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A photograph of a man with a full beard, wearing a red hard hat and a blue camouflage shirt, sitting and looking at a tablet. He is in a water treatment facility, with large blue and red pipes and machinery visible in the background. The image is partially covered by a green and yellow geometric overlay on the left side.

Water management trends in Canadian municipalities: A snapshot

March 2019

Acknowledgements

Canadian Water Network (CWN) thanks the many water managers from urban and rural communities across Canada who participated in the survey that contributed to this research. CWN also interviewed several Canadian and international water leaders, and thanks them for sharing their expertise.

The information contained in this summary report is a consolidation of insights informed by leading knowledge and practice, and does not necessarily reflect the individual views of contributors or the organizations with which they are associated.



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Water management trends in Canadian municipalities: A snapshot

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About this report

The municipal water sector has seen a number of changes over the last five years. This summary report presents highlights of a detailed water sector report completed for the Federation of Canadian Municipalities' (FCM) Green Municipal Fund. The report provides a snapshot of current water management trends, issues and best practices, and should not be interpreted as an official policy position of FCM.

Throughout this report, the term “water utility” includes public (municipal) and private utilities. The term “water systems” includes drinking water, wastewater and stormwater systems.

FCM had three objectives for this project:

- ▶ Articulate insights on trends in the municipal water sector.
- ▶ Analyze the drivers and needs of this sector.
- ▶ Identify leading practices and opportunities for innovation.

The research scan identified high-level decision trends in Canada's municipal water sector, which can be characterized as either existing trends in current and near-term priorities that are driving the sector as a whole, or emerging trends that are on the near horizon for Canadian municipalities.

Existing trends in Canada's municipal water sector are currently dominated by:

- ▶ asset management concerns
- ▶ financial sustainability issues
- ▶ the need for resilience in the face of uncertainty and extreme weather (particularly flooding)

Emerging trends in Canada's municipal water sector that are likely to become a higher priority over the next 5–10 years include:

- ▶ Potential impacts on receiving water quality from combined sewer overflows or bypasses, nutrients, pathogens and other contaminants of emerging concern.
- ▶ Wastewater resource recovery, where it supports financial sustainability objectives.
- ▶ Governance structures that support municipally integrated approaches.
- ▶ Transparent, customer-oriented water services with more public engagement.
- ▶ Equitable and affordable service delivery.
- ▶ Cybersecurity as a result of growing digitization.

Project design

Canadian Water Network (CWN) conducted a national survey, as well as in-depth interviews with selected sector experts. This process gave municipal water managers an opportunity to provide direct input in several areas:

- ▶ They confirmed high-level sector trends in Canada's municipal water sector, as well as the desired outcomes that municipal utilities

and their governance councils would like to achieve.

- ▶ They identified priority objectives, based on local needs and issues, that are guiding municipalities' technology and innovation choices.
- ▶ They highlighted opportunities to address these trends and priority objectives through leading management practices and innovative solutions. This included a discussion of implementation barriers, as well as co-benefits related to environmental stewardship, economic and social outcomes, and greenhouse gas (GHG) reductions.

CWN invited more than 100 senior water managers in urban, suburban and rural settings in regions across Canada (the Atlantic region, Québec and Ontario, the Prairie provinces, the West Coast and the North) to participate in an online survey. There were 47 responses—39 in English and eight in French. The survey's limited scope was not sufficiently representative to achieve statistical significance, but it yielded some valuable insights.



Water sector trends

CWN identified five important trends that are driving current and future decisions in the municipal water sector.

1. Financial sustainability

Water utilities are moving to better match revenues to real costs and achieve greater financial independence and sustainability.

Desired outcome: viable, financially sustainable structure and operations that better reflect a broader definition of financial sustainability (beyond annual accruing accounting) and better account for total costs and future considerations and impacts.

2. The expanding role of water utilities

The role of water utilities is expanding beyond service delivery and system compliance.

Desired outcome: utility governance and operational structures that address broader social, economic and environmental goals, and greater integration with other municipal departments and external groups to achieve shared goals.

3. Changing public expectations

Water utilities are responding to higher public expectations and increased public input into their role and function.

Desired outcome: increased public trust in, and satisfaction with, water utility decisions and actions to protect public health, the environment and the economy.

4. Increasing uncertainty

Water utilities are adopting new approaches to planning and decision-making that are necessary to address rapid change and greater uncertainty about future conditions.

Desired outcome: proactive, adaptive and resilient systems and approaches that anticipate change.

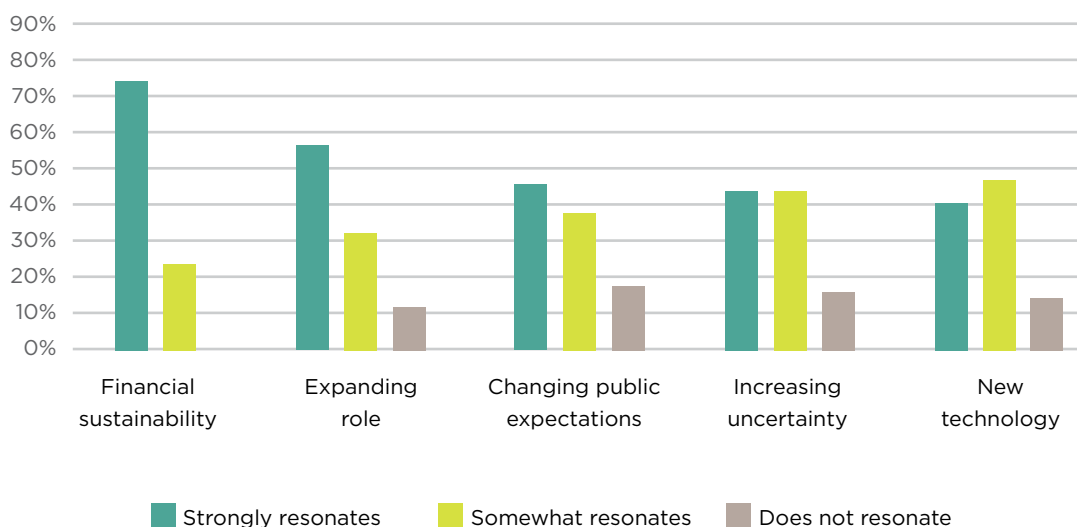
5. New technology

Water utilities are in the process of evaluating and adapting to new and potentially disruptive technologies, including digitization and smart systems.

Desired outcome: improved system performance through the effective use and management of new technologies and operating realities.

These trends strongly resonated or somewhat resonated with the realities being experienced by the survey respondents (see Figure 1).

Figure 1: Key trends impacting the water sector





Priority water sector objectives

Not all the challenges facing the water sector are new. For example, municipalities everywhere have long had a financial imperative to reduce and manage system costs. Other priorities may relate to the protection of human health and the environment from threats such as extreme weather events, nutrient loading or trace contaminants. Some of the priorities that are becoming increasingly pertinent, such as equity, resilience and cybersecurity, are related to an increased focus on social and economic concerns.

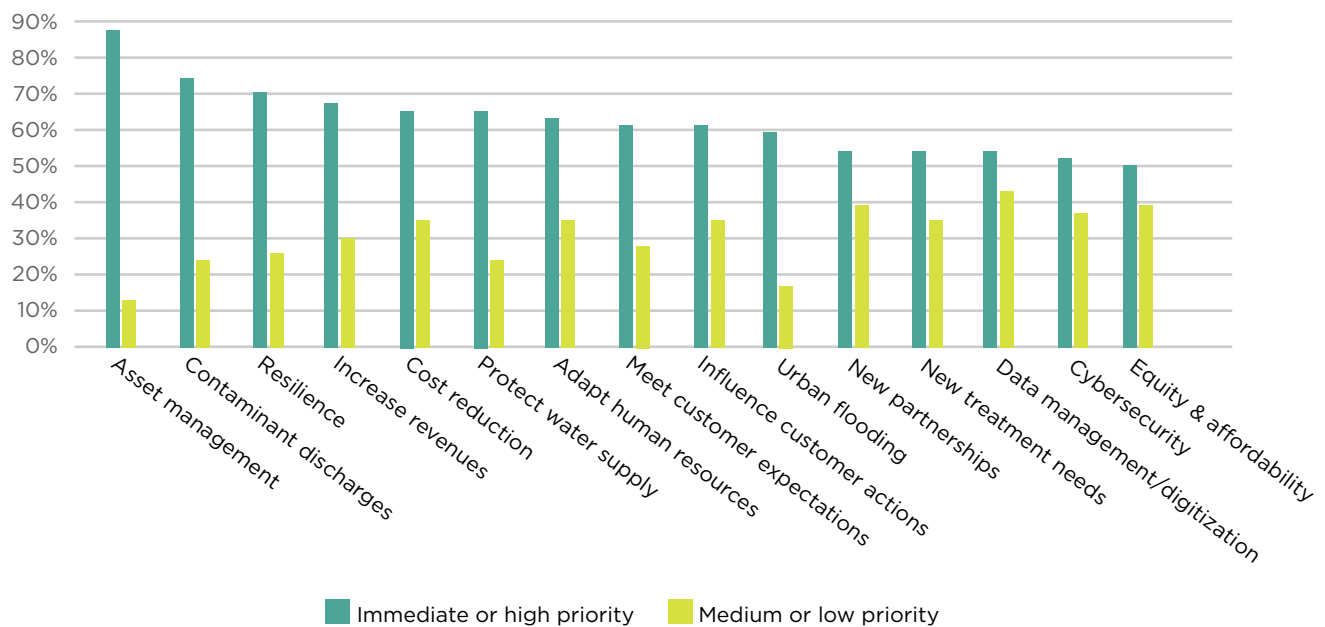
The objectives identified in this report point to which actions can most reasonably be undertaken to achieve local and national desired outcomes. It should be noted that regional and local realities ultimately dictate which objectives drive operations, planning and investment, as well as defining viable opportunities. Based on an environmental scan and its own institutional knowledge, CWN identified 15 objectives that shape municipal water decisions.

Water sector objectives

1. Reduce operating costs
2. Improve revenue generation
3. Improve equity and affordability
4. Create new working relationships and partnerships
5. Adapt human resources to address evolving needs
6. Address customer expectations
7. Influence customer actions
8. Adopt proactive asset management
9. Increase system resilience
10. Manage urban flooding
11. Minimize contaminant discharges
12. Meet new treatment needs
13. Protect source water supply
14. Address data management and digitization
15. Ensure privacy and cybersecurity

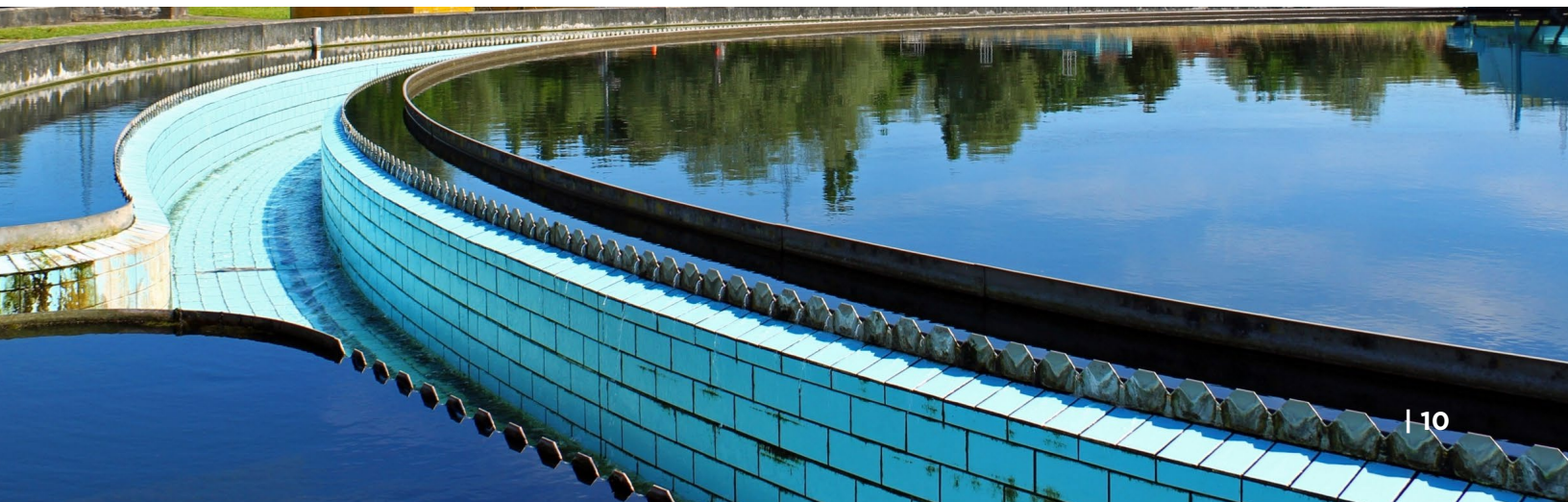
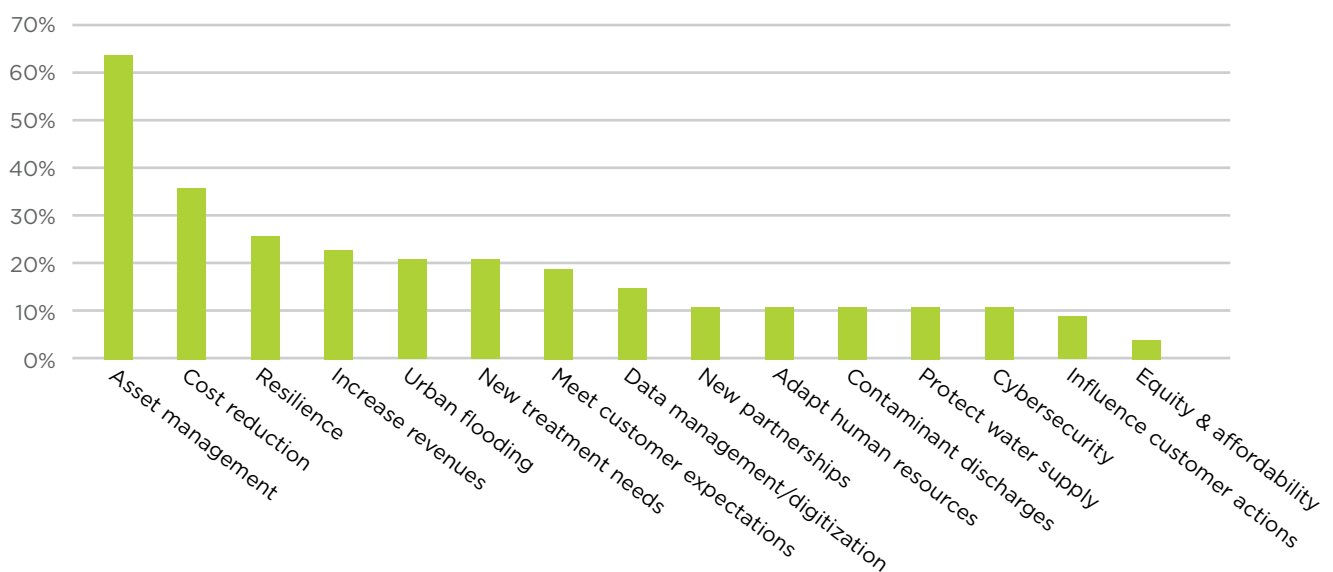
In the survey, the respondents were asked to assign a level of priority to each of the 15 listed objectives: Immediate (currently working on this objective); high (action planned within the next 5-10 years); medium (would like to advance, but requires additional support or changed conditions to act within the next 5-10 years); and low (unlikely to advance this objective within the next 5-10 years). Figure 2 shows the results. To simplify the aggregated results, responses for those objectives deemed to be immediate or high priorities are grouped together, as are those objectives ranked as medium or low priorities. The results are consistent with the overall trends noted in the sector, but also reflect local priorities.

Figure 2: Priority level of key water sector objectives



Regardless of the priority level assigned to objectives, there are often more priorities than resources to address them. To further understand how utilities are actually making choices among these declared priorities, CWN asked the respondents to prioritize further by selecting up to three of the 15 listed objectives as areas where their utility or municipality would invest resources or place significant focus over the next ten years (see Figure 3). The results do not reveal all the areas where the respondents are active, but they give an indication of where utilities are actively seeking opportunities to implement innovative options and solutions.

Figure 3: Objectives selected as key areas for investment or focus



For each objective, CWN analyzed the survey results, comments from in-depth interviews, the environmental scan and CWN's own institutional knowledge. Below is a synopsis of the top five objectives selected by the survey respondents as priority drivers for decisions in the sector over the next 5–10 years:

- ▶ **Undertake proactive asset management:** Adopt proactive asset management (maintenance, rehabilitation and replacement) to support long-term sustainable water system operation and address historic infrastructure funding deficits.
- ▶ **Reduce operating costs:** Increase efficiency and reduce operating expenses through mechanisms including, but not limited to, resource recovery, water conservation and energy efficiency.
- ▶ **Increase system resilience:** Increase the ability of water systems to respond to future uncertainties (including extreme weather and other effects of climate change, major changes in system demand, regulations and other issues) and sustain reliable services.
- ▶ **Improve revenue generation:** Better match rate structures and revenue options to long-term risks and costs.
- ▶ **Manage urban flooding:** Manage urban flooding to limit the disruption of essential city services and damage to public and private property.

Leading municipal practices

The national survey allowed respondents to select from 45 leading practices to provide insights on what actions municipalities and utilities are currently pursuing, including their relative immediacy, co-benefits, opportunities and barriers to implementation (see Figure 4). The survey analysis provides insights on the current state of practices that are already underway, in the planning stage or otherwise under consideration. These results also help forecast evolving interest in the uptake of new practices. Trends observed in the global water sector suggest that many of these emerging practices are likely to increase in degree of focus and priority in the near future.

Figure 5 summarizes the leading practices that were selected most frequently by the survey respondents as being actively implemented.

Figure 6 summarizes the leading practices that were selected most frequently by the survey respondents as being planned or under consideration for implementation within the next 10 years.



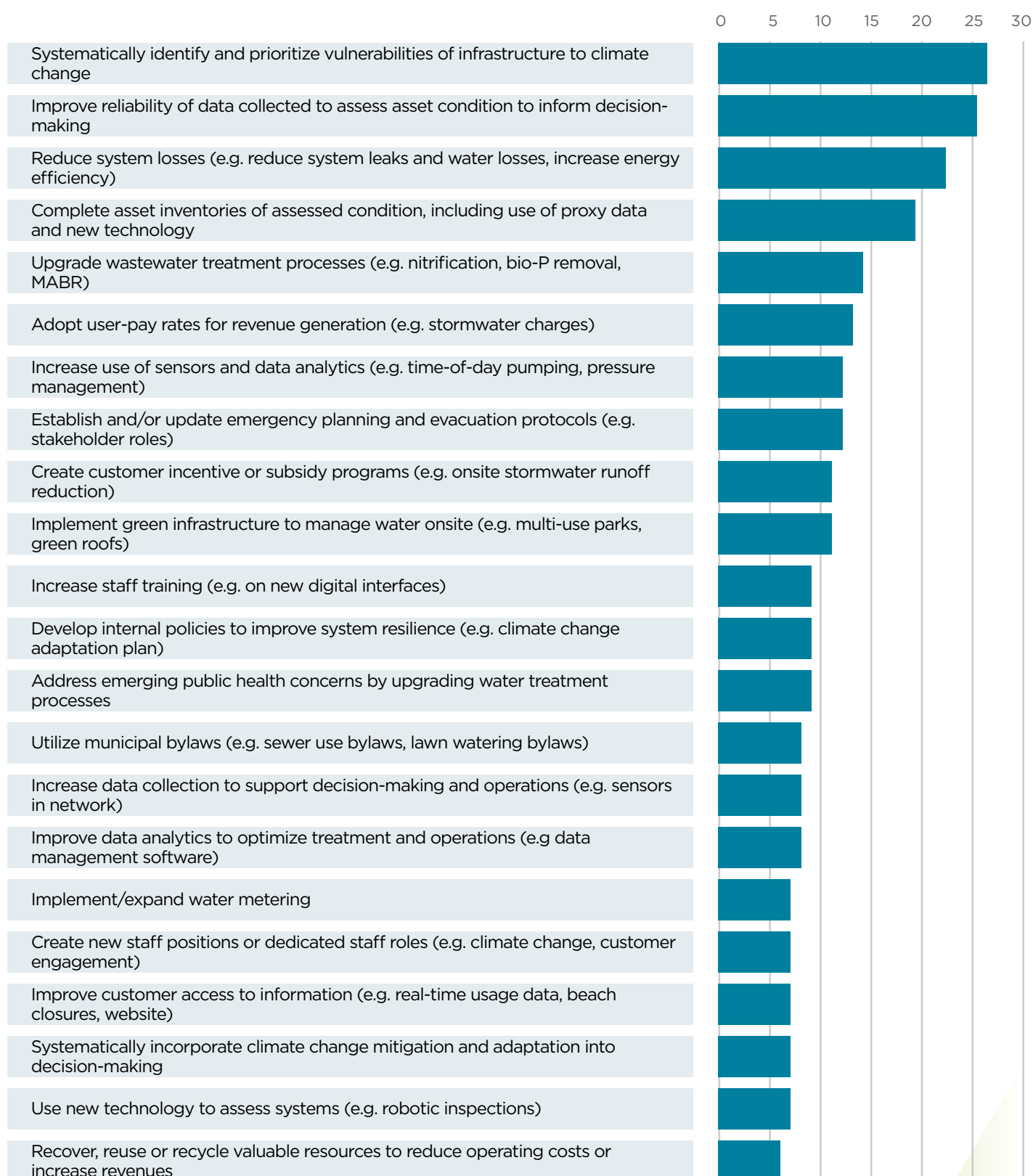
Figure 4: Leading practices, organized by the number of times selected*(Survey respondents could select up to four practices to achieve a stated objective)*



Figure 5: Leading practices that are actively being implemented by water utilities, organized by the number of times selected

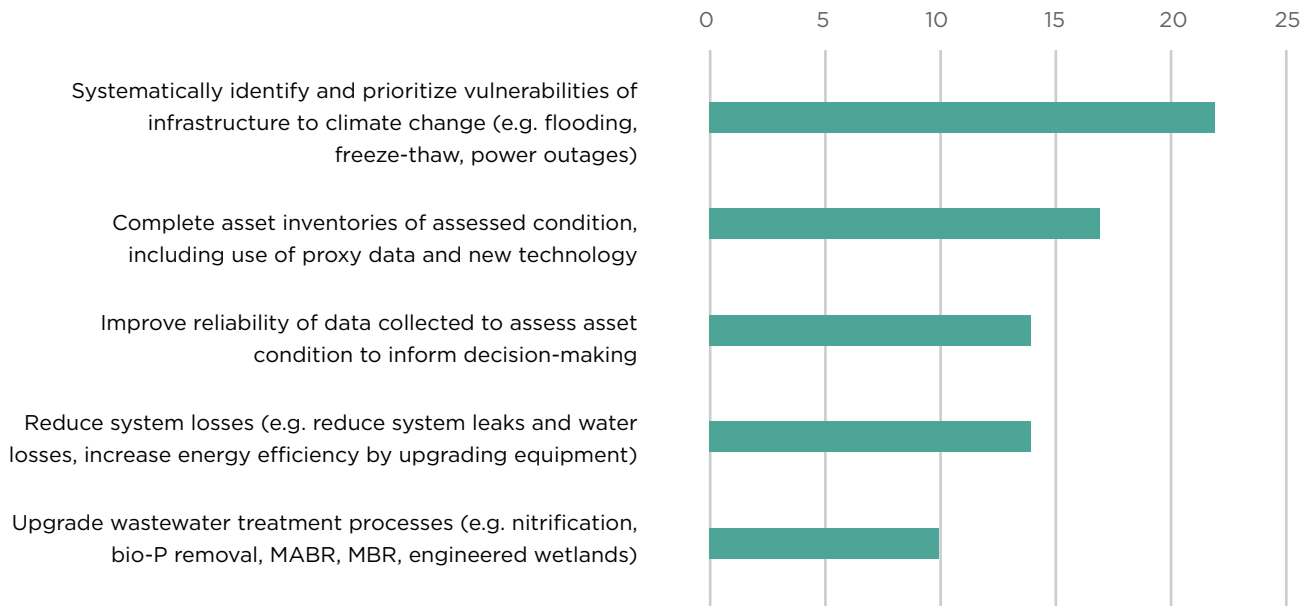
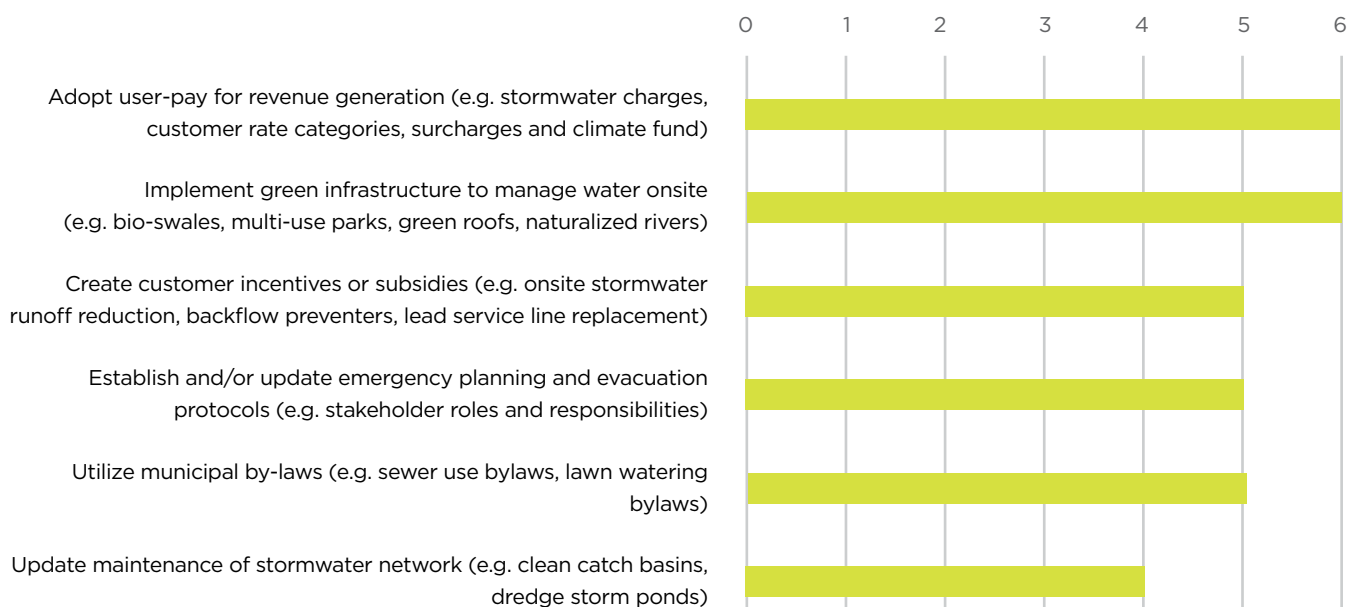


Figure 6: Leading practices planned or under consideration in the next 10 years, organized by the number of times selected



Summary of leading practices

Table 1: Summary of leading practices selected by survey respondents, with further detail on how utilities are implementing these practices

Leading practice	Target objective*	Summary of survey responses	Replication potential
Systematically identify and prioritize vulnerabilities of infrastructure to climate change (e.g. flooding, freeze-thaw and power outages)	Manage urban flooding Adopt proactive asset management Increase system resilience	The types of hazards being reviewed are primarily flood-related, but also include drought, fire and power outages. Activities involve whole-system studies, integrated planning, reviews of level of service, and public consultation. There are some linkages to asset management programs and capital programs to determine what can be done and how to fund it.	This leading practice was selected by respondents in all regions, but more frequently in British Columbia than Ontario, Quebec and Nova Scotia. It was also selected by respondents from all population service sizes, but less frequently in very small population centres with less than 5,000 serviced. Eight of the 10 respondents with very small populations were located in Quebec.
Improve the reliability of data collected to assess asset condition to inform decision-making	Adopt proactive asset management	The respondents are using technology to augment the quantity and quality of data collection (e.g. video). Utilities are striving for better use of existing data management (including GIS) to connect the information collected (e.g. pipe deterioration) to decision-making on repair and replacement. Decision-makers are connecting with operational staff to better understand maintenance, ongoing issues and asset life span.	This leading practice was selected by fewer respondents in Quebec. It was selected by respondents from all population service sizes, but less frequently in very small population centres with less than 5,000 serviced. Eight of the 10 respondents with very small populations were located in Quebec.

* The target objective most commonly cited by the survey respondents.

Leading practice	Target objective*	Summary of survey responses	Replication potential
Reduce system losses (e.g. system leaks and water losses) and increase energy efficiency by upgrading equipment	Reduce operating costs Adopt proactive asset management	Utilities are implementing programs to detect the loss of non-revenue water and to detect leaks: ▶ creating zones and district metering ▶ reviewing the distribution system and aligning with asset management to replace aging pipes and valves ▶ gathering real-time data ▶ using contractors to identify leaks ▶ installing pressure sensors and flow meters ▶ using radio equipment on meters Utilities are taking steps to improve energy efficiency through: ▶ energy assessments ▶ improvements at plants ▶ upgrades of old equipment, such as variable speed pumps ▶ energy-related operator training	This leading practice was selected more frequently by respondents from Ontario, Quebec and Nova Scotia. It was selected by respondents from a range of population service sizes, but was not selected in the largest centres, where population service size is over 750,000.
Complete asset inventories of assessed condition, including use of proxy data and new technology	Adopt proactive asset management	Utilities are in the process of completing and improving asset inventories through asset condition surveys, video technologies (e.g. CCTV), field information and other proxy data, such as number of breaks, material, age, soil corrosivity and operating history. Efforts are focused on critical infrastructure first. Utilities are using computerized work management and project management systems.	This leading practice was selected in all regions of the country, but less frequently in Ontario and Quebec, and more frequently in Nova Scotia and British Columbia. There was less uptake where population service sizes are very large or very small.
Upgrade wastewater treatment processes (e.g. nitrification, bio-P removal, MABR, MBR and engineered wetlands)	Adopt proactive asset management Meet new treatment needs Influence customer actions Minimize contaminant discharges	Wastewater treatment process upgrades include upgrades from primary to secondary treatment (e.g. MBBR), from secondary to advanced secondary, and from oxidization ditches to SBR. For better nutrient management, utilities are working toward nitrification, monitoring for phosphorus, and meeting new river load allocation models. Other steps include: ▶ innovative use of bacteria in ponds and sewer network ▶ planning for expansion and new requirements, such as emerging contaminants ▶ stormwater-related upgrades (e.g. bioswales and wetlands)	This leading practice was not selected as frequently in Ontario, Saskatchewan or Manitoba as in other regions of the country. These regions tend to have stronger wastewater treatment infrastructure in place due to the limitations of the receiving water bodies. This leading practice was selected more frequently where population service sizes are small to medium. It was not selected by very large population centres (over 750,000) and was only selected by one large population centre (250,000–750,000).

* The target objective most commonly cited by the survey respondents.

Recognizing co-benefits

A co-benefit is achieved when another goal is addressed alongside the primary intended goal. The survey results highlighted that in general, any given leading practice could address an average of five objectives. There are also opportunities to coordinate and achieve complementary goals that are shared by other municipal sectors, particularly in land use, transportation, waste and energy. For example, because energy use makes up a significant portion of a utility's costs, actions to improve operational efficiency and reduce costs will tend to focus on increasing energy efficiency. One of the clear co-benefits is a reduction in GHG emissions. There are also opportunities to better utilize wastewater components to generate heat, biogas and electricity that are linked to GHG reduction. Advancing a water sector priority may also involve actions that increase GHG emissions—for example, through the energy use for advanced treatment or processing.



Conclusion

Five key high-level trends for municipal water utilities are driving current and future decisions in the municipal water sector: financial sustainability; the expanding role of water utilities; changing public expectations; increasing uncertainty regarding future conditions; and new technology.

In response to these high-level trends, five top-priority objectives will drive utility decisions and investments over the next 5–10 years:

- ▶ Undertake proactive asset management (maintenance, rehabilitation and replacement) to support long-term sustainable water system operation and address historic infrastructure funding deficits.
- ▶ Reduce operating costs through mechanisms like resource recovery, water conservation and energy efficiency.
- ▶ Increase system resilience to future uncertainties, including extreme weather and other effects of climate change, changes in system demand, regulations and other issues.
- ▶ Improve revenue generation by better matching rate structures and revenue options to long-term risks and costs.
- ▶ Manage urban flooding to limit the disruption of essential city services and damage to public and private property.

To meet these objectives, survey respondents from municipal and private water utilities in various regions are actively implementing several leading practices:

- ▶ Systematically identifying and prioritizing infrastructure vulnerabilities to climate change (e.g. flooding, freeze-thaw and power outages).
- ▶ Improving the reliability of data collected to assess asset condition and inform decision-making.
- ▶ Reducing system losses (e.g. system leaks) and increasing energy efficiency (e.g. equipment upgrades).
- ▶ Completing asset inventories, including assessed condition and use of proxy data.
- ▶ Upgrading wastewater treatment processes (e.g. nitrification, bio-P removal, MABR, MBR and engineered wetlands).