systems. The Ministry of Health also provided the BC Water and Waste Water Association with \$500,000 in 2015/16 and \$250,000 in 2017/18 to develop and implement an outreach program for small water systems that promotes drinking water protection, financial best management practices, and strategies for successful small water system financing.</p> <p>The Ministry of Municipal Affairs and Housing has supported sustainable planning with Asset Management BC through workshops and training opportunities throughout the province. The training focuses on the development of an asset management plan. The ministry also continues to invest in its Infrastructure Planning Grant Program, which provides funding to local governments and non-local governments (so long as they are sponsored by a local government) to undertake feasibility studies, infrastructure assessments, and long-range planning.</p> <p>While many resources, training, and programs have been developed to address small water system challenges, capacity issues still remain and this should remain a priority. This work would benefit from an overarching strategy and greater coordination between agencies.</p> <p>For more information full cost accounting, see Chapters 6 and 9.</p>

2015 Recommendation	Update
<p><b>Recommendation 18</b></p> <p><b>Water Rates</b></p> <p><i>2015: Rates for drinking water should reflect the true, long-term costs of water treatment, distribution and water system operation, maintenance, and monitoring. Revenue generated from charges for water should be reinvested in programs that promote awareness of water quality and quantity, protect water quality, improve public health, and encourage sustainable water use to promote healthy communities.</i></p> <p><i>(Leads: Ministry of Community, Sport and Cultural Development, Ministry of Health)</i></p>	<p>Government actions regarding water rates and financial management are described in Chapter 6, Section 6.2. The Ministry of Municipal Affairs and Housing supported a number of activities to promote and support good asset management and financial management during the reporting period, including the development of the following: <i>Asset Management for Sustainable Delivery: A BC Framework</i>; Asset Management Planning Program; National Asset Management Systems Training Session Community Lifecycle Infrastructure Costing Tool; Municipal Natural Assets Initiative; Asset Management BC Roadmap; and Financial Best Management Practices for Small Water Systems. Similarly, FLNRORD developed new <i>Financial Guidelines for Certificate of Public Convenience and Necessity Applications</i>.</p> <p>The Ministry of Municipal Affairs and Housing continues to fund the Asset Management Planning Grant Program administered by the Union of BC Municipalities as well as the ministry’s Infrastructure Planning Grant Program. The Infrastructure Planning Grant Program has supported, and will continue to support, rate review studies for water systems moving to a sustainable financial model that reflects the full costs of the provision of the service. The Ministry of Health has also provided funding to the BC Water and Waste Water Association to develop and implement an outreach program for small water systems that promotes financial best management practices and encourages the sharing of strategies for successful small water system financing.</p> <p>Although much good work is being done on asset management and financial planning, small water systems are still challenged with their capacity to fund or plan for required upgrades. The uptake of such materials and programs by small systems is also uncertain. While the BC Water and Waste Association’s outreach program shows promise for building capacity and networks, it has only reached a small fraction of small water systems in the province, and mostly those that are already motivated to improve their systems. Going forward, strategies are needed to promote the uptake of available planning tools and to evaluate the impact of the uptake.</p> <p>For more information on water rates, see Chapters 6 and 9.</p>

## References

- <sup>1</sup> Ernst and Young. Review of British Columbia’s hydraulic fracturing regulatory framework [prepared for the BC Oil and Gas Commission. Vancouver, BC: Ernst and Young, 2015 Mar 03 [cited 2018 Sep 26]. Available from: <https://www.bcogc.ca/node/12471/download>.