GLOBAL WATER FUTURES

SOLUTIONS TO WATER THREATS IN AN ERA OF GLOBAL CHANGE

Water Security for Canadians
National Water Policy Panel

Panelists featured at the National Water Policy Panel on May 13th, 2020 have provided some answers to the questions submitted but not able to be addressed live. Panelists are not representatives of the Government of Canada and cannot answer questions directed toward the government's intentions, plans or processes, however have provided ideas and thoughts on how they could approach the topics posed in those questions. All answers are solely the opinion of the responder. Questions may have been edited for clarity or combined to reduce redundancy.

Thomas Axworthy, Chair Public Policy, Massey College, University of Toronto

John Pomeroy, Director, Global Water Futures and Centre for Hydrology, USask

Merrell-Ann Phare, Executive Director, Centre for Indigenous Environmental Resources

Shawn Marshall, Departmental Science Advisor, Environment and Climate Change Canada

Dimple Roy, Director Water Management, International Institute for Sustainable Development

Jon O'Riordan, Former Deputy Minister, BC Ministry of Sustainable Resource Management

Sandra Cooke, Director Canadian Municipal Water Consortium, Canadian Water Network

What are some specifics of the primary role of the federal government in these conversations? What do we need them to do?

John Pomeroy: The federal government has a longstanding role in freshwater that has varied over time and with need. The need for this has recently increased, with unprecedented stressors on our freshwater and a developing freshwater crisis, it is time for the federal government to coordinate its own approach to water and provide national leadership in working with provinces, territories, Indigenous governments, universities and NGOs to develop the national capacity for:

1) Adaptation to climate change by developing integrated observation and prediction systems for forecasting and predicting floods, droughts and water quality episodes and by mapping floodplains for current and future climates;
2) Enhancing and mobilizing Canada's water information to meet renewed policy and sustainable development goals and for the benefit of citizens, communities, industries and government. Monitoring and prediction systems that underpin water information systems should be comprehensive and include water quantity and quality aspects of Canada's rivers, lakes, wetlands, groundwater, soil moisture, glaciers, snow, and river ice; and
3) Collaborative river basin management by enhancing and coordinating interprovincial, Indigenous and international water management agreements and boards to help ensure evidence-based decision-making and the full range of cooperation needed to make wise, equitable water management decisions on the river basin basis, including input to the International Joint Commission.

Shawn Marshall: The federal government could play a coordinating role in the federal framework that is needed; perhaps a "National Partnership for Water Governance" that includes provinces, territories, Indigenous communities, federal departments, and perhaps some NGOs and academic participants. It would be unwieldy but is needed. There is also space for federal leadership on issues like water data (open data, standards for measurement and reporting), but within a national collation that has buy-in and may well be driven by the partners. I think that water science is very healthy in the country, and it would be federal over-reach for the government to influence this, but they could help in some coordinating capacity in national-scale projects, taking advantage once again of the national partnership/coalition. There are places where monitoring of certain variables (like water temperature) and model development (integrated weather, climate and hydrological models) can or should involve federal science capacity. It would be helpful to see a federal backstop for flood forecasting, for instance, in cases where a particular province or territory lacks capacity and for inter-provincial waters, but recognizing that flood forecasts and management are provincial responsibilities and are often closely guarded (as is provincial data in some cases).

Dimple Roy: The federal government can:

1. Support successful data collection that is critical to water decision-making, governance and management, such as in the case of community-based monitoring programs, open data platforms (such as DataStream by the Gordon Foundation), and IISD-ELA style long-term data and monitoring programs so that we can understand trends, hot spots and what's actually working.
2. Help resource, replicate and scale up some of these successful examples, while also supporting consistent protocols associated with data across jurisdictions. Also, collaborate across government sources of data, reporting on these more regularly so that this information can be used in industry, community and other forms of decision-making.
3. Build on its clear role in transboundary waters and help establish targets, metrics, shared data protocols, etc.

What mechanisms can be put in place for managing shared and transboundary water systems?

Tom Axworthy: River basin management and transboundary management (i.e. with the U.S.) naturally fit within the possible scope of the proposed new agency as the Boundary Waters Treaty make U.S. relations a clear federal responsibility and river watersheds cross provincial boundaries. The International Joint Commission (IJC), of course, already exists and this would be the agency of choice supported by the research of the Canada Water Agency. One of the benefits of a new federal agency is that if it was a forceful advocate of robust water management within the federal system as a whole, then this would enhance the political priority of the IJC and raise water issues on the bilateral negotiating agenda.

Dimple Roy: There are already some effective institutions and mechanisms working on transboundary basins, both through the IJC and through non-governmental efforts that have worked to bring governments, experts and others together on collaborative water management. These groups are sharing best practice, establishing data and information sharing mechanisms, developing strategies to combat specific issues such as aquatic invasive species, floods and water quality thresholds at borders.

What are the lessons to be learned by the EU approach in the Water Directive Framework's global and legally binding goals that lets national governments reach/implement, and opportunities to take up work with relevant UK organizations to learn from how we addressed issues and importantly the pitfalls that have been encountered?

Tom Axworthy: There is much to learn from UK and other European examples of water management. As part of its work in advocating for a new federal agency, Massey College has commissioned research papers on comparative lessons of water management (due to be completed by September 1) and in its daily work Global Water Futures at the University of Saskatchewan participates in an international network of scientists very involved in Europe.

What are some ways a large organization with a broad scope can stay nimble and proactive while avoiding falling back to status quo?

Tom Axworthy: As we begin this exercise in advocating for a federal water agency, the issue as I see it is that water is not high on the federal agenda and in past decades there have been large reductions in federal capacity. From the days I worked in the federal government the number of research scientists and water policy folks has been halved. With a new federal agency the hope is that this will provide a needed focus and burst of energy at the federal level. But more generally one way for institutions to avoid stasis is to regularly interact with interested parties or outside expertise which helps to dispel group think and lethargy. A federal water agency should have an annual conference on lessons learned drawing on examples from across Canada, North America and the world.

Should a federal agency take more of a political approach (right to water, Sustainable Development Goals, institutions, etc.) or a technical approach (data, infrastructure, coordination, etc.)?

Tom Axworthy: There is a fine line to be drawn in public servants being advocates for a position in addition to doing the research and assessing the facts of the situation. Usually it is the Minister who advocates with the public service providing input. But sometimes Parliament creates an independent advocacy office reporting to Parliament such as the Privacy or Official languages Commissioner. In addition to a Canada Water agency largely devoted to science there may be a good case to be made for a Water Commissioner to advocate for the priority. One model we are looking at in our research at Massey is what lessons might be drawn from how the Canada Health Agency is performing in its role.

Dimple Roy: These are not necessarily mutually exclusive approaches. At IISD, we're recommending an initial focus on foundational issues such as data, information sharing, metrics, technology in order to enable meeting Sustainable Development Goal targets and larger scale governance reform.

How can we protect the integrity of existing data networks, continue to increase monitoring and expansion of existing networks, and prevent the cutback or closure of provincial networks until we are able to establish a Canadian Water Agency that oversees and protects the integrity of these crucial data needed for climate change assessment and forecasting?

John Pomeroy: We must continue to demonstrate the value of existing networks and monitoring and show the benefits of their expansion. One hopes that a Canada Water Agency, once it is established, could enter into agreements with individual provinces, territories and other jurisdictions on monitoring and conduct a national review and assessment of the value and need for monitoring that can underpin

national standards, including the use of observations from NGOs, universities, communities, First Nations and other groups.

Could the federal government contemplate a central agency with regional bodies across the country, for example, to intensify science based water "management" for the Laurentian Great Lakes, Lake Winnipeg, and other large scale systems? Could it appear like PFRA 2.0 or Inland Waters 2.0?

John Pomeroy: We need a Canada Water Agency that is fit for the needs of the 21st century and so restoring solutions for the past will not be sufficient, notwithstanding the merits of IWD and PFRA for their times. Development of national science, modelling and observational capacities and capabilities will be critical, but a river/lake basin approach makes great sense for organizing and implementing water management because that is how nature has organized water flows. Regional offices are not necessary for a river basin approach to management in the 21st C.

Shawn Marshall: Perhaps. I think it is good to think of all models at this stage. It is important to better understand what is not functional now though. Do we not already have regional offices and science-based water management for most major water bodies? The system is largely fragmented, but there is a great deal of academic, provincial, and federal science, along with monitoring activities, that can be martialed to support the Canada Water Agency. My sense is that governance and co-ordination are the main challenges. Some of the science to support management (e.g., monitoring within the Canada-U.S. Great Lakes Water Quality Agreement) could well be done out of the Agency instead of ECCC's Canadian Centre for Inland Waters in Burlington (as an example of a regional office), but in some ways it does not matter where this science sits, as long as it feeds into water management. There is also a policy and enforcement apparatus built up around this, with the HR, policy analysts, lawyers, etc. that go with this, so I worry about the Agency duplicating already established bureaucratic infrastructure. There is a danger of creating a bureaucratic response to a bureaucratic problem, which just adds another layer of federal government and duplicates effort.

How is the scientific community monitoring what positive changes are occurring in the environment due to the pandemic-induced global shut down?

John Pomeroy: Many automated monitoring programs in Canada continue, but most are negatively impacted by the pandemic due to restrictions on technicians travelling to sites to repair stations or take supplemental observations. Water quality monitoring is severely impacted as the operation of chemistry labs is currently suspended and very few samples are being collected and analyzed. At least one province has suspended part of its monitoring program, and as a result, we will have missing water data from this pandemic that will make its future assessment very challenging.

How can we improve our approach towards protecting groundwater under the Canada Water Act? How can a new agency provide leadership on national scale groundwater management, sustainability, security and data standards?

John Pomeroy: Groundwater sustainability is something that the Canada Water Agency could contribute substantially to. A national panel in 2008 noted a national lack of capacity in groundwater monitoring and assessment. Agreements with the provinces on groundwater could move towards standardized approaches to observations and mapping, data sharing, principles of management, water quality for

consumption and source water protection. Transboundary aquifers and those that are used by Indigenous communities could be areas of special attention.

What new models do we have to advance protection of water for agricultural uses that don't involve the disruption often associated with dams, diversion and storage scenarios?

John Pomeroy: There are a variety of large-scale to small-scale hydrology and water quality models that are suited for agricultural basins which can be, and are, used to assess both non-structural and structural agricultural water management approaches. Wetland and depressional storage retention and restoration can be highly effective techniques for instance. Recently published research by Dr. Westbrook shows the impact of beaver dams in holding back floodwaters in the Rockies. Perhaps a basin water trading system could transfer rewards for the benefits of beneficial water management practices to land managers on certain basins and a Canada Water Agency could oversee such a trading system. These approaches need to be further developed and deployed to support decision-making across farm country in Canada.

How can we start to dovetail some of the academic research with existing and often sophisticated grassroots monitoring efforts that already align with provincial and federal monitoring standards for applied research?

John Pomeroy: In many parts of Canada, community-based monitoring is one of the prime sources for information and academics increasingly appreciate and contribute to this. As a result, some academic programs such as GWF are already using community-based monitoring and developing new methods to support this such as the "Nutrient App". It is also a key part of engagement with communities.

Dimple Roy: This is already happening in many instances. The examples I highlighted in my panel comments, like the Gordon Foundation's Datastream, as open-access data platforms and community-based monitoring programs are linking to government data, monitoring programs and priorities. If you are working on academic research, reach out to your local watershed group, or provincial agency to see how best you might be able to coordinate and build on existing efforts.

Effective responses to increasingly frequent climate-driven water management crises will need to be data driven but vast expanses of the country lack adequate data on water quantity and quality variations. What could be the role of a Canada Water Agency in addressing this issue?

John Pomeroy: The water management crises we are experiencing and will experience require data that is not observed and in some cases is not likely to be observed on the ground due to cost and the vastness of Canada. However, predictive models, combined with observations can create "data" through assimilation of observations, including both surface and satellite observations, into models. This enhances the value of observations and extends their applicability through models to ungauged basins. It is something that a Canada Water Agency could provide tremendous support to water users – by providing this new data in an open platform.

Shawn Marshall: There are unlikely to be large budgets for expanded monitoring activities, especially given the scale of the poorly serviced area in Canada (i.e. the north). It is a hard problem and I see the need for increased community collaborations (i.e. community-based monitoring that works) as well as satellite data if we have any hope to improve on this situation. Many hydrological variables are difficult with remote sensing, leaving an essential need for good models to fill the gaps and address water stresses

and crises in remote areas. Some progress is possible though with the incredible remote-sensed altimetry data (and other) that is increasingly available – ways to estimate river/flood stage using such data will become increasingly important, much the way Great Lakes water levels can now be effectively monitored from space. This is also true for some water quality indicators (e.g., nutrient levels), but work is needed here. I see the Canada Water Agency playing an important role in helping to set a national research agenda on important large-scale questions like this, perhaps through joint NSERC calls for research programs when appropriate, and sometimes by bringing together the right group of national and international experts.

Perhaps the most important information that is collected in Canada is collaboratively collected (Prov/Fed) by the cost shared hydrometric program which has been broadly neglected for a long time and has only recently been funded to fix the "emergency" issues with expertise and infrastructure neglect. How would an agency help in preventing this kind of program degradation in the future?

John Pomeroy: The federal government recently responded to some of the concerns that the National Hydrological Service (NHS) raised in the Blue Ribbon Panel of 2017 with investments in staff and infrastructure. Future improvements can be made through hybrid data products that incorporate both observations from the surface, satellite observations and models. This provides great value added in providing streamflow estimates for ungauged basins and sites. These systems are dependent upon observations and so the value of individual gauges can be demonstrated in how they influence regional flow estimation and model evaluation. As coupled water models extend to hydroeconomic models, the financial values of gauges and the value of gauges in flood and drought forecasting can be demonstrated, and therefore the value of such forecasting can be demonstrated. This can bolster the case for high quality monitoring in support of prediction as well as its other uses. It is useful to build on successful programs such as the NHS.

Shawn Marshall: This is a great example – the NHS works incredibly well and has received some 'just in time' infrastructure support, but cracks are showing in various places, here and in other aspects of federal science. A long-term vision including capital costs is essential, and such a vision needs to include the long-term national monitoring strategy. There may be opportunities to improve on how this is done (build efficiencies) with partnership arrangements and better coordination with the Meteorological Service of Canada (MSC), through a more integrated hydrometric, meteorological, and climate observation network and satellite missions, expanded community partnerships, etc., but there is no getting around the need for an ongoing Operations & Management plan that includes equipment replacement. We do it with condo fees, planning for roof replacements every 20 years in the capital plan – we can surely plan for this but need to maintain pressure on the Treasury Board and through partners with continued communication of how vital these observations are.

The nature of water points to a federal role but a narrow read of our constitution may undermine the notion of co-governance. Any ideas of how co-governance might overcome regional push back?

Merrell-Ann Phare: Our constitution includes recognition and affirmation of Indigenous rights, which include the right to self-government. And, many Indigenous rights are exercised off reserve in treaty territories that are also subject to provincial, territorial and federal law. What we have not yet done is have federal, provincial and territorial governments work with Indigenous self-governments as governments of Canada. To be clear, what I am saying is that we have not opened up our collaborative governance tables to allow Indigenous seats. Canada's cooperative federalism is highly skilled at dealing with federal/provincial/territorial (FPT) push and pull. Acknowledging and adding more chairs around the

many FPT tables for Indigenous governments would be the process by which push back is managed. The goal isn't to avoid it, it's a necessary part of collaborative governance. Everyone's goal should be to have Indigenous governments have their own voice at those tables.

Could the Canada Water Agency and all orders of government truly find a way to engage participatory planning in water resource management?

Merrell-Ann Phare: Yes, we have done it before around the Great Lakes and in the Northwest Territories. Multi-jurisdictional, deeply participatory planning and agreement-making occurred in those regions. They were both challenging situations for different reasons, but the experience can be extended to all other parts of Canada.

How can water ethics and justice be baked-into the Canada Water Agency? What role does humanities research have in complementing scientific water research in the creation of water policy?

Merrell-Ann Phare: I certainly hope so. Although it is not possible to ensure this, at least having all of the people who have differing ethics and conceptions of justice involved is a first step and Indigenous traditional and contemporary governments are critical to this. So are our knowledge keepers, women, youth. Yet, there are many forms of ethics and morality when it comes to water. At the end of the day I think the Canada Water Agency should be striving to achieve a level of morality in its work that deals with the most fundamental necessity of life (along with air). Ursula Le Guin put it very well when she wrote, "A moral choice in its basic terms appears to be a choice that favours survival: a choice made in favour of life." The social sciences have a critical role in understanding and helping us achieve moral and ethical water decisions in the face of our own fear. This is a critical area of research that helps break down cultural barriers and could be a pathway to addressing some of the terrifying and illogical water decisions we make every day.

Could the new organization be driven by basic water management and negotiation logistics between parties?

Merrell-Ann Phare: I do think that the solution to the problem starts with identifying a key fundamental, which is an allocation issue. This fundamental is that we have to ensure there is enough water for nature because we survive on both water and nature. After that, human use can be negotiated. It may seem impossible, we did it when we negotiated the Mackenzie River Basin Transboundary Water bilateral agreement between NWT and Alberta. That is the standard that is in that agreement. I think that Indigenous governments, for example, have not been involved in the negotiation regarding which humans get priority access to water and for which uses. If you get all governments at the table then theoretically the best possible decision is, or can be, made. This is what I refer to as collaborative governance and I think of it as "cooperative federalism with Indigenous governments always at the table". I focus on decision makers/governments and the process that they need to create a clear, ethical decision when it comes to water. Yes it is complex, but we've already been doing it since Canada was created, we just have not involved all of the governments we should have. We can fix this.

How could the government engage and respect Indigenous governance and rights to inform the new Canada Water Agency?

Merrell-Ann Phare: The new Canada Water Agency should be created through a co-development process where Indigenous and non-Indigenous governments sit down together and build the thing they want to

create. We have many examples of co-development of laws that affect Indigenous people (the *Indigenous Languages Act* and the new child welfare legislation were codeveloped). BC's UNDRIP law was also co-developed. Co-development is not consultation. In co-development the power is shared and collaboration and long-term commitment to co-design would result in a Canada Water Agency institution that is based on a collective vision and set of programs and policies created by the designers (in this case Indigenous and non-Indigenous governments). Heads of government would have to work together to define the Agency co-development process, because co-developing an institution is somewhat different than co-developing a law, but in essence, once the political mandate has been established then the systems work together to create the intended outcome.

Could efforts to reduce boil water advisories connect or be coordinated in some way with the mandate of the Canadian Water Agency?

Merrell-Ann Phare: Absolutely. The problem with safe drinking water is not only one of resources and capacity (which is what you most often hear about in the news). My argument has always been that the problem started–and persists–because of governance, and the problem will never be solved until the governance challenges are addressed. The governance challenges in this case are around source water protection, which is frequently either off-reserve or impacted greatly by off-reserve decisions of provincial, territorial, municipal and federal governments that result in negative impacts to water quality and quantity that Indigenous nations rely upon. If the Canada Water Agency is an institution that was mandated to engage in collaborative governance with all other jurisdictions (and they clearly include Indigenous governments) and to form agreements to that end, and for example be mandated with a requirement to ensure watershed planning is occurring, then Indigenous nations could be partners in protecting their source water.

Could the Canada Water Agency be an opportunity to begin managing water resources from a watershed boundary perspective rather than political boundary?

Shawn Marshall: This would make sense, but it would honestly be very difficult to do, given the constitutional endowment of water resources to the provinces in 1867. Management boards, infrastructure, legislation, and water rights have built up around this. Can anyone imagine Alberta opening the door to its neighbouring prairie provinces for its own regulatory choices regarding water and irrigation allocations, etc.? That said, there is generally a layer of watershed boundary governance already. Sticking with Alberta, the Saskatchewan River basins are managed in a way that guarantees certain flow levels (50%) to enter Saskatchewan, for example. The Columbia and Colorado Rivers are managed on a watershed scale at the highest level, where different provinces and states have certain allocations. So the natural definition of a watershed is certainly recognized and considered, but regional, territorial, provincial, and Indigenous territorial water rights and management practices can be expected to continue within a basin.

How could a Canada Water Agency work to establish flexible, responsive water policies that survive longer than a 4-year election cycle which is clearly not sufficient for water resource management?

Shawn Marshall: Very true. I think the country needs a National Partnership on Water Governance that lays out shared responsibilities and commitments across the 200+ jurisdictions and groups in the country that have a hand in water governance, but this is likely not enough. For instance, the Pan-Canadian Framework on Clean Growth and Climate Change, a deal with the provinces, territories, and federal government, is cracking at the seams as some provinces effectively withdraw from it. In principle, the

federal government can also withdraw from international commitments. The federal government passed a "Federal Water Strategy" in 1987 that is a very impressive document, still relevant today. It makes reference to groundwater, droughts, First Nations water rights, the perils of inter-basin water transfers, the need for open data for water management, and the need for improved federal coordination. It has a prescient discussion of climate change, speaking of "epic floods", threats to ice roads, and amplification of climate change in northern Canada – this was three years before the first IPCC report and 5 years before Rio. But while the climate change warnings have played out largely as foreseen, the Strategy itself has fallen by the wayside, and we would be better situated right now if many of its recommendations had been followed.

To reduce political vulnerability, it will help for certain principles to be entrenched in a revised *Canada Water Act*. But this will be a long and arduous process, akin to constitutional reform, and is likely to contain generalities rather than the specific structures and programs that we need for water management. I think that the most effective things will be to develop a renewed governance structure and a federal water coordination framework that works so well and clearly benefits the country (as it needs to), such that it testifies for itself and will not be seriously challenged. Make it incredibly functional and it will endure. I think of something like the Tri-Council research agency (NSERC, SSHRC, CIHR), which is so good at its job and works so well serving the country that no change in government would be a threat to its survival. I think the Federal Water Strategy failed to a large extent because, while it stated the needs and motivation clearly, it was not accompanied by a structure or the authority to act on its recommendations. The Canada Water Agency risks the same unless it secures genuine and ongoing partnerships with those that actually control and govern water resources across the country.

How do you see scientific activities in federal departments changing with the establishment of the Canada Water Agency?

Shawn Marshall: I think it would be a huge mistake to pull the hydrological monitoring and modelling out of ECCC. This would be opposite to what is needed, and the way the rest of the world is going (e.g., with development of Earth systems models, with the World Meteorological Organization's (WMO) recent uniting of weather, climate, and water services). The hydrological data and models need to be better integrated with the Meteorological Service of Canada (MSC), and with the national climate modelling efforts, not separated from these groups. Much of what we need to be better at with flood forecasting involves closer coupling and hydrological/snow data ingestion with the precipitation models, generation of future intensity-duration-frequency curves under different climate scenarios, etc. I think that current scientific activities can feed and support the Canada Water Agency, but don't necessarily need to be centralized. As discussed above, much of the federal water quality work is also deeply embedded in a policy, legal, and enforcement apparatus, with capacity built up around this (HR, policy analysts, lawyers, etc.), as well as labs. My sense is that duplicating this would be wasteful, but there is also a danger in separating the science even further from the policy and governance pieces. So this needs to be carefully considered. What does not work so well right now is coordination around the different bits of water science done in different departments and branches. Ideally, a Canada Water Agency could more effectively gather and integrate the water science from Environment and Climate Change; Natural Resources; Agriculture and Agri-Food; Health; Industry, Science and Innovation; and others, but pulling the actual science out of all these agencies would be a challenge. Especially where the science currently works well and relies on institutional support structures, and the problem lies more in the integration.

Could there be a focus for the Canada Water Agency to generate capacity or a clear mandate to better coordinate knowledge generators with end users to improve efficiencies and effectiveness?

Shawn Marshall: I think this would be fantastic within a Canada Water Agency mandate, and largely maps onto the need for a coordinated and open data portal. With clear data and measurement standards, and in some cases expanded national monitoring programs (for instance, we need a coordinated effort to measure and report water temperature and ice conditions), knowledge generators would feed into a common system which supports such a network, and links it to the end user community. In the other direction, the end users could represent a more national community that is able to feed up knowledge requests and needs.

How could the provinces be brought into this process to gain buy-in?

Jon O'Riordan: I do not and cannot speak for any provincial level government, however, in British Columbia, the government has passed very progressive legislation known as the *Water Sustainability Act.* For the first time groundwater use is regulated; it also requires decision makers to establish environmental flows before new licenses are granted and enables water objectives to be drafted dealing with water quantity, quality, and protection of aquatic values. All these initiatives require careful science and monitoring, which could be supported by the proposed Canada Water Agency

How can we make sure that efforts by the Federal government on a Canada Water Agency do not duplicate efforts by other levels of governments?

Jon O'Riordan: There would have to be careful collaboration between all provinces and the federal government before the Canada Water Agency could be established. Provinces have different capacities for delivering science and monitoring so there would likely be arrangements between individual provinces and the federal government.

Since most of the "heavy lifting" when it comes to water management is done by the provinces, collaboration needs to be core to an effective water agency. How can provinces, First Nations, and others be meaningfully engaged in the governance of water and this agency?

Jon O'Riordan: I agree that the Provinces have primary responsibility for most water management functions within each Province. The federal role is more important for waters that cross the international boundary. With climate change there will be no new normal as the climate, and therefore hydrology, will always be dynamic. This will require adaptive management where management measures are tried and monitored and changed if targets are not met. There will therefore be a greater dependence on science and monitoring and so long as there is close collaboration, joint initiatives involving the capabilities of both federal and provincial governments can lead to better governance results.

What role could a Canada Water Agency play in the development and governance of integrated watershed management plans, particularly for watersheds that span provincial and/or national boundaries?

Jon O'Riordan: The Agency would play a stronger role for managing rivers that cross inter-provincial and especially international boundaries. The main advantage of a Canada Water Agency would be to consolidate science and monitoring functions and capabilities within federal agencies. So to the degree that these functions are critical to developing and completing integrated watershed management plans, the Agency would provide a more responsive role in assisting provinces in watershed planning.

How could small communities participate in developing a water policy?

Jon O'Riordan: Small communities often face challenging water policies such as flood and drought management. To deal with such policies, communities have to have access to a range of expertise in higher levels of government. A Canada Water Agency might be able to assist communities navigate to obtain this expertise through its links with the many provincial agencies that deal with water policies.

Is there thought to contend with old(er) infrastructure that were engineered using assumptions that are now out of date, for example, buildings/equipment that were designed assuming a 1/100 year storm event?

Sandra Cooke: This is an engineering specification that is likely needed to be assessed by each province. For instance, in Ontario, the Ministry of Environment, Conservation and Parks has been reviewing the stormwater specifications and guidance which should then feed into design specifications. It is my understanding that they are incorporating climate change scenarios but a provincial-level specialist should be contacted for comment on this. I cannot speak to what other provinces are doing in this regard.

What are potential insights and policies towards adapting water reuse at central water treatment plants as well as distributed indoor water treatment devices?

Sandra Cooke: In my opinion, water reuse is a strategy that Canada should review and incorporate into the water management toolbox. There are also public perceptions associated with water reuse that also need to be addressed. There are municipalities who have already built the 'purple pipe' for reuse purposes but it does require policy changes that are championed at the provincial level to succeed.

What could be the role of technology, and innovation more generally, in shaping the new Canada Water Agency? Could innovative efficient technologies in water and wastewater, conservation, reuse and energy efficient standards be within the mandate of the Agency?

Sandra Cooke: In my opinion, an approach that is performance-based and outcomes-based should be used to drive innovation and not be limited by just prescriptive approaches. This could be for technology, effluent performance targets or energy consumption targets. We also need to move beyond compliance.

Dimple Roy: We're clearly under-utilizing available and innovative technology to understand and resolve our water related issues. Technology that is now well-used in the context of big data in the financial and business worlds can be deployed to understand and manage issues in the water sector better. Examples include the use of remote sensors and AI (artificial intelligence) to understand and leverage monitoring

data, etc. At IISD-Experimental Lakes Area, we're exploring the use of low-cost sensors in getting more data about water flows, contamination events (such as combined sewer overflows or pipeline spills), using AI to make sense of what big datasets are telling us about our waters and looking at block chain technology to improve trust amongst various data providers and users. These technologies are well used in financial sector applications and can be deployed in the environmental sector to resolve long-standing gaps.

Could the Canada Water Agency have any concrete strategies for looking at the demand-side aspect of water management to ensure that municipalities and provinces produce the actual quantities of water their residents need?

Sandra Cooke: Demand management, conservation, etc. has been a strategy for many municipalities to ensure that their current supplies are sufficient for the planning horizon. This, combined with energy efficient appliances has seen water consumption drop for many years now. That said, yes, Canadians do consume a lot of water per capita when compared to European counterparts or even Australians. It will be the use of combined instruments, such as appropriate pricing and demand management tools that will encourage consumers to watch their water consumption.

How can the Government of Canada encourage the United Nations through the Canada Water Agency that we need to seriously rethink what is occurring and how Canada can lead the global community in putting the environment first?

Dimple Roy: The UN Sustainable Development Goals (SDGs) are an effort to set clear targets and conduct effective monitoring to ensure that we meet our targets. Globally, countries are struggling with a lack of data and information to set targets, and move towards global goals. By coordinating efforts related to water and ecosystem health monitoring and leveraging innovative data and technology to better understand water issues, identify problem hotspots and effective management efforts, Canada can help build global capacity in water-related issues and targets related to SDG 6 (clean water).

How could the federal government leverage existing networks and people already rooted in communities/different jurisdictions in the formation of an agency?

Dimple Roy: Recognizing that many community-based and remote efforts and networks are relevant to water decision-making is the first step. By acknowledging and establishing relevant roles for various levels of government, non-government, academics and others, particularly in data provision can help include these groups in decision-making. Open reporting of government and other data as part of the government open government efforts will also help involve groups in validating, using and innovating in this space.

Which other countries, if any, should Canada emulate in designing our new agency?

Dimple Roy: I don't believe that there is silver bullet when it comes to a particular type of water governance. We can learn from international best practice. Singapore's regulatory agency (PUB) has demonstrated how to set clear goals, implement clear actions on management, and achieving water security objectives. Finland has implemented open data in relation to water and lakes management (Jarviwiki.fi) that brings together government and citizen knowledge on Finnish waters to collaboratively manage based on good information. The U.S. (our closest analog in terms of size, issues, but not tax base), has best practices, such as related to establishing impaired waters and total maximum daily loads

for contaminants, and the implementation of market mechanisms to ensure that overall limits are met. All these are built on a foundation of good data, information and collaboration. This can be a key role of the Canada Water Agency.

How can we rank the most effective and proven public policy and private or NGO sector initiatives on water issues according to their comparative effectiveness in order to prioritize allocation of scare resources? What are the priorities for metrics of effectiveness?

Dimple Roy: I agree, we need clear metrics to understand what's effective and what's not in water management. These metrics need to be evidence-based, backed by scientific evidence, data and information about not only how they impact land, water and aquatic ecosystems, but also aspects of their sustainability such as their economic (most often benefit-cost ratios) and social implications (e.g. equity of impact). I do not know of a single methodology for ranking, but collaboratively establishing metrics is a great role for the Canada Water Agency.

Please visit the event website for recordings and supporting materials including the draft White Paper *Modernizing Federal Freshwater Leadership*.

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