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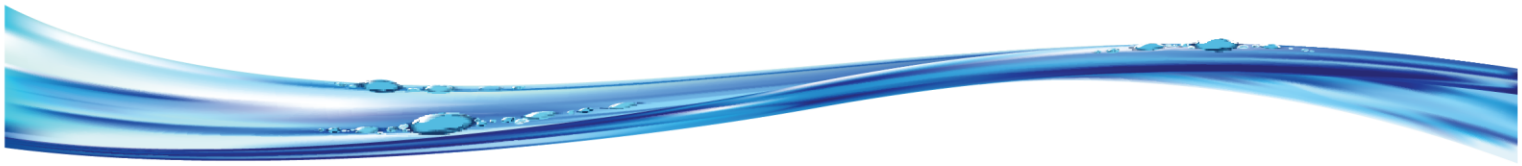

Toward the Creation of a Canada Water Agency

Discussion Paper

Environment and Climate Change Canada

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1.0 INTRODUCTION[1]

In 2019, the Government of Canada committed to establishing a Canada Water Agency (CWA) to "work together with the provinces, territories, Indigenous communities, local authorities, scientists and others to find the best ways to keep our water safe, clean and well-managed."[2]

Governments at all levels have made significant investments to protect fresh water. Federal efforts have included collaborative agreements on important water bodies like the Great Lakes, St. Lawrence River, and Lake Winnipeg.

Federal climate and nature agendas also support freshwater priorities. Climate change adaptation efforts, for example, aim to reduce extreme weather risks and changes in freshwater availability. Many federal departments conduct world-class science on freshwater issues to support sustainable economic growth. Infrastructure funding helps upgrade drinking water and wastewater facilities.

Recognizing the Government's strong foundational freshwater work, and the important freshwater management roles played by provinces and territories, municipalities, Indigenous governments, and others, the "Toward the Creation of a Canada Water Agency" Discussion Paper is designed to obtain your input on how to maximize the benefits from these investments and respond to future challenges. The Discussion Paper seeks feedback on which opportunities the federal government should pursue to enhance freshwater management, and which are the highest priorities, because the Government of Canada cannot implement all of them at once, or without collaboration with others.

The CWA's focus is on fresh water in Canada, recognizing that the Government of Canada is already implementing separate marine initiatives. And the Government is not embarking on legislative or regulatory changes through this Discussion Paper. If there is a future need to examine such changes, that process will be distinct from this consultation.

[1] Please note that certain terms used in this Discussion Paper are defined for readers in the Glossary in Annex 3.
[2] Government of Canada. (2019). Minister of Environment and Climate Change Mandate Letter. Retrieved from: https://pm.gc.ca/en/mandate-letters/2019/12/13/minister-environment-and-climate-change-mandate-letter

Fresh water is a shared responsibility. The CWA will work collaboratively and respect the jurisdictions of provincial, territorial, and Indigenous governments by building on successful existing mechanisms for cooperation. The CWA will also aim to help the Government of Canada advance reconciliation with Indigenous peoples with respect to areas under federal jurisdiction.

Input on this Discussion Paper is sought from provinces, territories, Indigenous peoples, local authorities, the private sector, non-government organizations, and the public. Section 5 of this Paper describes how you can provide input. Feedback will inform the Government's next steps in implementing the CWA commitment.

2.0 BACKGROUND

Canada has more than two million lakes and rivers—more inland waters than any other country. Canada has 20% of the world's fresh water and the third largest renewable supply of fresh water at 7%.[3] The country has 25 major watersheds (see map in Annex 1). These waters flow to all three coasts, crossing international, provincial and territorial boundaries. Canada also has one quarter of the world's remaining wetlands, covering 13% of the country.[4]

Fresh water features in many of the nation's most iconic scenes, from western rain forests, green mountain lakes and meandering prairie rivers, to a Great Lakes gale, a hydroelectric project in Quebec, or a Maritime salmon run. When a child splashes in a summer wading pool, when a moose stands alert on the shores of a forest lake, when a canoe glides past a loon at night, when we first visit a glacier, even when we slake our thirst from the tap on a hot day without a second thought: these are the ways in which water defines us as Canadians.

For many Indigenous peoples water is sacred, protected, and honoured as the giver of all life. Fresh water is essential to health and critical for the economy. Lakes and rivers across Canada support fisheries, forestry, agriculture, energy, manufacturing, recreation and tourism, shipping, and navigation.

[3] Statistics Canada. (2018). Environment. *Government of Canada*. Retrieved from: https://www150.statcan.gc.ca/n1/pub/11-402-x/2011000/chap/env/env-eng.htm
[4] Government of Canada. (2016). Extent of Canada's wetlands. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/extent-wetlands.html

In these challenging times, water is also an increasingly precious resource. We have a duty and a responsibility to manage this water wealth for our own use, and to preserve it with care for generations to come. Our lives, our jobs, our culture, our health, and the health of plants and animals depend on wise and thoughtful water stewardship.

Over the years, Canadians and their governments have successfully addressed a wide range of freshwater challenges, which differ from region to region because of our enormous size and varied geography.

Climate change is foremost among today's challenges and its impacts are already being felt. Canada as a whole is warming at more than twice the global rate, and in the Arctic at about three times the rate. Higher annual precipitation levels are projected throughout Canada in this century, with the greatest changes expected in our three northern territories. The predicted result: altered annual flows of Canadian rivers, especially in the north. Continued thinning of Arctic and alpine glaciers due to increasing surface temperatures, meanwhile, will one day result in less glacial meltwater supply to rivers and streams.[5]

In 2001-2002, Canada experienced the first coast to coast drought on record, and the worst drought to hit western Canada in more than 100 years, affecting many economic sectors.[6] Agricultural production dropped by $3.6 billion, Gross Domestic Product (GDP) fell by $5.8 billion, and more than 41,000 jobs were lost.[7] In 2013, flooding in Alberta and the Greater Toronto region destroyed homes, vehicles, and commercial properties, resulting in insured damages of $3.4 billion.[8]

Other impacts of climate change include toxic and nuisance algae—an issue affecting many freshwater bodies nationwide. Algae in Lake Erie alone costs the Canadian economy an estimated $270 million each year.[9]

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[5] Bush, E., & Lemmen, D.S., editors. (2019). Canada's Changing Climate Report. *Government of Canada*. Retrieved from: https://changingclimate.ca/site/assets/uploads/sites/2/2020/06/CCCR_FULLREPORT-EN-FINAL.pdf

[6] AAFC. (2016). Lessons Learned from the Canadian Drought Years 2001 and 2002. *Government of Canada.* Retrieved from: https://www.agr.gc.ca/eng/agriculture-and-climate/drought-watch/managing-agroclimate-risk/lessons-learned-from-the-canadian-drought-years-2001-and-2002/?id=1463593613430

[7] Ibid.

[8] IBC. (2014). Canada inundated by severe weather in 2013: Insurance companies pay out record-breaking $3.2 billion to policyholders. Retrieved from: http://www.ibc.ca/yt/resources/media-centre/media-releases/canada-inundated-by-severe-weather-in-2013-insurance-companies-pay-out-record-breaking-$3-2-billion-to-policyholders

[9] Smith, R. B., Bass, B., Sawyer, D., Depew, D., & Watson, S. B. (2019). Estimating the economic costs of algal blooms in the Canadian Lake Erie Basin. *Harmful algae*, *87*, 101624. https://doi.org/10.1016/j.hal.2019.101624

The Canadian Environmental Sustainability Indicators track long-term trends in water quality using the Canada Council of Ministers of the Environment water quality index. On average, water quality in Canada is good. From 2016 to 2018, 80% of sites monitored were rated fair to excellent. But the index also showed that water quality varies between regions.

As shown in Annex 2, drainage basins with the highest proportion of sites rated as good to excellent were the Atlantic Ocean and the Mackenzie River, while drainage basins with the highest number of marginal to poor water quality sites were the Great Lakes and the St. Lawrence, and Pacific Ocean. The Hudson Bay drainage basin has a high proportion of sites in the good to excellent category, but also many rated as marginal to poor. The index also shows that from 2002 to 2018 water quality was unchanged at 69% of sites.[10]

About 60% of fresh water in Canada flows to the north, away from the majority of the population.[11]

Because northern communities—both Indigenous and non-Indigenous—are often downstream, they are particularly affected by water issues. In the north, climate change also means increased permafrost thaw and a shorter ice cover season.[12] In addition, parts of northern and western Canada are most prone to droughts, which can affect water-dependent industries, municipal water supplies, and may result in increased vulnerability to wildfires.[13]

Elsewhere in Canada:

- As of November 2020, 59 long-term drinking water advisories were in effect in First Nations communities.[14]
- Groundwater quality—the source of drinking water for many—is an issue in several regions.

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[10] Environment and Climate Change Canada. (2020). Canadian Environmental Sustainability Indicators: Water quality in Canadian rivers. *Government of Canada.* Retrieved from: www.canada.ca/en/environment-climate-change/services/environmental-indicators/water-quality-canadian-rivers.html
[11] Government of Canada. (2020). Hydrology of Canada. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey/hydrology.html
[12] Bush, E., & Lemmen, D.S., editors. (2019). Canada's Changing Climate Report. *Government of Canada*. Retrieved from: https://changingclimate.ca/site/assets/uploads/sites/2/2020/06/CCCR_FULLREPORT-EN-FINAL.pdf
[13] Ibid.
[14] Indigenous Services Canada. (2020). Ending long-term drinking water advisories. *Government of Canada*. Retrieved from: https://www.sac-isc.gc.ca/eng/1506514143353/1533317130660

- 70% of the Prairies' ecologically invaluable wetlands have been lost.[15]
- Populations of species in freshwater ecosystems across Canada, following a global trend, have experienced a decline due to the cumulative impact of climate change, pollution, land use, overfishing, and invasive species.[16]
- There are important interactions between freshwater and marine ecosystems in Canada's coastal areas.

Climate change is having and will have an increasingly profound influence on freshwater quality and the health of aquatic ecosystems. Other influences include municipal and industrial discharges, aquatic invasive species, water control structures, and land use practices.

2.1 Freshwater management in Canada

Freshwater management in Canada is a responsibility shared between federal, provincial, territorial, and Indigenous governments.[17]

The federal government is involved in freshwater-related areas such as fisheries, pollution prevention, shipping and navigation, international relations, domestic transboundary waters, and the creation and management of protected areas. The federal government is also responsible for management of fresh water on federal lands.

Provincial and territorial governments play major roles in the management of fresh water. They are generally involved in freshwater-related areas such as providing the authorization for water use within their borders, responsibility for drinking water, as well as managing inland fisheries, aquatic species at risk, and invasive species. Provinces and territories often delegate operational responsibility for drinking water and wastewater services to municipalities.[18] Some provinces and territories have created

[15] Ducks Unlimited Canada. (2020). Canadian Wetland Inventory. Retrieved from: https://www.ducks.ca/initiatives/canadian-wetland-inventory/#overview

[16] Tickner, D., Opperman, J. J., Abell, R., Acreman, M., Arthington, A. H., Bunn, S. E., ... & Harrison, I. (2020). Bending the curve of global freshwater biodiversity loss: an emergency recovery plan. *Bioscience*, 70(4), 330-342. https://doi.org/10.1093/biosci/biaa002. See also Canadian Geographic. (2020). Emergency recovery plan could help restore freshwater biodiversity around the world. Retrieved from: https://canadiangeographic.ca/article/emergency-recovery-plan-could-help-restore-freshwater-biodiversity-around-world

[17] In this Paper, the term "Indigenous governments" refers to band councils of First Nation reserve lands and Indigenous governments operating under a land claims agreement (modern treaty) or self-government agreement with the Crown.

[18] This paper recognizes that municipalities fall under provincial and territorial responsibility.

local authorities operating at the watershed scale to advance integrated water resources management.[19]

Section 35 of the *Constitution Act, 1982*, recognizes and affirms the existing aboriginal and treaty rights of Indigenous peoples, and those can be affected by freshwater management decisions. Under many historic and modern treaties, and self-government agreements, Indigenous peoples have freshwater-related rights. Indigenous peoples are also involved in transboundary freshwater management, including through water management boards. First Nations, Métis, and Inuit identify and relate to water in different ways, and their interests vary. But in each case, water carries specific socio-economic, political, and cultural importance. Access to clean water remains an urgent issue for many Indigenous communities.

Academia, non-governmental organizations, and the private sector also contribute to a wide variety of freshwater initiatives, including research and community-based water monitoring.

2.2 Freshwater activity in the federal government

More than 20 federal departments and agencies have freshwater responsibilities. This section provides examples of federal freshwater activities.

Freshwater transboundary management

Global Affairs Canada (GAC) with Environment and Climate Change Canada (ECCC) cooperate to help guide and support the work of the International Joint Commission (IJC). The IJC, created by the Boundary Waters Treaty of 1909, provides a forum for joint effort with the United States (U.S.) to manage waters that mark or cross the 8,891 kilometer-long border.

The Government of Canada also works collaboratively with provinces and territories to support four domestic transboundary water boards that oversee one-third of Canada's land mass.[20]

[19] Please note that the federal, provincial, and territorial freshwater responsibilities are only examples and not intended to be an exhaustive list. It is important to note that other governments in Canada undertake significant freshwater activity that is not summarized in this Discussion Paper because it is focused on federal roles.
[20] A list of the existing transboundary water boards can be found in Appendix K of the ECCC (2019) report on the Ottawa River Watershed http://publications.gc.ca/collections/collection_2019/eccc/En4-373-2019-eng.pdf.

Freshwater science and information

Health Canada works with its provincial and territorial partners to develop and update the Guidelines for Canadian Drinking Water Quality. ECCC coordinates national monitoring programs to provide information on water quality, flow, and levels across rivers and lakes in Canada. ECCC is also responsible for the Federal Sustainable Development Strategy (FSDS) that sets out the Government of Canada's environmental sustainability goals—including clean and healthy lakes and rivers to support economic prosperity and the well-being of Canadians. It also identifies the actions to achieve them.

ECCC manages the Canadian Environmental Sustainability Indicators, which measure progress on the FSDS, including freshwater issues. ECCC's Canadian Centre for Climate Services helps Canadians understand and become more resilient to climate change by providing access to information, building local capacity, and offering training and support.

Natural Resources Canada (NRCan) maps surface waters and major Canadian aquifers. NRCan also provides tools and data to support freshwater management, such as the National Hydrographic Network, the Federal Geospatial Platform, Open Maps, and the Open Science and Data Platform.

Statistics Canada collects and reports statistics on industrial and agricultural water use, water supply, and water yield, and produces water accounts and water supply and demand analysis.

Agriculture and Agri-Food Canada's (AAFC) Drought Watch program provides agroclimate information to farmers. AAFC also conducts research and develops technology to address agricultural water issues.

The National Research Council (NRC) undertakes research on issues such as flood protection, water quality, and wastewater treatment. Transport Canada and the Canadian Coast Guard provide mariners with navigation information.

Fisheries and Oceans Canada (DFO) manages Canada's fisheries and ensures healthy and sustainable ecosystems through protection of aquatic species and their habitat, as well as sound science.

Legislation, regulation, and departmental mandates

The Minister of Environment and Climate Change has the authority to enter into agreements with provinces under the *Canada Water Act*, which is also used to support research and monitoring activities for the conservation, development, and use of water resources in Canada. The Minister is responsible for regulating certain types of pollution in water bodies through the pollution prevention provisions of the *Fisheries Act,* the *Migratory Birds Convention Act, 1994,* and the *Canadian Environmental Protection Act, 1999*. ECCC is also responsible for enforcing this legislation and associated regulations.

The Minister responsible for Parks Canada protects freshwater ecosystems through the powers of the *Canada National Parks Act* and the *Canada National Marine Conservation Areas Act*, and safeguards national historic sites, including historic waterways.

Public Safety Canada is mandated to reduce disaster risk through policy and programming, and manages water-related emergencies through the Government Operations Centre.

The Department of National Defence offers support in domestic emergencies such as floods.

The Minister of Fisheries, Oceans and the Canadian Coast Guard administers and enforces the *Fisheries Act*, which provides a framework for the proper management and control of fisheries; and the conservation and protection of fish and fish habitat, including by preventing pollution. The Aquatic Invasive Species Regulations under the Act enable the Minister to enforce prohibitions and controls to manage aquatic invasive species. DFO is also responsible for the protection of aquatic species under the *Species at Risk Act*.

The Minister of Transport regulates shipping and navigation, which offer protections to freshwater and marine habitats. Examples include the Vessel Pollution and Dangerous Chemicals Regulations made pursuant to the *Canada Shipping Act, 2001*. The Minister of Transport is also responsible for the *Canadian Navigable Waters Act*.

The Minister of Foreign Affairs administers the *International Boundary Waters Treaty Act*, through which Canada’s obligations under the Boundary Waters Treaty of 1909 are implemented in Canadian law.

Crown-Indigenous Relations and Northern Affairs Canada is responsible for Crown-Indigenous relations and water management in Nunavut, where responsibilities have not been transferred to other governments. Where Crown-Indigenous Relations and Northern Affairs Canada is in negotiations with Indigenous groups, issues related to freshwater management and administration may be part of these discussions and negotiated agreements.

Indigenous Services Canada works with Indigenous peoples to support the provision of drinking water and wastewater services and First Nations-led solutions to water issues on First Nations reserve lands.

Funding and innovation

Infrastructure Canada provides funding to other orders of government for drinking water and wastewater infrastructure, and for infrastructure to mitigate floods and other extreme events.

The Canada Infrastructure Bank has earmarked funds for irrigation infrastructure and green energy projects (e.g., hydroelectricity).

Innovation, Science and Economic Development Canada and NRCan support water technology development and commercialization.

Canada's Regional Development Agencies work closely with businesses and innovators in their regions and support the Government of Canada's Innovation and Skills Plan. Western Economic Diversification Canada recently funded a study of water issues in the Prairies.

ECCC funds programs in major watersheds, such as the Great Lakes, the St. Lawrence River, and Lake Winnipeg.

DFO is responsible for funding programs that support the conservation of aquatic species and habitats.

AAFC supports agricultural discovery science and innovation to address priorities including soil and water conservation.

3.0 DISCUSSION ISSUES

Beyond the establishment of the CWA, the Government of Canada has made several important freshwater-related commitments recently. For example, in the 2020 Speech from the Throne the Government committed additional investments to meet the clean drinking water commitment in First Nations communities. Meanwhile, the Ministers of Natural Resources, Public Safety and Emergency Preparedness, and Environment and Climate Change have been tasked to work with the provinces and territories and Indigenous peoples to complete all flood maps in Canada.

This section begins with potential objectives to enhance freshwater management in Canada. The Government requests feedback on whether these are the right objectives for the federal government to pursue, and which should be prioritized.

Discussion issues are then presented, which identify possible opportunities to build on the federal government's existing activity to enhance domestic freshwater management. Each discussion issue is accompanied by a set of questions. In each case, opportunities are proposed in recognition of the shared responsibility for freshwater management in Canada and the important roles of provinces, territories, Indigenous governments, municipal governments, and others.

3.1 Freshwater objectives

The Government of Canada has previously stated its objective to ensure First Nations have access to safe, clean drinking water and is working with First Nations communities to improve water infrastructure on reserves, end long-term drinking water advisories on public systems on reserves, and prevent short-term advisories from becoming long-term. Identifying freshwater management objectives for the federal government, while recognizing provincial and territorial jurisdiction, is critical in designing the CWA. The Government of Canada proposes the following further objectives to enhance freshwater management:

- Federal policies promote effective management and protection of freshwater resources and ecosystems in Canada for 21st century challenges and beyond—including adapting to climate change.
- Canada has a state of the art prediction system for floods and droughts that informs climate change adaptation and disaster risk reduction.

- Indigenous peoples play an increased role in the management of Canada's fresh water.
- Canada is a leader in sustainable agricultural water management.
- Canada's economic sectors have the fresh water they need to grow sustainably, and the tools they need to improve freshwater management and use.
- Canada has and applies cutting edge science to tackle the freshwater challenges of the next century, including climate change.
- Data and information are available to support informed freshwater decision-making at all levels.
- Collaborative arrangements are in place and support effective management of domestic and Canada-U.S. transboundary fresh waters.
- Canada is a global leader in freshwater technology, innovation, and infrastructure.
- Canadians are actively engaged in managing and protecting fresh water.

As noted earlier, responsibility for many aspects of freshwater management rests with provinces, territories, Indigenous peoples, local authorities, and others. Achieving these objectives, therefore, requires action by the Government of Canada in collaboration with others. In recognition of the Government of Canada's commitment to consider identity factors such as gender, race, ethnicity, religion, age, and mental or physical disability, achieving these objectives will also engage diverse groups of Canadians.[21]

Discussion Questions

- What are your thoughts on the above objectives?
- Which objectives are a priority for you?
- Are any objectives missing?

[21] Women and Gender Equality Canada. (2020). What is GBA+. *Government of Canada.* Retrieved from: https://cfc-swc.gc.ca/gba-acs/index-en.html

3.2 Freshwater policy, coordination and multilateral engagement

Policy in the federal government is an important decision-making tool. The federal government uses policy to guide decisions, and direct activities to achieve priorities and results. The Federal Water Policy, created in 1987, provides a framework for coordinating federal actions on fresh water. Other federal policies—ranging from energy to agriculture to forestry—also bear on freshwater issues. Consequently, many federal departments have direct or indirect freshwater-relevant responsibilities. While these federal departments and agencies coordinate on specific initiatives, there is no permanent coordinating mechanism with a whole-of-federal government view on fresh water.

Since the Federal Water Policy's introduction, Canada has seen shifts in areas affecting freshwater and ecosystem management. For example, the priority accorded to climate change adaptation, global biodiversity loss, and rapid technological change are some of the factors that have opened up new challenges and opportunities for freshwater management. The Government of Canada's commitment to reconciliation with Indigenous peoples is also opening up dialogue on inclusion of Indigenous governance systems in freshwater management.

Many Canadian provinces and territories, meanwhile, have developed their own freshwater policies. Other orders of government hold significant freshwater policy levers given shared responsibility for freshwater management. Effective collaboration and coordination between governments and others can support progress in addressing important freshwater challenges.

In parallel, jurisdictions at home and abroad are experimenting with innovative policy approaches such as water quality trading, in which sources with higher pollution control costs purchase pollution reductions from sources with lower costs, and other market-based instruments and nature-related approaches. There is room to capitalize on significant freshwater expertise across Canada to explore new ways to protect fresh water.

Freshwater policy continues to feature in multilateral forums and initiatives. For example, the United Nations' 2030 Agenda for Sustainable Development and its corresponding Sustainable Development Goals underpin much of the current effort to advance water policy goals on the global scale. Canada is generally viewed as a sound and responsible water manager with significant technical expertise to share, and a

history of collaborative management absent in some parts of the world. Engagement by the Government of Canada in certain multilateral initiatives can support Canadian federal policy priorities, such as advancing diplomacy and promoting global health and security.

Further action can be taken to update, strengthen, and align freshwater policy and activities within the Government of Canada to support environmental, health, and economic goals domestically and internationally.

Possible opportunities

1. Establish a formal federal governance structure mandated to provide a whole-of-federal government perspective on freshwater priorities, and ensure federal policies and actions reflect freshwater objectives.

2. Support engagement on freshwater issues among all orders of government and by convening experts, facilitating information sharing, and supporting collaborative initiatives.

3. Provide the public with a central point of contact for federal freshwater-related questions and an integrated picture of federal freshwater programs and services.

4. Support increased and coordinated Canadian engagement in international freshwater-related activities, including through certain multilateral forums and by proactively sharing Canadian expertise on freshwater governance, technology, and management.

5. Build federal capacity to research and experiment with innovative policy solutions to address freshwater challenges and support climate change adaptation.

Discussion Questions

- What are your thoughts on the current level of federal engagement on freshwater issues with others in Canada? How can the federal government support engagement?
- How should federal, provincial, territorial, municipal, and Indigenous governments work together to coordinate efforts and cooperatively address local and regional freshwater issues?
- How should the federal government support freshwater-related international activities?

3.3 Freshwater prediction to inform climate change adaptation and disaster risk reduction

Climate change amplifies freshwater management challenges across Canada. Our vast land mass and regional variability rules out a one-size-fits-all approach to adaptation.

Decision-makers require models and tools that reliably predict floods, droughts, soil moisture levels, freshwater—including surface and groundwater—supply and demand and more at a regional or local scale.

Freshwater monitoring and powerful models underpin the ability to predict. ECCC is responsible for monitoring freshwater level and flow on all federal lands. The department uses this information to meet requirements for managing Canada-U.S. and domestic transboundary waters and in areas of federal interest.

ECCC also operates the national hydrometric monitoring network on behalf of provinces and territories through cost-shared agreements. Data about the atmosphere, ocean, cryosphere, ice, groundwater, and soil moisture are critical inputs to powerful weather prediction and other tools.

Following direction from the World Meteorological Organization, all countries are evolving their modeling platforms toward the same full Earth Systems approach. The existing modelling capability in Canada is well positioned to move in this direction and to provide an unprecedented level of products and services to Canadians. This evolution is critical to improve the quality of forecasts and warnings and to provide longer reaction times to Canadians and decision-makers.

Foundational investments have been made in supercomputing for use in weather modelling, and in service delivery to Canadians 24/7. In partnership with other federal departments, provincial authorities, and academia, ECCC is continually improving Canada's world-class monitoring, data assimilation, processing, modelling and data dissemination infrastructure. This helps governments analyze past and present water, weather, climate, ocean, and ice conditions, and make predictions for the future.

The federal government is well-placed to support advanced modelling given the requirements for data infrastructure, monitoring, and satellite information.

Meanwhile, however, there are wide variations in flood prediction capabilities at the local level, and large gaps in flood hazard mapping across Canada. Many existing maps are out-of-date. Recently, Canada-wide flood hazard maps have been developed through the insurance industry to fill some of these gaps. These have broad geographical coverage, but lack the accuracy and precision of high-quality science-based mapping, and do not include forward-looking climate scenarios. Up-to-date flood hazard maps, which include climate scenarios, are critical to understand flood risk in Canada and support disaster risk reduction.

Possible opportunities

1. Develop and implement a national coordinated observation, modelling, and prediction framework, in order to provide standardized water forecasts, and more automated flood and drought outlooks to provide provinces, territories, municipalities, and others the information they need to support regional and local decision-making.

2. Improve water prediction at regional and local levels to better support decision-making by pursuing innovations in atmospheric, ocean, ice, and water prediction using new observation technologies, earth observation data, and models that can

better characterize terrestrial snow, surface, and groundwater, and the integration of climate change scenarios.

3. Support research, development, and delivery of state-of-the-science national hydrologic data, analyses, predictive information, decision-support services and guidance to better inform emergency services and water management at all scales from national to local, including in the context of a changing climate.

Discussion Questions

- What scale and geographic precision of modelling output is needed to support your decision-making and how do you see this evolving over the next decade?
- What are your needs for water quantity prediction products, services, and applications?
- Which of your needs are or are not being met now? How do you see your needs evolving over the next 10 years?

3.4 Indigenous peoples and freshwater management

Indigenous peoples are implicated by all the discussion issues contained in this Paper. However, due to the unique relationships between the Crown and Indigenous peoples, this section is specifically focused on Indigenous peoples and freshwater management.

This section of the Paper is informed by previous statements and positions Indigenous peoples have made publicly, as well as by initial meetings between some Indigenous peoples and the Government of Canada on the CWA and other freshwater-related topics. The purpose of this section of the Paper is to initiate a dialogue with First Nations, Métis and Inuit—it is a starting point, not an end point. The Government is open to co-developing discussion materials on the CWA with Indigenous organizations to support engagement.

The Government of Canada is engaging directly with First Nations, Métis and Inuit on considerations and recommendations for the CWA. This input will directly inform the CWA's mandate and priorities. This process does not seek to replace or duplicate existing mechanisms, such as the Nunavut Water Board, and water provisions set out in modern treaties. Likewise, this process will not replace or duplicate other engagement and consultations on freshwater initiatives, such as the important work underway on safe drinking water for First Nations being led by Indigenous Services Canada or discussions currently occurring at Crown-Indigenous negotiation tables. ECCC will coordinate with implicated federal departments to ensure that priorities and concerns voiced by Indigenous peoples are shared with officials actively working in those areas.

As previously stated, the Government has confirmed through the Minister of Indigenous Services mandate letter and the Speech from the Throne that eliminating long-term drinking water advisories on reserves is a priority. The Fall 2020 Economic Statement committed the Government of Canada to accelerate work to lift all long-term drinking water advisories and stabilize funding for water and wastewater infrastructure, including operation and maintenance costs, in First Nations communities. Given this pre-existing commitment, the topic of drinking water on reserves is not discussed in this Paper. However, federal officials will share any input received on this topic directly with Indigenous Services Canada.

The Government of Canada is committed to reconciliation with Indigenous peoples through a renewed, nation-to-nation, government-to-government, and Inuit-Crown relationship based on recognition of rights, respect, co-operation, and partnership as the foundation for transformative change. The Government of Canada's commitment to reconciliation includes implementing the United Nations Declaration on the Rights of Indigenous Peoples, as well as other collaborative initiatives and actions. Through the creation of the CWA, the Government of Canada has an opportunity to contribute to advancing reconciliation in freshwater management in areas where the federal government has a role.

The Government of Canada wishes to develop a comprehensive understanding of the various freshwater interests of First Nations, Métis and Inuit to better inform the creation of the CWA. It is important to advance this conversation in order to strengthen relations, honour agreements and respect Indigenous rights, interests, knowledge systems, and cultures.

Fresh water is often sacred and at the centre of all life for Indigenous peoples. While all nations and communities are different, for many, water permeates every aspect of existence. Waterways have always been used for travel and navigation—both within territories and as a means of trade with other Indigenous groups or settlers. Water crossings served as meeting places, residences and centres of trade for Indigenous peoples long before the arrival of European settlers.

First Nations, Métis, and Inuit are affected by climate change, pollution, hydrological and resource development, and other factors that negatively affect fresh water and freshwater species, such as fish, ducks, cattail, willow, muskrat, otters, and moose, to name a few. Many Indigenous peoples have stated that freshwater governance cannot be separated from decisions related to health and well-being, environment, or economy.

Through previous initiatives, public statements, and documents, some Indigenous peoples have called for:

- greater autonomy in freshwater management as part of the recognition and implementation of their right to self-government, and as an element of their vision for self-determination;
- the Government of Canada to respect Indigenous rights, interests, and their relationships with freshwater ecosystems, in decisions related to development, commercial industries, conservation, and general freshwater governance;
- Indigenous knowledge systems to carry equal weight to the Crown's ways of knowing; and
- the inclusion of traditional and contemporary Indigenous governance structures in the management of fresh water and the broader environment.

The Government of Canada recognizes that, for various reasons, Indigenous peoples in Canada have mixed and often limited opportunities to play a meaningful role in freshwater governance. The commitment to create a new CWA provides an opportunity for constructive dialogue between the federal government and Indigenous peoples on freshwater issues.

Recognizing the significance of fresh water to Indigenous peoples and the Government of Canada's commitment to reconciliation, the Government is engaging First Nations, Métis, and Inuit directly on the development of the CWA. The possible opportunities listed below are presented for consideration as preliminary ideas to facilitate dialogue on the potential roles and priorities for the CWA.

Possible opportunities

1. Promote a dialogue with First Nations, Métis, and Inuit on what role a CWA could have in working with Indigenous peoples on freshwater issues.

2. Receive guidance from First Nations, Métis, and Inuit on ways to identify systemic barriers and advance the inclusion of Indigenous peoples in Government of Canada freshwater decision-making processes, and other decision-making processes in which the Government of Canada participates, for example, by harnessing expertise from existing water boards and creating an Indigenous advisory committee to advise the Government of Canada on freshwater issues.

3. Support the inclusion of Indigenous laws, institutions, knowledge systems, values, and responsibilities by promoting enhanced collaboration for freshwater governance, including through existing water management boards and other freshwater decision-making mechanisms in which the Government of Canada participates.

Discussion Questions

Through engagement with Indigenous peoples, the Government would like to bring clarity to the following questions and is open to other discussion questions:

- From the perspective of Indigenous peoples, what concerns, gaps or opportunities related to fresh water should be taken into consideration when establishing the mandate of the CWA?

- What are some positive examples of First Nations, Métis, and Inuit participation in freshwater governance and decision-making? How might the CWA present an opportunity for better freshwater management informed by these examples?

3.5 Agriculture and fresh water

The agriculture and agri-food industry is a significant contributor to Canada's economy, generating $140 billion of GDP and employing 2.3 million people. As the largest consumer of water,[22] and a sector with diverse production systems, agriculture faces particular freshwater challenges in the context of climate change.

Agricultural producers rely on clean and reliable surface and groundwater for safe and efficient food production. Producers understand the importance of managing ecosystem functions and services such as nutrient and water cycling, carbon sequestration, and pollination, and realize that stewardship of critical natural resources such as water, soil, and biodiversity is essential to the long-term success of their farms.

The agricultural sector faces many freshwater challenges, including drought and flooding, impacts of growing agricultural production on water quantity and quality, and availability of fresh water given needs of other users. There is regional variability in these challenges across Canada, ranging from drought in the Prairies to surface water quality issues in the Great Lakes, and groundwater quality issues in the Fraser Valley. Climate change will present new, different challenges and opportunities for Canadian agriculture that will be region-specific and require locally-based adaptation responses.

The Government of Canada, through AAFC, has a long history of working with the provinces and territories to help producers and processors continuously improve the sustainability of their operations, including the management of freshwater resources. Significant progress has been achieved through three successive five-year federal-provincial/territorial agricultural policy frameworks. The Canadian Agricultural Partnership is a $3 billion, five-year (2018-2023) investment supporting collaborative agricultural discovery science and innovation. It focuses on priorities including climate change and soil and freshwater conservation, as well as programs that accelerate the on-farm adoption of resilient freshwater management practices.[23]

The former Prairie Farm Rehabilitation Administration (PFRA) took a successful place-based approach to providing services and expertise addressing land and water

[22] Water use describes the total amount of water withdrawn from its source to be used. Water consumption is the portion of water use that is not returned to the original water source after being withdrawn.
[23] AAFC. (2019). Canadian Agricultural Partnership. *Government of Canada*. Retrieved from: https://www.agr.gc.ca/eng/about-our-department/key-departmental-initiatives/canadian-agricultural-partnership/?id=1461767369849

challenges in Prairie Canada. It operated from the 1930s to the early 2000s, providing leadership in designing and building water infrastructure, mobilizing knowledge to facilitate informed decision-making in the agricultural sector, and working with provinces, rural communities and agricultural organizations to ensure sustainable land and water management (see Annex 4 for more detail).

Possible opportunities

1. Strengthen opportunities for collaboration to advance regionally adapted freshwater management strategies, such as for the Prairies, to address shared water management priorities.

2. Improve coordination of science-related information and activities to bridge knowledge gaps across jurisdictions and within the agricultural sector to ensure that farmers have access to the data and knowledge needed to make effective freshwater management decisions.

3. Work with provinces and territories, the agriculture sector and other partners to enhance development of innovative water efficient technologies and decision-support tools and to accelerate adoption of practices and technologies that will increase resilience and sustainability.

Discussion Questions

- How should Canada support the agriculture sector to sustainably manage freshwater resources needed for production and to enhance resilience?

- What new or improved tools or science-related information would help the agriculture sector to enhance water management?

3.6 Economic sectors and fresh water

Canada's COVID-19 Economic Response Plan is the most recent example of how the Government of Canada works to support economic sectors, economic growth, and sustainability.

In 2015, water withdrawals for economic and household activities totalled 35,733 million cubic metres.[24] Industry and households withdrew 86% of this water directly from rivers, lakes, and groundwater, while the remainder was supplied by drinking water plants.[25] Although some of this water was consumed, the majority was returned back to the environment after use.

Fresh water is an economic driver. In 2017, the main water users by sector were electric power generation, transmission and distribution (65%); manufacturing (10%); agriculture (7%); and mining and oil and gas extraction (3%).[26] [27] These industries contributed 22% of total GDP and 13% of Canada's employment in 2019, highlighting the significant link between sustainable freshwater quality and quantity, and Canada's economic security.[28] [29]

Fisheries, shipping, tourism, and recreation are among the other sectors directly affected by fresh water and the health of aquatic ecosystems. In 2015, recreational anglers contributed a total of $7.9 billion to local economies in provinces and territories;[30] while in 2018, commercial inland fisheries were valued at $78 million.[31] Together, fishing and tourism support economic opportunities and the overall resilience of many northern, rural, and remote communities. In the first nine months of 2018,

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[24] Statistics Canada. (2020a). Physical flow account for water use (x 1,000). *Government of Canada.* Retrieved from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810025001

[25] Statistics Canada. (2020b). Potable water volumes and population served from drinking water plants, by treatment category. *Government of Canada.* Retrieved from: https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3810027001

[26] Statistics Canada. (2020a). Physical flow account for water use (x 1,000). *Government of Canada.* Retrieved from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810025001

[27] Water use describes the total amount of water withdrawn from its source to be used. Water consumption is the portion of water use that is not returned to the original water source after being withdrawn.

[28] Statistics Canada. (2020c). Gross domestic product (GDP) at basic prices, by industry, annual average (x 1,000,000). *Government of Canada.* Retrieved from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043403

[29] Statistics Canada. (2020d). Labour force characteristics by industry, annual (x 1,000). *Government of Canada.* Retrieved from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410002301

[30] Fisheries and Oceans Canada. (2015). Survey of Recreational Fishing in Canada, 2015. *Government of Canada.* Retrieved from: https://www.dfo-mpo.gc.ca/stats/rec/can/2015/index-eng.html

[31] Fisheries and Oceans Canada. (2018). Freshwater landings, 2018. *Government of Canada.* Retrieved from: https://www.dfo-mpo.gc.ca/stats/commercial/land-debarq/freshwater-eaudouce/2018-eng.htm

tourism activities, many of which rely on clean and biodiverse waters, directly accounted for $33.9 billion of Canada's GDP.[32]

Sufficient, dependable supplies of clean fresh water are critical to the success of every Canadian economic sector. Insufficient fresh water, due to drought or in areas where demand exceeds supply, can result in conflict between competing water users and limit economic growth.[33] Poor water quality can increase operating costs or make water unusable.

While these are key challenges for Canada's economic sectors, industry also has a role to play in sustainable water management—the ability to meet the water needs of the present without compromising the ability of future generations to do the same. There are many positive examples of industry sectors taking steps to minimize the impacts of their activities on freshwater quality and quantity; however, as climate change and other factors continue to exert pressure on Canada's freshwater resources, continued advances by industry in relation to water use efficiency and treatment will be required.

Possible opportunities

1. Together with other governments and partners, support economic sectors in developing and implementing sector-specific freshwater sustainability strategies that consider both present and future challenges and opportunities.

2. Together with other governments, academia, industry, and others support the development, testing, and implementation of innovative technologies and approaches for sustainable freshwater management.

3. Work collaboratively to improve coordination of science pursuits and information gathering activities to bridge knowledge gaps across jurisdictions and economic sectors, and ensure access to the data and knowledge needed to make effective freshwater management decisions.

[32] Statistics Canada. (2019). National tourism indicators, third quarter 2018. *Government of Canada.* Retrieved from: https://www150.statcan.gc.ca/n1/daily-quotidien/190110/dq190110b-eng.htm
[33] Water allocation is governed by provinces, territories, and the transboundary agreements that have been made between governments.

Discussion Questions

- What sectors do you believe will face the greatest freshwater challenges nationally, and in your region in the next 5, 10, and 20 years? What support is needed to assist sectors in addressing these challenges in terms of technology, information, and other approaches for sustainable freshwater management?

- What are some positive examples of freshwater challenges addressed in sector-specific strategies and what can we learn from them?

3.7 Freshwater science

Robust freshwater science is fundamental to effective, evidence-based, water resources decision-making. Canada has a wealth of academic, government, non-governmental, and community-based scientific water-related expertise. Many federal departments carry out freshwater science, including ECCC, DFO, NRCan, AAFC, Health Canada, and the NRC. Water research funding under the granting councils and Research Chair and Excellence programs has developed a significant network of water experts in academia. Canada employs this expertise to tackle challenges such as growing water demand and competition, drinking water contaminants, excess nutrients and pollutants, invasive species, and the protection of critical ecosystem services and aquatic biodiversity.

There are opportunities to further focus and mobilize freshwater science across the federal and other governments, in collaboration with experts, and informed by Indigenous and local knowledge, to solve pressing challenges through well informed decisions.

This could include, for example, promoting a comprehensive source-to-tap approach—monitoring raw drinking water quality and tracking it through its treatment, distribution, and delivery.

Using robust freshwater science to inform decision-making requires the use of the best available information, including Indigenous knowledge. Indigenous knowledge is distinct

from Western Scientific knowledge and provides a highly valuable source of information on freshwater issues.

Over the coming months the Government of Canada will have focused discussions with experts to identify the state of existing freshwater science in Canada. The Government also wishes to hear from the science users about their needs—including the people who create policy, regulation, programs, and initiatives. The ultimate goal: match the scientific effort to the needs of freshwater managers. This will help focus future federal freshwater science investments, improve the availability of knowledge generated for decision-making, and better respond to key regional freshwater challenges.

Possible opportunities

1. Together with provinces, territories, and others develop a national freshwater science agenda to galvanize efforts around key research priorities; improve science integration and communication across governments, academics, and others; and ensure the science is well linked with policy and program needs, including climate change adaptation.

2. In collaboration with other governments and partners, respond to unique regional water management challenges by supporting regional centres of expertise that bring expertise together to focus on issue-specific freshwater science.

3. Work with Indigenous peoples to co-develop and deliver programs and strategies that provide information to support freshwater decision-making that respectfully includes and protects Indigenous knowledge systems.

4. Together with other governments and partners develop and implement tools to improve science and data sharing and knowledge mobilization.

5. Undertake targeted studies to anticipate, mitigate, and resolve emerging domestic and Canada-U.S. transboundary freshwater issues and other freshwater issues of national significance, such as the impacts of climate change.

Discussion Questions

- What are the priority knowledge and research gaps to be filled to achieve effective freshwater management over the next 10 years?
- How well is freshwater science coordinated today? If further coordination is needed, how might that be accomplished?

3.8 Freshwater data

Along with freshwater science, data and information are also paramount to supporting evidence-based decision-making. The growing volume of data and advancements in analytics open new freshwater management possibilities.

Many initiatives are in place to collect and share data and information on freshwater quantity, quality, use and demand. ECCC, AAFC, NRCan, DFO, Parks Canada, Statistics Canada, and other federal departments provide more than 1000 datasets on the Open Data website.

The federal, provincial and territorial governments often collaborate to collect and disseminate water quantity and quality data, and frameworks for information sharing are already somewhat developed.

That said, freshwater demand and use, and ecosystem data, are primarily collected outside of arrangements in place between the federal government and its various partners. And it is not always collected, managed, and disseminated in a consistent manner. In some areas, national data standards are unclear, or they are adopted by data producers inconsistently. When data is not interoperable, it is challenging to use for effective decision-making. Finally, even when data is accessible, Canadians may not know where to find it.

With external experts, the federal government is developing an inventory of freshwater datasets and their availability. The goal is to determine what freshwater data is collected, how, and how it is shared. This information will help build consensus on

priorities for advancing the collection, management, and use of freshwater data in Canada.

Possible opportunities

1. Together with provinces, territories, and others, agree on a National Data Management Strategy, including principles and common standards to ensure that freshwater data is collected and managed in a consistent manner, leading to effective and efficient data integration that provides more comprehensive insights.

2. Implement a Freshwater Data Discovery Strategy that allows users to:
   - discover vital freshwater data according to international standards;
   - bring datasets together, based on agreed themes; and,
   - apply visualization and analysis techniques to freshwater data to support decision-making and other priorities.

3. Work with First Nations, Métis, and Inuit to share freshwater data and information, and ensure access to Indigenous knowledge, data, and information is respected.

Discussion Questions

- What are your experiences with freshwater data? What worked well and what areas have the most room for improvement? Are there good models to learn from?

- What advances in data analytics present opportunities for freshwater management and decision-making? What can the Government of Canada do to capitalize on these opportunities?

- What are examples of where compatibility and interoperability of data across orders of government and with non-government organizations has been achieved? What can we learn from these examples?

3.9 Transboundary freshwater management

Three-quarters of Canada's 25 major basins cross provincial or territorial boundaries. Nine share boundary waters with the U.S. and account for more than 40% of the frontier between Canada and the U.S., with over 300 lakes and rivers crossing the international boundary.[34] Transboundary water management can be complex, as decisions made in one jurisdiction can have significant impacts on another. The goal of transboundary water management is to support integrated decision-making aimed at protecting ecosystems and the health, property, and economic well-being of citizens.

Canada and the U.S. have a long history of successful cooperation, with 10 water management treaties and agreements. One of these, the Great Lakes Water Quality Agreement, will celebrate its 50th Anniversary in 2022. It is an international model of effective binational cooperation on the management of shared waters.

Other important Canada-U.S. freshwater management agreements include the Boundary Waters Treaty of 1909 and the Columbia River Treaty. The Boundary Waters Treaty was created to provide principles and a mechanism to address issues and to prevent and resolve disputes associated with water use and quality of shared waters.

The Boundary Waters Treaty also established the IJC, an independent international organization. GAC is responsible for the Boundary Waters Treaty and manages the Government of Canada's relationship with the IJC. Many other federal departments, together with provinces and territories, support the 15 regional IJC water boards and committees by providing science and expert advice.

Examples of successful collaboration within Canada between federal, provincial, and territorial governments include four domestic transboundary water boards—the Mackenzie River Basin Board, the Prairie Provinces Water Board, the Lake of the Woods Control Board, and the Ottawa River Regulation Planning Board. Water boards also feature within modern treaties. The Nunavut Water Board, established pursuant to the Nunavut Agreement, seeks to protect, manage and regulate fresh waters in Nunavut by incorporating Inuit Qaujimajatuqangit and scientific knowledge in decision-making.[35]

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[34] Zubrycki, K., Roy, D., Venema, H., Brooks, D. (2011). Water Security in Canada: Responsibilities of the federal government. *International Institute Sustainable Development*. Retrieved from: https://www.iisd.org/system/files/publications/water_security_canada.pdf

[35] Additional modern treaties with water boards include: Yukon Agreements, Sahtu Dene and Métis, Tlicho, Gwich'in, Inuvialuit, Déline, Nunavut, Nunavik Inuit.

In addition, the Government of Canada has agreements with provinces and territories that support regional freshwater management in transboundary basins such as Lake Winnipeg, the Great Lakes and the St. Lawrence River, and other collaborative arrangements covering freshwater bodies such as the Wolastoq/Saint John River. These domestic transboundary arrangements vary widely, with different enabling legislations, mandates, membership composition, and structure.

Canada's successful Canada-U.S. and domestic transboundary experiences provide opportunities to advance the concepts of integrated watershed management and to show how the Government can use collaborative approaches to protect ecosystems and the health, property, and economic well-being of communities. Based on these experiences, it is evident that effective management mechanisms require clear mandates and structures with the flexibility to adapt and respond to current and future challenges. These mechanisms also require harmonized science, data, and tools in order to understand freshwater issues and support decision-making. Furthermore, active engagement and participation of Indigenous peoples, stakeholders, communities, and the public provides a broader range of perspectives for decision-making, enables information and knowledge sharing, promotes coordination, and ultimately facilitates consensus building. Holistic and integrated approaches that consider Indigenous knowledge and environmental, social, cultural, and economic factors result in better decision-making.

Possible opportunities

1. Better coordinate and enhance Government of Canada support to existing domestic and Canada-U.S. transboundary freshwater collaborative mechanisms, including the IJC and its Boards, to ensure that they have the science, data, and information needed to fulfill their responsibilities, and to help anticipate and prevent freshwater problems.

2. Together with provinces, territories, and others support the timely review of domestic transboundary freshwater management mechanisms and develop new mechanisms to ensure the cooperative and coordinated management of transboundary surface freshwater and groundwater resources.

3. Engage the U.S., provinces and territories, Indigenous peoples, and others in climate impact assessments for transboundary waters so that decision-makers

have the information they need to make adaptive management decisions coordinated across jurisdictions.

4. Build on successful transboundary mechanisms to develop and implement cooperative initiatives with provinces and territories, Indigenous peoples, and others to restore and protect domestic transboundary freshwater ecosystems that are under significant stress—including, but not limited to, existing federal-provincial initiatives for the Great Lakes, St. Lawrence River, and Lake Winnipeg.

5. Support the IJC and other binational collaborative mechanisms to advance the harmonization and sharing of data, knowledge, models, and cooperative science.

Discussion Questions

- Canada has many positive examples of transboundary freshwater management. What can we learn from these experiences and build on moving forward?

- What is needed to ensure that water boards have the science and data they need to manage and protect transboundary waters, including in the context of climate change adaptation?

- How should the Government of Canada support Indigenous peoples in transboundary water management?

3.10 Freshwater technology, innovation, and infrastructure

Water technologies and infrastructure mitigate freshwater pollution, provide drinking water and wastewater services, improve freshwater conservation, and help manage extreme water events.

There is an opportunity for Canada to be a leader in water technology. Canada has developed a number of well-recognized test facilities, research centers and

technologies led by academia, industry, entrepreneurs, and government, including municipalities, and continues to advance innovative technologies to optimize farm management practices, including through precision agriculture. Federal government support of research, development, and adoption of freshwater technologies includes Sustainable Development Technology Canada; NRC's Industrial Research Assistance Program; NRCan's Clean Growth Programs; and AAFC's Clean Technology Program. And the Government of Canada's Clean Growth Hub serves as a concierge service, connecting technology developers to appropriate federal programs and support.

The development and funding of freshwater technology and innovation in Canada is coordinated between many partners, including federal, provincial, and territorial agencies, municipalities, research institutions, investors, and industry. But gaps remain in connections between developers and end users, impeding the identification and understanding of priorities for technology advancement to address key freshwater issues. Innovation can be limited when freshwater data and information is not readily accessible or available in the right form. As with all new technology, funding is required to scale and commercialize new ideas.

The federal government supports investments in water, wastewater, stormwater infrastructure, and natural infrastructure,[36] through, for example, the Investing in Canada Infrastructure Program, the Disaster Mitigation and Adaptation Fund, the National Disaster Mitigation Program, the Canada Infrastructure Bank, the Green Municipal Fund, and the First Nations Water and Wastewater Infrastructure on Reserves Fund.

Despite these significant investments, water and wastewater infrastructure deficits persist in provinces and territories, municipalities, and Indigenous communities across the country. This includes challenges faced by operators of small and remote drinking water systems. In addition, climate change poses further long-term challenges for maintaining and building new water infrastructure. These challenges require innovation and support to design resilient water infrastructure that will serve Canadians effectively for decades.

[36] Examples of natural infrastructure include the use of wetlands in wastewater treatment.

Possible opportunities

1. Promote technology development in relation to identified priorities, including but not limited to: climate change adaptation, climate friendly freshwater technologies, and climate resilient infrastructure; groundwater and surface water monitoring and prediction; rural and remote community water security, including drinking water quality for small systems; wastewater treatment; efficient freshwater use in oil, gas and mining sectors; efficient irrigation solutions for agriculture; and tools to protect biodiversity, wetland health and natural ecosystem functions.

2. Provide overarching coordination and guidance for freshwater technology development by engaging across federal departments, provinces and territories, municipalities, and with Indigenous peoples, academia, sector representatives, and others to identify new and emerging priorities for technology advancement.

3. Provide targeted support for scaling and commercializing freshwater technology by improving data access critical to innovation; identifying funding opportunities; and making connections between technology developers, academia, federal scientists, and end users.

4. Engage across federal departments, provinces and territories, municipal governments, Indigenous peoples, sector representatives, and others to identify freshwater infrastructure investment priorities that will maximize our ability to address key freshwater challenges, including climate change adaptation.

5. Better inform federal government infrastructure investments and climate change adaptation by adopting baseline criteria to designate flood hazard areas.

6. Advance the development, testing and implementation of natural infrastructure solutions to climate change impacts, including wetland protection and restoration. Natural infrastructure can increase resilience to floods and drought; improve water quality; and provide a cost effective alternative to replacing aging infrastructure.

Discussion Questions

- What are your thoughts on the technology and infrastructure priority areas identified above? Should others be considered?
- What are the most important freshwater infrastructure priorities for your community, including those needed to adapt to a changing climate?
- What models should the Government of Canada consider to enhance coordination and collaboration on freshwater technology, innovation and infrastructure?

3.11 Engaging Canadians in managing and protecting fresh water

Canadians care deeply about fresh water and want information about the health of freshwater resources and ecosystems, including whether conditions are getting better or worse. Many are ready to do their part in protecting Canada's fresh waters through participation in citizen science, community-based water monitoring, and stewardship activities.

Across the country there are successful citizen and community engagement models, ranging from initiatives to better understand the state of local waters through quality monitoring, to on-the-ground stewardship activities to protect freshwater ecosystems.

Community-based freshwater research and monitoring in Canada is growing and the quality of data produced is improving, as is the use of innovative technologies for monitoring and analysis.

Youth are particularly important agents of change. Canada's diverse youth, including Indigenous youth, have already demonstrated leadership on fresh water. Their involvement in freshwater protection can stimulate broader societal change toward a future in which water is clean, safe, and secure for all.

Possible opportunities

1. Increase freshwater knowledge and awareness of Canadians by improving the availability of data and information on freshwater resources, species, and ecosystems, through regular reporting on the state of Canada's fresh water.

2. Engage Canadians directly in learning about and protecting freshwater resources, species and ecosystems by developing and implementing a comprehensive strategy linked to the needs of decision-makers in order to increase the conduct, value, sharing, and use of community-based freshwater monitoring, including participation by Indigenous peoples.

Discussion Questions

- What specific tools and approaches will be most effective in advancing high-quality citizen and community science and data for freshwater decision-making, and in enabling involvement by all groups?

3.12 Overarching discussion questions

Setting priorities is important. Establishing an initial focus on those roles where the CWA can make the most significant contribution will be critical to its success in working together with provinces, territories, Indigenous communities, local authorities, scientists and others, to keep our water safe, clean, and well-managed.

Discussion Questions

- What are your views on the possible opportunities to enhance freshwater management identified in sections 3.2 to 3.11? Which should be the highest priority? What is missing?

- Which of these possible opportunities should be priority roles for a CWA?

4.0 GOVERNANCE CONSIDERATIONS FOR A CANADA WATER AGENCY

Once the Government has received feedback on potential roles for a CWA, it will work internally to determine the best federal delivery structure. In the meantime, the Government of Canada can look at how other jurisdictions manage fresh water to identify some key considerations for the CWA (see Annex 4). In reviewing those examples, it is important to keep in mind the Canadian context and its comparability. As noted before, Canada's large drainage basins and climatic variability pose different challenges than those faced by many smaller countries with more homogenous freshwater issues.

A country's constitutional division of powers determines what water organizations focus on at the national and sub-national levels. Federations like Canada are more likely to have sub-national governments with freshwater management responsibilities. A wide range of additional factors beyond a country's division of powers determines how countries organize their freshwater management. There is no single, common model.

Several jurisdictions nest freshwater functions in different parts of government, often in connection with environment departments and public information providers. In the U.S., for example, the Office of Water is part of the Environmental Protection Agency and focuses on safe drinking water, protecting and restoring watersheds and aquatic habitat, and supporting water-related economic and recreational activities. The National Oceanic and Atmospheric Administration and U.S. Geological Survey lead on providing freshwater information.

In England, responsibilities for protecting freshwater quality and managing flood risk reside with the Environment Agency. In Australia, freshwater policy at the national level falls under the Department of Agriculture, Water and Environment, and the Bureau of Meteorology provides freshwater information.

In some instances, there are co-located functions in a single water-focused agency. For example, Saskatchewan's Water Security Agency brings together the majority of its government's core freshwater management responsibilities, including water supply, water quality, drinking water and wastewater, flood and drought, aquatic habitat, and water information. The Japan Water Agency has responsibilities for freshwater supply infrastructure, freshwater quality, flood control, and international cooperation.

Some national water agencies organize their work around watersheds. France has six water agencies at the basin level under the Ministry for the Ecological Transition. These agencies are responsible for freshwater quality and supply, aquatic habitat, flood control, and other roles. The Japan Water Agency operates at the basin level in an integrated manner across seven river systems.

Other countries account for regional differences using political rather than watershed boundaries. As in Canada, sub-national jurisdictions in the U.S. and Australia have significant constitutional powers for freshwater management.

There are various models for collaboration between national government water organizations and others, including other governments, Indigenous peoples, non-government organizations, stakeholders, the private sector, and citizens. As noted before, Canada has significant experience using formal agreements to manage fresh water with provinces, territories, and the U.S. In New Zealand, the newly-announced Taumata Arowai will be responsible for drinking water, wastewater, and stormwater management at a national level. A Māori Advisory Group was formed to ensure the new agency is established with the systems, processes, and capability to uphold the principles of the Treaty of Waitangi, and to engage with and understand the Iwi/Māori perspectives. France's six basin-level agencies each have a committee made up of local authorities, manufacturers, farmers, consumers, government officials, and non-government organizations. These committees are responsible for the Water Development and Management Master Plans that the agencies implement.

Potential considerations for a CWA:

- What are the advantages and disadvantages of the different approaches to organizing freshwater governance at the national level based on these examples and others?

- How should the governance of a CWA account for regional freshwater differences? Should a CWA approach issues at the watershed scale?

- How should a CWA collaborate with provinces, territories, Indigenous governments and peoples, local authorities, scientists, private sector stakeholders and others?

Discussion Questions

- What are examples or best practices from other jurisdictions or other governance models the Government of Canada should consider in creating a CWA?

- What are your views on the considerations presented? What should be the highest priority? What is missing?

5.0 CONCLUSION

Freshwater management in Canada is important and complex, with implications for society, the environment, public health and safety, the economy, and more. This Discussion Paper presents key issues for consideration in the Government of Canada's approach to creating a CWA. Broad input from provinces, territories, Indigenous peoples, stakeholders and the public is being sought. The results of this engagement process will inform the Government's next steps in implementing the commitment to create a CWA.

Feedback can be submitted through the website PlaceSpeak until March 1, 2021. The website contains information on virtual engagement workshops open to the public.

Feedback can also be sent directly by email to *ec.water-eau.ec@canada.ca* or by regular mail to:

Environment and Climate Change Canada
4905 Dufferin Street, 2S423
Toronto, Ontario, M3H 5T4
Canada

After the engagement process, public feedback will be shared in a What We Heard Report.

With the aid of the feedback received on this Discussion Paper, the federal government looks forward to delivering on its commitment to establish a CWA to work together with the provinces, territories, Indigenous communities, local authorities, scientists, and others to find the best ways to keep our water safe, clean, and well-managed.

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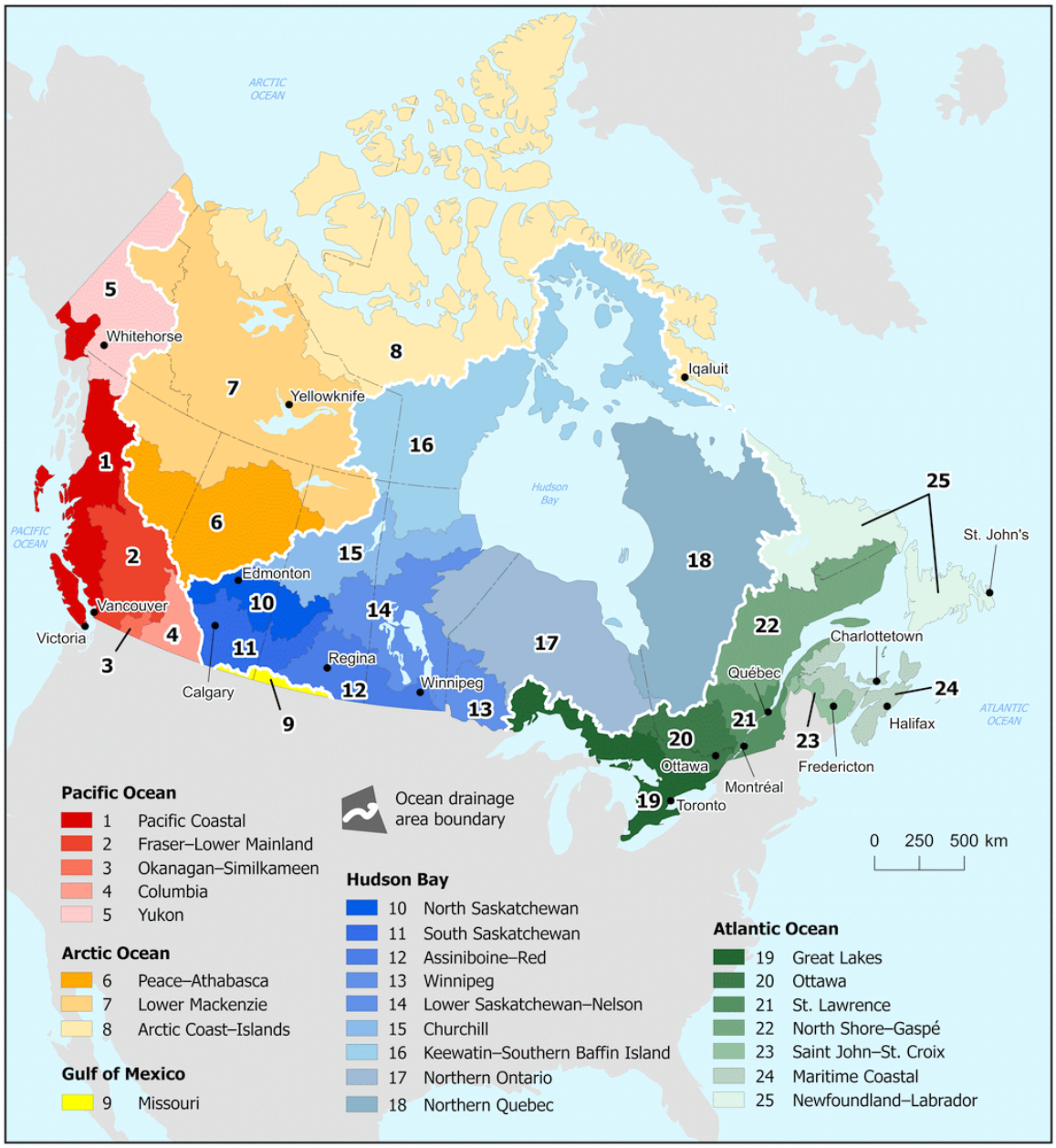
ANNEX 1 – MAP OF CANADIAN DRAINAGE REGIONS[37]

Map 1.1 Drainage regions of Canada



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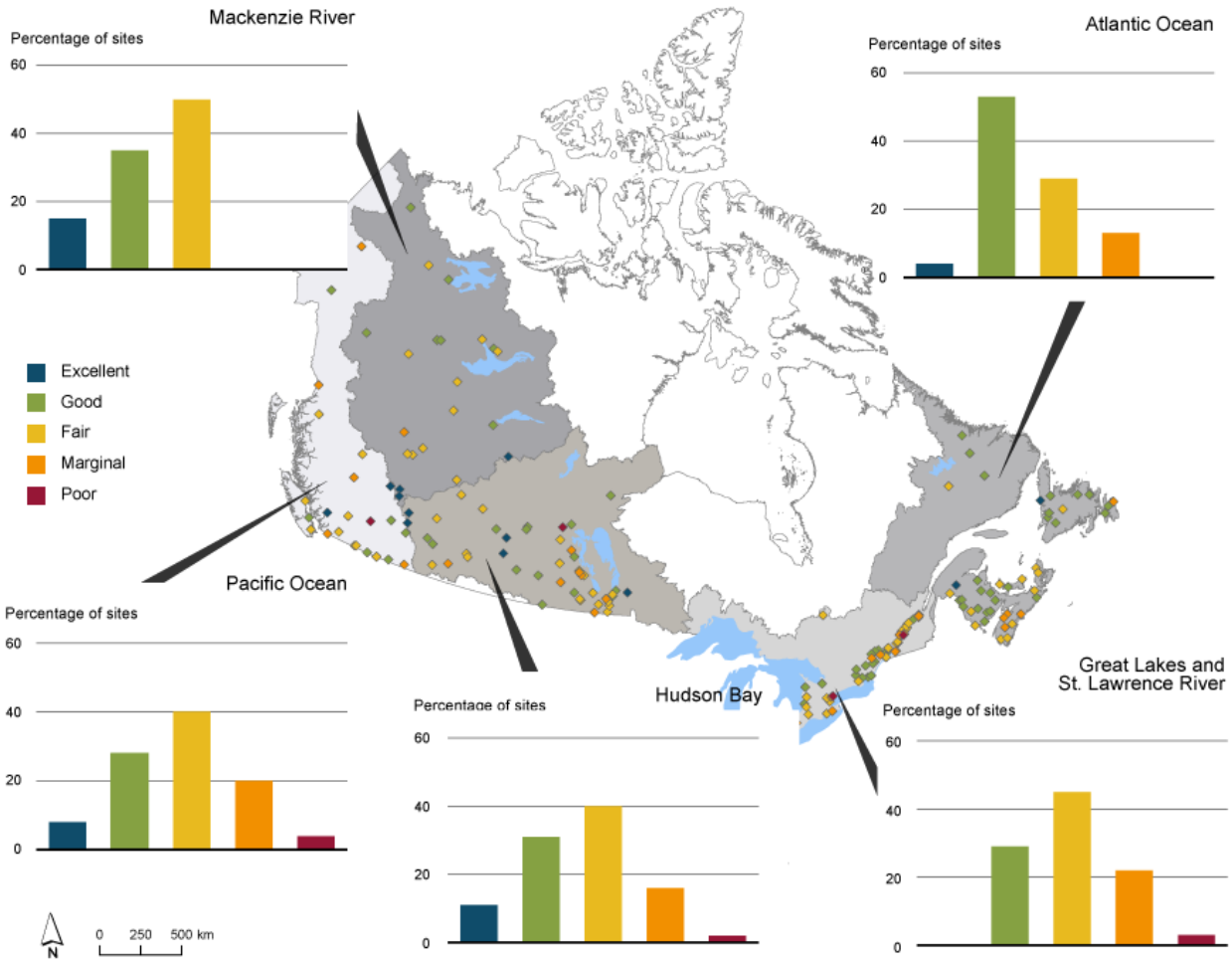
[37] Statistics Canada. (2017). Human Activity and the Environment 2016: Freshwater in Canada. *Government of Canada*. Retrieved from: https://www150.statcan.gc.ca/n1/pub/16-201-x/16-201-x2017000-eng.htm

ANNEX 2 – MAP OF WATER QUALITY STATUS[38]



[38] ECCC. (2020). Canadian Environmental Sustainability Indicators: Water quality in Canadian rivers. *Government of Canada*. Retrieved from: www.canada.ca/en/environment-climate-change/services/environmental-indicators/water-quality-canadian-rivers.html

ANNEX 3 – GLOSSARY[39]

- Biodiversity
    - The variety of life forms in a given area. Typically, biodiversity measures the mix of genetics, species and ecosystems.

- Community-Based Water Monitoring
    - Community-based water monitoring is a process where citizens, government agencies, industry, academia, community groups and local institutions collaborate to monitor, track, and respond to water issues of common community interest.

- Citizen Science
    - The active engagement of the public in scientific activities and processes. Individuals volunteer to be contributors in research and monitoring and can participate through different levels of commitment.

- Data Integration
    - Generally understood as a process to combine data from different sources in such a way as to bring them under a common structure, or under what is called a “unified view”.

- Ecosystem Services
    - The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling that maintain the conditions for life on Earth.

- Forecast
    - Statement about the future based on past and present data and most commonly by analyzing trends. A commonplace example might be the estimation of some variable of interest at some specified future date.

[39] Please note that this Glossary is specific to how terms are used in this Discussion Paper and should not be considered definitions applicable to other Government of Canada documents or activities.

- Fresh water[40]
    - Water typically found in the form of rivers, lakes, groundwater, ice, and snow; does not include seawater and brackish water.

- Groundwater
    - Water located below ground between particles of soil and fractured rock in the saturated zone below the water table.

- Governance[41]
    - The act or process of governing or overseeing the control and direction of something (such as a country or an organization).

- Indigenous knowledge
    - Although there are many different definitions of Indigenous knowledge by various Indigenous communities and organizations and in academic or international literature, there is no one universally accepted definition. For this reason, no definition of Indigenous knowledge is provided in this document. In general, it may be said that Indigenous knowledge is based in the worldview of an Indigenous people – First Nation, Inuit or Métis.

- Interoperability[42]
    - The ability to access and process data from multiple sources without losing meaning, and then integrate those data for mapping, visualization, and other forms of representation and analysis. It enables people to find, explore, and understand the structure and content of datasets. In essence, it is the ability to join up data from different sources to help create more holistic and contextual information for simpler, and sometimes automated, analysis; better decision-making; and accountability purposes.

- Monitoring
    - Monitoring is the systematic observation over time to detect ongoing and emerging changes in the condition of water quantity, quality or the health of aquatic ecosystems through selected measures.

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[40] Government of Canada. (2013). Water in Canada. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/water-overview/publications/water-in-canada.html
[41] Merriam-Webster. (n.d.). Governance. Retrieved from: https://www.merriam-webster.com/dictionary/governance
[42] Statistics Canada. (2020e). Statistics Canada Data Strategy. Government of Canada. Retrieved from: https://www.statcan.gc.ca/eng/about/datastrategy#a10

- Natural infrastructure[43]
    - The use of natural resources such as plants, soil and wetlands to reduce or mitigate the impacts of climate change or natural hazards.

- Prediction
    - The term prediction is used in hydrology in the broadest possible sense, as a quantitative statement about the state of the system. Predictions include both short-term forecasts (e.g., seconds to seasons) as well as longer-term projections (e.g., decades to centuries). In meteorology, prediction is linked to Numerical Weather Prediction, which is about resolving a complex set of mathematical equations using the current observed atmospheric variables of interest.

- Surface water
    - The water on the surface of the earth, including streams, rivers, lakes, bays, oceans, etc.

- Transboundary Waters
    - Domestic Transboundary Waters
        - Water bodies, such as lakes, rivers and aquifers that are located within the boundaries of two or more governing bodies within Canada, such as a province or a territory.

    - Canada-U.S. Transboundary Waters
        - These are waters along which an international boundary runs as defined in the 1909 Boundary Waters Treaty, and for the purposes of this document, also includes waters which flow across the international boundary between Canada and the U.S.

- Wastewater
    - Wastewater is used water that is generated from domestic, commercial, industrial or agricultural activities.

[43] Stanley, M., Puzyreva, M., Roy, D. (2019). Advancing Natural Infrastructure in Canada. *International Institute for Sustainable Development.* Retrieved from: https://www.iisd.org/system/files/publications/advancing-natural-infrastructure-canada.pdf

- Water Management
    - The operational approaches used to ensure the adequate allocation, stewardship and flow of water resources.

- Watershed / Drainage Basins
    - Also referred to as a catchment or drainage basin, a watershed is an area of land where all surface water and precipitation (e.g., rain or snow) drain into the same place—be it a creek, a stream, a river, or an ocean.

ANNEX 4 – EXAMPLES OF WATER GOVERNANCE IN OTHER CONTEXTS

Introduction

This annex summarizes examples of freshwater governance and management in other contexts with a focus on the national level, including the six other G7 countries, two examples from G20 countries, three other international examples, and two Canadian examples (one existing provincial agency and a federal program that no longer exists). These examples are brief, illustrative summaries drawn from publicly-available information and should not be considered exhaustive descriptions of how a jurisdiction manages their fresh water.

G7 Countries:

- U.S. – Multiple Agencies
- France – Les Agences de l'Eau and Service central d'hydrométéorologie et d'appui à la prévision des inondations (SCHAPI)
- Japan – Japan Water Agency (JWA)
- England (United Kingdom) – Environment Agency (EA)
- Germany – Umweltbundesamt (UBA)
- Italy – Sistema Nazionale per la Protezione dell'Ambiente (SNPA)

G20 Countries:

- Australia – Department of Agriculture, Water and Environment
- Spain (Catalonia) – Agència Catalana de l'Aigua (ACA)

Other:

- Singapore – Public Utilities Board (PUB)
- New Zealand – Taumata Arowai
- Sweden – Swedish Agency for Marine and Water Management (SwAM) and the Swedish Meteorological and Hydrological Institute (SMHI)
- Saskatchewan – Water Security Agency
- Western Canada – the former PFRA

United States

In the U.S., there are several federal agencies responsible for aspects of water management. These agencies share the responsibility of managing water issues with the states.

Federal Water Agencies

National Oceanic and Atmospheric Administration (NOAA)[44]

NOAA is the source for official weather and water prediction and forecasts as well as warning and advisory products. NOAA's water-related responsibilities include: satellites, information and data; weather, water and climate prediction; weather and climate research; oceans and coasts; and fisheries and habitats. NOAA has sought to improve national water security by transforming integrated water prediction services through the creation of the National Water Center (2015) and NOAA's 5-Year Water Initiative (2016) to support and inform essential emergency services and water management decisions.

NOAA Water Initiative
The initiative focuses on giving people and governments better access to water information. Its objectives are to build strategic partnerships for water information services; strengthen water decision support tools and networks, revolutionize water modeling, and precipitation prediction; accelerate water information research and development; and enhance and sustain water-related observations.

The initiative is housed at the new U.S. National Water Centre, which was created to address the country's growing need for water intelligence. The National Water Centre is designed to facilitate partnerships and collaboration across organizations and sectors to deliver a new generation of water information and decision-support services.

United States Geological Survey (USGS)[45]

The USGS monitors, researches, and delivers information on many water resources and conditions including streamflow, groundwater, water quality, and water use and availability. For example, the USGS provides information from more than 8000 stream

[44] NOAA. (2016). NOAA Water Initiative: Vision and Five Year Plan. *U.S. Department of Commerce*. Retrieved from: https://www.noaa.gov/sites/default/files/atoms/files/NOAA_Water_Initiative%20Plan-final-12202016.pdf
[45] USGS. (n.d.). Programs. *United States Government.* Retrieved from: https://www.usgs.gov/mission-areas/water-resources/programs

and lake gauges that serve as locations for the NOAA to release official river forecasts. The USGS also develops detailed topographic, geologic, hydrographic, and biogeographic surveys, maps, and data to help Federal, State, local agencies, decision-makers, and the public.

Environmental Protection Agency's Office of Water (OW)[46]

In the U.S., drinking water quality regulation is the joint responsibility of state departments of health and the Environmental Protection Agency (EPA). The EPA carries out these responsibilities through the OW. The mandate of the OW is to ensure clean and safe drinking water; restore and maintain oceans, watersheds, and their aquatic ecosystems; support economic and recreational activities with links to water; and provide healthy habitat for fish, plants, and wildlife.

The Office is divided into five sub-offices that cover its primary responsibilities. The Immediate Office of the Assistant Administrator for Water manages the National Water Program that provides guidance and implementation strategies to EPA regional offices, states, and tribes. The offices dedicated to groundwater and drinking water, science and technology, and wastewater management provide regulatory standards, voluntary management approaches, and financial and technical assistance to states, tribes, communities, and regulated entities. The office dedicated to wetlands, oceans, and watersheds regulates and monitors ocean dumping, and vessel discharges and reduces freshwater and marine debris. This office also controls pollution runoff and restores impaired waters.

France

In France, both the federal and state governments have roles in freshwater management. The national Ministry for the Ecological Transition provides the legal framework, while State representatives grant abstraction authorisations and issues entitlements.[47]

[46] United States Environmental Protection Agency. (2020). About the Office of Water. Retrieved from: https://www.epa.gov/aboutepa/about-office-water
[47] OECD. (2015a). Water resources allocation – France. Retrieved from: http://www.oecd.org/france/Water-Resources-Allocation-France.pdf

Les Agences de l'Eau[48]

France has six separate regionally-based water agencies divided among its seven hydrographic basins (one agency is responsible for two basins).

The primary mandate of these agencies is to manage and preserve water resources and aquatic environments. They implement national and European water policies, collect water use fees, and provide financial aid to local government, among other tasks.

Water Development and Management Master Plans (SDAGE) are developed for each hydrographic basin. The scope of these plans is broad and all lower-level urban planning documents and administrative decisions in the water sector must comply with them. The water agencies, along with the State, are responsible for implementing the action plans that supplement the SDAGE.[49]

The six agencies are public bodies of the national Ministry for the Ecological Transition. Each agency is responsible for providing secretariat services to its basin committee. These basin committees are made up of relevant stakeholders (local authorities, manufacturers, farmers, State, consumers, non-government organizations, and others) and develop the SDAGEs that the water agencies implement. They also determine the rate of royalties their water agencies can collect.[50]

Service central d'hydrométéorologie et d'appui à la prévision des inondations (SCHAPI)[51]

SCHAPI is the national service mandated for flood forecasting in France. SCHAPI, as part of the Ministry of Ecological Transition, is responsible for informing the water agencies and the public about the risk of flooding. With approximately 500 hydrometric stations and forecasters spread over the country, SCHAPI forms the national information service on the flood risk of the main rivers in France. This service is

[48] Les Agences De L'eau. (n.d.-a). The Six Water Agencies. Retrieved from: http://www.lesagencesdeleau.fr/les-agences-de-leau/les-six-agences-de-leau-francaises/
[49] Les Agences De L'eau. (n.d.-b). The Strategy of the French Basins. Retrieved from: http://www.lesagencesdeleau.fr/en/une-ambition-pour-la-ressource-en-eau/la-strategie-des-bassins-francais/
[50] Les Agences De L'eau. (n.d.-c). Water democracy in the basins. Retrieved from: http://www.lesagencesdeleau.fr/les-agences-de-leau/la-democratie-de-leau/
[51] Vigicrues. (n.d.). Information service on the risk of flooding of the main rivers in France. *Ministry for Ecological Transition.* Retrieved from: https://www.vigicrues.gouv.fr/

separate from Météo-France, which is the French national meteorological and climatological service.

Japan

Water governance in Japan is divided among various levels and ministries of government. On the national scale, the Ministry of Land, Infrastructure, Transport and Tourism is in charge of policy, issuing water right permissions, and the formulation and coordination of the basic plan for water resources development. Other national ministries have roles to play in the formulation and coordination of water use and supply plans as well as the operation and maintenance of facilities.[52]

Japan Water Agency (JWA)[53]

The JWA is an independent and self-supportive administrative corporation. It oversees the operation and maintenance of facilities (mainly dams and canals) in seven river systems where water demand is highest.

The mission of the JWA is to provide a stable supply of safe and quality water, prevent and mitigate flood hazards, prepare for crises, ensure facility integrity, develop facilities in a systematic and appropriate manner, conserve the natural environment, promote international cooperation, and to supply various water-supply related equipment such as portable water purification units.

Regional and working-level offices are divided among the 5 major river systems. These regional and working-level offices report to the headquarters.[54] The JWA is supervised by several national ministries under the Water Resources Development Basin Plans that are developed by the federal cabinet and related ministries.

[52] OECD. (2015b). Water resources allocation – Japan. Retrieved from: http://www.oecd.org/japan/Water-Resources-Allocation-Japan.pdf
[53] Japan Water Agency. (n.d.). About Us. Retrieved from: http://www.water.go.jp/honsya/honsya/english/index.html
[54] Japan Water Agency. (2019). Organization. Retrieved from: https://www.water.go.jp/honsya/honsya/english/about/organization.html

England (United Kingdom)

The Department for Environment, Food and Rural Affairs (DEFRA) determines water policy in England, works closely with administrations in Wales, Scotland, and Northern Ireland, and generally leads on negotiations in the European Union (EU) and internationally. The Environment Agency (EA) implements a majority of these policies, such as those related to water quality and resources, fisheries, navigation, flooding, conservation and ecology across England. Scotland, Wales, and Northern Ireland have their own environmental regulators.[55] The Water Services Regulation Authority (Ofwat) is the body responsible for economic regulation of the privatized water and sewerage industry in both England and Wales. The Drinking Water Inspectorate operates under DEFRA to ensure that public water supplies are safe and drinking water quality is acceptable.

United Kingdom Environment Agency (EA)

England does not have a specific national water agency. Water is included in the jurisdiction of the EA.

The EA has many roles and responsibilities across various environmental topics. Specific to water, the EA is responsible for water quality monitoring, assessing water availability, issuing water licenses, monitoring water abstraction, enforcement, and flood risk management.[56] The EA is also responsible for producing River Basin Management Plans.

As a non-departmental public body, the EA's board of directors is directly responsible to government ministers. Within the EA, there are dedicated sub-divisions dedicated to water resources, water planning, and water quality.[57]

Germany

In Germany, the federal government is responsible for issuing framework provisions on water policy. Germany's federated states, also known as the Länder, are responsible for

[55] OECD. (2015c). Water resources allocation – United Kingdom. Retrieved from: http://www.oecd.org/unitedkingdom/Water-Resources-Allocation-United-Kingdom.pdf
[56] Government of the United Kingdom. (n.d.-a). Environment Agency – About us. Retrieved from: https://www.gov.uk/government/organisations/environment-agency/about
[57] Government of the United Kingdom. (n.d.-b). Environment Agency – Our governance. Retrieved from: https://www.gov.uk/government/organisations/environment-agency/about/our-governance

the implementation of those federal provisions and the enforcement of all legal provisions regarding water protection.[58] In Germany, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is responsible for implementing regulatory law related to water management, in accordance with the European Water Framework Directive. The Umweltbundesamt, the German Environment Agency, is responsible for gathering data concerning the state of the environment and providing relevant information to the public and other federal departments.

Umweltbundesamt (UBA)[59]

Germany has no specific water agency; rather the roles and responsibilities for water management at a national level are included in the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the UBA.

The UBA's mandate on water includes protecting drinking water and aquatic ecosystems, as well as ensuring sustainable water allocation. Their work includes the assessment of waterways, water quality (i.e. metals, nutrients, chemicals, organic pollutant, pharmaceuticals, and pesticides), water quantity (i.e. drinking water distribution, management of supply, guidelines, and research), the Antarctic ecosystem (as a party to the Antarctic Treaty), river restoration, and water reuse.

As part of the EU, Germany is obligated to implement the Water Framework Directive. For the UBA, this work includes the establishment and operation of basic information and assessment systems for rivers, lakes, estuarine, and coastal marine waters.

The UBA's water mandate is carried out by two subdivisions within the Environmental Health and Protection of Ecosystems Division (Division II): the Water & Land and Drinking Water & Swimming Water Quality subdivisions. Each of these subdivisions has many working-level groups.[60] The UBA also houses the office of the Germany Advisory Council on the Environment, which is an independent academic body that evaluates environmental performance in Germany, including water resources.

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[58] Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety. (n.d.). What is water management about? *Government of Germany.* Retrieved from: https://www.bmu.de/en/topics/water-waste-soil/water-management/what-is-water-management-about/

[59] Umwelt Bundesamt. (n.d.).Water. Retrieved from: https://www.umweltbundesamt.de/themen/wasser

[60] Umwelt Bundesamt. (2020). Organisation. Retrieved from: https://www.umweltbundesamt.de/das-uba/wer-wir-sind/organisation

Italy

The roles and responsibilities for water management at a national level are incorporated into the Systema Nazionale per la Protezione dell'Ambiente, the National System for Environmental Protection, which operates under the legal framework set out by the Ministry for Environment, Land and Sea Protection, which is responsible for water law.

Sistema Nazionale per la Protezione dell'Ambiente (SNPA)[61]

The SNPA is a consolidated federal system for the 21 regional and autonomous provincial environmental agencies in Italy and the Italian Institute for Environmental Protection and Research (ISPRA).[62]

The mandate of the SNPA is to offer technical and scientific expertise on national policies for environmental protection, using the knowledge of the regional and autonomous provincial environmental agencies. [63] The SNPA Council is chaired by the President of ISPRA and is made up of representatives of the provincial and regional environmental protection agencies as well as the general manager of ISPRA. This council reports to the Ministry of Environment and Protection of the Land and Sea and the Permanent Conference for Relations between the State, the Regions, and the Autonomous provinces.

The SNPA's specific areas of work include inspection activities in the context of environmental control functions; environmental monitoring activities; control of pollution factors and sources; research aimed at supporting its functions; technical and scientific support for the activities of national, regional, and local bodies with environmental administration duties; and the collection, organization, and dissemination of environmental data. The SNPA includes a focus on water projects and data, such as aquatic pollutants, water reuse, consolidation of national water quality data in coastal areas, and seabed restoration.

[61] Sistema nazionale per la protezione dell'ambiente. (2020). Who We Are. Retrieved from: https://www.snpambiente.it/chi-siamo/
[62] Istituto Superiore per la Protezione e la Ricerca Ambientale. (n.d.). National System for Environmental Protection. Retrieved from: http://www.isprambiente.gov.it/en/national-system-for-environmental-protection
[63] Sistema Nazionale per la Protezione dell'Ambiente. (n.d.). ARPA – APPA. Retrieved from: https://www.snpambiente.it/chi-siamo/i-nodi-del-sistema/i-siti-web/

Australia

State and territory governments have responsibility for land and water management, and the Australian federal government has an oversight, facilitation, and funding role.

Department of Agriculture, Water and Environment

Federal responsibility for water policy and resources is under the Department of Agriculture, Water, and Environment, which administers key federal water legislation and has a number of water-related functions in its portfolio.[64]

The Bureau of Meteorology (BoM)

The BoM, Australia's national weather and climate agency, has responsibility for compiling and disseminating comprehensive water information across Australia through the *Improving Water Information Programme*. The Bureau works closely with data collectors and stakeholders across Australia on water data collection, accounting standards, warehousing and management, agreements for sharing and licensing, and upgrades to hydrological monitoring systems. The *Improving Water Information Programme* produces products and services such as historical information and trends on water, water resource assessments, and water restrictions. The BoM has the power to collect and publish high-quality water information as well as set and implement national standards for water information. It also has the authority to identify who must provide specified water information.

The Murray-Darling Basin Authority (MDBA)

The MDBA is an independent expertise-based statutory agency that works in partnership with governments and communities to manage the largest water resource in the country, the Murray-Darling Basin. Its work includes the development of a Basin Plan for the sustainable use of the Basin's resources; operation of the River Murray system to deliver water to users on behalf of partner governments; measurement, monitoring, and recording the quality and quantity of the water resources of the MDB; and supporting, encouraging and conducting research on the Basin's water resources and ecosystems.

[64] Department of Agriculture, Water and Environment. (n.d.). Organisational Structure. *Australian Government.* Retrieved from: https://www.awe.gov.au/about/who-we-are/structure

The Commonwealth Environmental Water Office (CEWO)[65]

The CEWO makes decisions annually on how, when and where water will be used across the MDB. The CEWO works with state government land managers, environmental water holders, river operators, scientists, Indigenous peoples, local communities and interest groups, and the MDBA using an annual water management cycle to plan, deliver, measure and review the use of water for the environment.

Catalonia (Spain)

Catalonia is an autonomous region in northwest Spain. According to Spanish law, the state has the ultimate authority over water; however, management of water resources is both centralized and decentralized. Marine and inter-regional waters are managed by the Spanish central government. Catalonia's inter-regional waters are managed by the Catalan Water Agency (ACA).[66]

Agència Catalana de l'Aigua (ACA)[67]

The ACA is the public company of the Government of Catalonia responsible for water planning and management.

The mandate of the ACA includes water planning and management following the principles of the EU's Water Framework Directive. Specific roles include the promotion of action plans that are determined by the Catalan River Basin District Management Plan; planning, financing, and managing the operation of Catalonia's sewage system; identifying potential floodable areas for protection of people and property; providing necessary space to preserve the quality of river ecosystems; and determining water supply and sanitation policy.

The ACA is made up of a board of directors and three departments focused on communication, economic-financial control, and management. Within the management department there are several technical areas: water supply area, wastewater sanitation

[65] Commonwealth Environmental Water Office. (2020). Managing water for the environment. *Australian Government*. Retrieved from: https://www.environment.gov.au/water/cewo/about-commonwealth-environmental-water
[66] Osbeck, M., et al. (2013). Water Governance in Europe Insights from Spain, the UK, Finland and Estonia. *Stockholm Environment Institute*. Retrieved from: https://mediamanager.sei.org/documents/Publications/Air-land-water-resources/sei-2013-water-governance-in-europe.pdf
[67] Catalan Water Agency. (n.d.). About the ACA. *Government of Catalonia*. Retrieved from: http://aca.gencat.cat/ca/laca/sobre-laca/

area, environmental management area, area of execution of actions, and tax and revenue area.

The Council for the Sustainable Use of Water is the agency's advisory and participation body. Council members are appointed by the Minister responsible for the agency, with a large portion made up of water users (e.g. irrigation groups, hydropower, municipalities) (35%) and a small representation from organizations with environmental and socio-economic interests (2-3%).[68]

Singapore

Singapore is an island city-state, meaning that "national" agencies and boards often operate in the way that municipal agencies and boards would.

Public Utilities Board (PUB)[69]

PUB is Singapore's national water agency and is a statutory board under the Ministry of the Environment and Water Resources. PUB is responsible for the collection, production, distribution and reclamation of water in Singapore.

The specific roles of PUB include overseeing the collection of rainwater and seawater; production of clean drinking water; distribution of drinking water to customers; reclamation and treatment of wastewater and used water; flood risk mitigation and management; and maintaining water infrastructure, such as dams and canals.

The board's structure is made of an executive board, a chief executive, and three branches (operations, policy & development, and future systems & technology), as well as an internal audit office. Each of the branches has multiple divisions headed by directors and officers.[70]

[68] Osbeck, M., et al. (2013). Water Governance in Europe Insights from Spain, the UK, Finland and Estonia. Stockholm Environment Institute. Retrieved from: https://mediamanager.sei.org/documents/Publications/Air-land-water-resources/sei-2013-water-governance-in-europe.pdf
[69] Public Utilities Board. (2019). About us. *Singapore Government*. Retrieved from: https://www.pub.gov.sg/about
[70] Public Utilities Board (2020). *Singapore Government.* Organisational Chart. Retrieved from: https://www.pub.gov.sg/about/organisationalchart

New Zealand

Water governance in New Zealand is under the control of both the central government and local authorities. Regional councils are responsible for managing water quality and quantity in the regions.[71] The central government sets national laws and regulations, which councils follow when making decisions about how to manage fresh water. Federal authority for fresh water is assigned to the Ministry for the Environment, who has introduced freshwater rules and regulations through the 2020 Essential Freshwater Package.[72] The National Policy Statement for Freshwater Management provides direction to local authorities on managing the activities that affect the health of fresh water.

Taumata Arowai[73]

In July 2019, New Zealand's government moved forward with the decision to create a new central water regulator to oversee the country's entire drinking water system. This came after a government review found that there was a systemic failure of New Zealand's water suppliers to meet the standards required to ensure the safe supply of drinking water. The agency is currently under development.

The bill that established the Taumata Arowai as the country's new water services regulator outlined the agency's general functions:

- administering and enforcing a new drinking water regulatory system (including the management of risks to sources of drinking water); and
- a small number of complementary functions relating to improving the environmental performance of wastewater and stormwater networks.[74]

A complementary bill, which is still under review in Parliament,[75] will solidify the agency's wastewater and stormwater monitoring functions. However, the current plan is

[71] Ministry for the Environment. (n.d.-a). Roles and responsibilities for managing freshwater in New Zealand. *New Zealand Government*. Retrieved from: https://www.mfe.govt.nz/fresh-water/we-all-have-role-play/roles-and-responsibilities-managing-freshwater
[72] Ministry for the Environment. (n.d.-b). Essential Freshwater new rules and regulations. *New Zealand Government*. Retrieved from: https://www.mfe.govt.nz/essential-freshwater-new-rules-and-regulations
[73] New Zealand Government. (2019). Dedicated watchdog for water quality. Retrieved from: https://www.beehive.govt.nz/release/dedicated-watchdog-water-quality
[74] Department of Internal Affairs. (2019). Taumata Arowai Establishment Unit. *New Zealand Government*. Retrieved from: https://www.dia.govt.nz/Taumata-Arowai-Establishment-Unit
[75] New Zealand Parliament (2020). Water Services Bill. Retrieved from: https://www.parliament.nz/en/pb/bills-and-laws/bills-proposed-laws/document/BILL_99655/water-services-bill

that the agency will have a range of responsibilities and functions, including sector leadership; standards setting; compliance, monitoring and enforcement; capability building; information, advice and education; and performance reporting.

The structure of the agency is still being developed but a governance board and interim Chief Executive have been selected. There is also a Māori Advisory Group that will provide advice and guidance to Taumata Arowai. The goal of the advisory group is to ensure Taumata Arowai is established with the systems, processes, and capability to uphold the principles of the Treaty of Waitangi and to engage with and understand the Iwi/Māori perspectives.

Sweden

In Sweden, the Ministry of Environment is responsible for water policy. Sweden is obligated to incorporate the EU Water Framework Directive into its national laws and policies. As a result, Sweden introduced new river basin management based on five river basin districts. Sweden's national agencies work to coordinate the various efforts at multiple levels related to water.

The Swedish Agency for Marine and Water Management (SwAM)[76]

SwAM is the national entity responsible for marine, surface water, and fisheries management that oversees environmental issues regarding the conservation, restoration and sustainable use of streams, lakes and seas in Sweden. Nationally, SwAM coordinates Sweden's five water district authorities, as well as water-related issues for Sweden's 21 county administrative boards.

The Swedish Meteorological and Hydrological Institute (SMHI)[77]

The SMHI is an agency under the Ministry of the Environment. Through their expertise in meteorology, hydrology, oceanography and climatology, SMHI administers and develops information about the weather, water and climate that provides social functions, trade and industry and the general public with knowledge and qualified decision guidance. Through their Hydrology Research unit, SMHI provides new

[76] Swedish Agency Marine and Water Management. (2013). About the Agency. Retrieved from: https://www.havochvatten.se/en/our-organization/about-swam.html#:~:text=About%20the%20Agency,Sweden's%20marine%20and%20freshwater%20environments.
[77] Swedish Meterological and Hydrological Institute. (2020). Who we are. Retrieved from: https://www.smhi.se/en/about-smhi/who-we-are/who-we-are-1.83748

information, forecasts, and knowledge of water resources in Sweden and worldwide, covering different spatial and temporal scales and a broad range of users. The information is used in decision support for a safe and sustainable society, water management, environmental protection, and building of infrastructure.

Saskatchewan

Saskatchewan Water Security Agency (WSA)

The WSA was established in 2012 to bring together most of Saskatchewan's core water management responsibilities through a single-window service approach.[78] The WSA is responsible for managing water supply, protecting water quality, ensuring safe drinking water, managing dams and water supply channels, reducing flood and drought damage and providing information on water.[79] The WSA represents Saskatchewan on collaborative transboundary water efforts, and applies an integrated approach to water management to ensure water supplies support economic growth, quality of life and environmental well-being.[80] While the WSA oversees most water-related responsibilities in Saskatchewan, the Ministry of Environment oversees regulatory aspects related to energy and mining, as well as industrial effluent; and SaskWater, a commercial Crown water utility, assists communities, First Nations, and industry with water and wastewater services.

The WSA reports to the Minister responsible for the Agency who also serves as the Agency's one-person board of directors. The WSA's executive committee (Chief Executive Officer and three Vice-Presidents) report to the Board.[81]

The Senior Vice Presidents are responsible for managing the following three divisions:

- Corporate Services—includes legal services, human resources, and financial management.
- Regulatory—includes licensing and water use, water quality, environmental and municipal management, agricultural drainage, and environmental protection.

[78] Saskatchewan Water Security Agency. (n.d.-a). About. Retrieved from: https://www.wsask.ca/About-WSA/About/
[79] Saskatchewan Water Security Agency. (2020). Annual Report for 2019-20. Retrieved from: https://www.wsask.ca/Global/About%20WSA/Publications/WaterSecurityAgencyPlan%202019-2020_FINAL.pdf
[80] Ibid.
[81] Saskatchewan Water Security Agency. (n.d.-b). WSA Board. Retrieved from: https://www.wsask.ca/About-WSA/Governance/WSA-Board/

- Technical Services—includes operation and management of dams and major structures, engineering services, and hydrology and groundwater management.

Headquartered in Moose Jaw, the WSA uses a decentralized approach in managing its operation and in providing services throughout Saskatchewan.

Western Canada

Prairie Farm Rehabilitation Administration (PFRA)

The PFRA was established in 1935 under the federal *Prairie Farm Rehabilitation Act* in response to the economic crisis created by the 1930s Prairie drought.[82] For most of its duration, the PFRA was part of AAFC. Its mandate was to help the agricultural sector and rural residents of Manitoba, Saskatchewan, Alberta and the Peace River Region of British Columbia to use soil and water resources in a sustainable manner while fostering economic growth.

The PFRA's initial focus on water security included designing and building dams, reservoirs, and other associated water infrastructure such as irrigation projects to stabilize rural and agriculture water supplies and working with producers to manage and conserve soil and water resources on the Prairies. The PFRA later expanded to deliver on-farm soil and water conservation programs, including the Community Pasture Program, Rural Water Development Program, Southwestern Saskatchewan Water Supply System, Shelterbelt Program, Canada-Saskatchewan Irrigation Development Centre, and the Canada-Manitoba Crop Diversification Centre.[83]

The PFRA's service delivery model applied a place-based and multi-disciplinary approach in addressing environmental challenges and advancing economic opportunities in close collaboration with a wide range of partners (e.g., academia, provinces, rural communities, industry associations, watershed groups). Its services ranged from conducting comprehensive studies to support regional and local decision-making; facilitating and convening partners and stakeholders to address issues in a collaborative manner; bridging science with adaptation through demonstration projects, innovative technologies, and knowledge mobilization to accelerate the adoption of soil and water management practices; to helping establish local, producer-led soil and water

[82] Agri-Environment Services Branch. (2010). PFRA 1935 - 75 Years - AESB 2010. *Agriculture and Agri-Food Canada*
[83] Ibid, 36.

management organizations and associations for program delivery. PFRA's expertise in a wide range of areas (e.g., engineering, water resources management, agrology, rural development, and range management), close ties with on-the-ground program delivery and regional capacity allowed it to deliver on a number of disaster-related responses in agricultural areas. This included the 1951 Hoof and Mouth outbreak and the 1997 Red River Flood emergency response and subsequent treatment of contaminated water supplies. Given PFRA's expertise and knowledge of water management, governance, and sustainable land and water management practices, the federal government, the Canadian International Development Agency and other partners also requested PFRA's assistance to help address land and water challenges in other countries.[84]

The PFRA's decentralized structure, provided through a network of approximately 22 district and five regional offices, three specialty centres, 87 community pastures, and a head office in Regina, Saskatchewan, enabled staff to have direct contact with clients and partners and facilitated solutions that addressed local priorities.[85]

In the early 2000s, the PFRA transitioned to national program development and delivery including the National Environmental Farm Plan Initiative and the National Farm Stewardship Program before being incorporated into the Agri-Environmental Services Branch (AESB) and ultimately transitioning into the Science and Technology Branch of AAFC.[86] A number of ongoing activities related to the work of the former AESB involve developing decision-support tools to inform the sustainable management of agricultural landscapes.

[84] Ibid, 36.
[85] Input from AAFC.
[86] Ibid.