

Building the case for water and resource recovery in Canada: practitioners' perspectives

Jacqueline Noga^{a,*}, Jane Springett^a and Nicholas Ashbolt^{IWA}^{a,b}

^a*School of Public Health, University of Alberta, 11405 87 Ave NW, Edmonton, AB, Canada*

^{*}*Corresponding author. E-mail: jnoga@ualberta.ca*

^b*Current address: School of Environment, Science & Engineering, Southern Cross University, 1 Military Rd, Lismore, NSW 2480, Australia*

Abstract

Water and resource recovery (WRR) involves the collection and treatment of rainwater, stormwater, and/or municipal wastewater to a fit-for-purpose standard. There is no national policy for WRR in Canada, and there are minimal WRR-specific provincial regulations; given this lack of regulation, current projects are highly specific to the local context and approved individually. We engaged people who work with water and wastewater services in the province of Alberta, Canada to discuss what WRR could look like in their context. During 3-h workshops, information on WRR was shared and participants engaged in discussions using a World Café process. Participants discussed the need for supportive regulations and government leadership, financial support, collaboration and knowledge sharing, education and communication, and accounting for risk and liability. Given that the participants are individuals who would be impacted by the development of regulations for WRR, we discuss concepts to provide the guidance needed for the successful implementation of WRR. This research connected experts in water and wastewater and gave space for developing ideas that make sense to those most closely involved in delivering WRR systems.

Keywords: Resource recovery; Stakeholder engagement; Water reuse; Water stakeholders; World Café

Highlights

- Guidance is provided on delivering water and resource recovery systems for municipal water services in the absence of national and limited provincial regulations.
- Collaboration/engagement from inception supports the organized and efficient implementation of a WRR project.
- Overall, WRR guidance needs to be simple and sensible, and collaboration must be across different sectors, stakeholders, and rights-holders.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Licence (CC BY 4.0), which permits copying, adaptation and redistribution, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/>).

doi: 10.2166/wp.2021.206

© 2021 The Authors

Introduction

The processes involved in collecting rainwater, stormwater and wastewater, treating the resources to a fit-for-purpose standard, and, subsequently, using those resources have been referred to as water reuse, water recycling, resource recovery, water reclamation, and more. In this paper, we use the acronym WRR, referring to water and resource recovery (WRR) from various community source waters. WRR includes both the recovery of water from rainwater, stormwater, blackwater (toilet flushwater), and gray water (all other household wastewater than blackwater), as well as the recovery of other resources found in those sources, such as fertilizer (nitrogen and phosphorous) and organics for energy recovery via biogas production. It is becoming increasingly accepted that wastewater is a resource (Exall *et al.*, 2004; Šteflová *et al.*, 2018; Upper York Sewage Solutions Stormwater Management Notice, 2020) for which the economics may only be apparent when the whole community water service is assessed (Wood *et al.*, 2015; Romeiko, 2019). Hence, a system's assessment is a critical aspect, along with appropriate metrics when undertaking an evaluation of options (Xue *et al.*, 2015). Yet there are many other factors (e.g. social acceptance, governance arrangements/approvals, etc.) that come into play for a WRR project to be successful.

There is minimal legislation and guidance on WRR in Canada. At the national level, there is no federal policy, although there is the *Canadian Guidelines for Domestic Reclaimed Water for Use in Toilet and Urinal Flushing (2010)* from Health Canada. At the provincial/territorial level, there are few WRR-specific regulations, although there are some guidelines for particular types of WRR, such as the *Reclaimed Water Guideline (2013)* in British Columbia, the *Alberta Guidelines for Residential Rainwater Harvesting Systems (2010)*, and the *Ontario Guidelines for Residential Rainwater Harvesting Systems (2010)*. Other legislation related to environment, health, infrastructure, and other aspects of WRR also need to be addressed at the provincial level. Given this lack of cohesive regulation, current projects use procedures and metrics that are highly specific to the local context and approved on a case-by-case basis, adding to administrative costs and frustration to scheme advocates. Hence, the rationale for the current study is to better understand what is needed to progress WRR.

To implement a WRR scheme, it is essential to understand context, engage with those who live in, work in, and address the local situation (Khan & Gerrard, 2006; Lundie *et al.*, 2006; Harris-Lovett *et al.*, 2015; Romano & Akhmouch, 2019). After all, 'the production of any knowledge is an outcome of social position, location or situatedness producing a particular way the world is understood' (Genat, 2009, p. 108). The approach to engagement depends on who is being engaged; project collaborators, stakeholders, and rights-holders should all be involved in the decision-making process (Khan & Gerrard, 2006; Koop *et al.*, 2017). Lundie *et al.* (2006) suggest starting with experts and aligning the perspectives of the relevant governments, authorities, and community organizations. Harris-Lovett *et al.* (2015) discuss the need for public engagement to build legitimacy for a water reuse project, and that continuous communication with the public will contribute to the understanding of and responding to any opposition, thereby improving trust and developing legitimacy and public 'pull' for the project. Without this pull, there are numerous examples of failed implementation due to public rejection (Steneke *et al.*, 2006).

To contribute to this discussion, we engaged people who work with water and wastewater services in the province of Alberta, Canada to discuss what WRR could look like in their context. Alberta is home to several current and upcoming WRR projects (Exall *et al.*, 2004) and, therefore, has many individuals who work in water and wastewater services with interest in implementing WRR. The purpose of this paper is to demonstrate the perspectives of those who work with water and wastewater in Canada. Given this research topic is still in the exploratory phase in Canada, we employed a participatory

approach to create an opportunity for contextual learning. The findings of the three workshops, each hosted in a different region of Alberta, add to the current conversation in three primary ways: (1) demonstrating the importance of engaging with stakeholders to understand the context, (2) offering another method of engagement, namely World Café, and (3) building on the idea of shared governance for sustainable results. Outcomes from this research are being used to inform a structured guidance for WRR in Canada (Noga et al., 2020).

Materials and methods

To better understand the collective thinking of those who work directly with water and wastewater, we held workshops with 30–50 people per workshop over 3 h at two water conferences: Canadian Water Resources Association Alberta Branch (CWRA-AB) 2019 and Western Canada Water 2019 (WCW19), and one private workshop with municipalities in Southern Alberta (Southern-AB workshop). Alberta was selected based on the opportunities to host workshops and specific interest in WRR. The workshops had three major components:

1. *Education*: sharing information on WRR, including an overview of possible projects and examples from around the world;
2. *World Café*: using one question ‘What could water reuse look like in ...?’, participants divided into tables to discuss the question, rotating among the tables three times to build on conversations; and
3. *Engaged discussion*: sharing the ideas from the World Café and discussing opportunities within the communities represented.

The workshops allowed participants the opportunity to develop conversations based on their understanding of the overarching concept of WRR in their own context. Table hosts were also participants and provided continuity between the rotations of other table participants. Data from the workshops were taken in the form of notes, including notes taken by the researchers and notes taken by the table hosts during the World Café. These notes were converted to an electronic format and analyzed using thematic qualitative analysis, namely the process of coding, categorizing, and theming (Mayan, 2009). The themes identified were used to compare across the workshops and apply the findings to the literature on WRR.

Results

Themes from the workshops (Table 1) demonstrate the similarities and the differences between the workshops, including the way the question was discussed. A key feature of World Café is that it allows participants to converse without external facilitation, even the group-elected table host who takes notes is a participant. As such, an aspect of the results is the context and how the question was discussed.

While we did not take note of exactly who was participating, the general roles participants have in water and wastewater were mentioned during introductions. From this, we know that the workshops included water and wastewater operators and managers, municipal planners and engineers, developers, regulators, and consultants (Table 1). Of note, the WCW19 workshop had many water and wastewater operators and the Southern-AB workshop primarily had participants who worked in planning and

Table 1. WRR themes developed from workshops held in Alberta, Canada during 2019.

CWRA-AB workshop 30 participants Primarily regulators, nonprofit, researchers, water and wastewater operators	WCW19 workshop 32 participants Primarily water and wastewater operators, regulators, and municipal planners	Southern-AB workshop 28 participants Primarily regulators, municipal planners, and developers
Themes organized into sections for discussion		
Supportive regulations and government leadership		
<ul style="list-style-type: none"> • Need updated, harmonized regulations, and support from government (CWRA-AB) • Need government support and leadership, including regulations for reuse (CWRA-AB) • Social and political leadership are needed; current legislation is restrictive, need supportive regulations and government leadership (WCW19) 		
Financial considerations		
<ul style="list-style-type: none"> • Incentivize change, both with financial incentives and by demonstrating cost-savings (CWRA-AB) • Need an economic driver and a plan for financing (WCW19) • Need incentives (WCW19) • Consider the economic driver and incentives for change (Southern-AB) 		
Collaboration and knowledge sharing		
<ul style="list-style-type: none"> • Collaborate for change: share information, responsibility, and costs (CWRA-AB) • Need interorganizational collaboration and sharing of information and resources (Southern-AB) • Need developers and private sector to drive change (Southern-AB) 		
Technical considerations, risk and liability, and impact		
<ul style="list-style-type: none"> • Consider technical and contextual aspects: fit-for-purpose, infrastructure potential, and impact of receiving water body (CWRA-AB) • Operators supportive, supporting, and supported (WCW19) • Technical considerations: climate variability, maintenance, monitoring, impact assessment, and infrastructure changes (WCW19) • Consider potential risks: lost revenue and human health (CWRA-AB) • Consider risk and liability (WCW19) 		
Education: communicating evidence and creating support		
<ul style="list-style-type: none"> • Create public support through public outreach, education, and proof of safety and benefits (CWRA-AB) • Need to educate and communicate proof, and change perceptions (CWRA-AB) • Need to educate everyone: the public, young people, and public officials (WCW19) • Need proof it works, using pilot projects, and current examples (WCW19) 		
Keep it simple and sensible		
<ul style="list-style-type: none"> • Make implementation simple: start where there is a need and where it makes sense, minimize disruption and social impact, and take a staged approach (CWRA-AB) • Reuse for agriculture and energy industries, as well as for golf course irrigation and fire suppression (WCW19) • How to create acceptance and change: start with non-human uses and get people comfortable, and start in new developments (WCW19) • Consider regional needs (Southern-AB) • Consider the scarcity driver and be proactive (Southern-AB) 		
Southern-AB specific		
<ul style="list-style-type: none"> • Make reuse the norm (Southern-AB) • Reuse all water, including blackwater (Southern-AB) 		

development, whereas the CWRA-AB workshop had a more balanced representation of different sectors involved in municipal water services. Although there is value in knowing the exact background and role of a participant, given the exploratory nature and collaborative approach to this research, the focus was on collective understanding rather than disciplinary differences.

Supportive regulations and government leadership

The most commonly discussed need for successful implementation of a WRR project is supportive regulations harmonized with plumbing codes, building codes, municipal bylaws, and other relevant legislation. This was discussed as fundamental and as the first thing needed for WRR. Within this discussion, participants from all three workshops discussed the need for new regulations specific to WRR and updated regulations to support specific WRR projects such as rainwater and stormwater harvesting (which have been developed but their release delayed as not seen as a high priority by the regulatory department responsible at the time of writing this manuscript).

Participants described the current regulatory system as a barrier, restrictive, and prohibitory, and cite the issue of a lack of political will to support WRR. This perception is described by a note taken during the World Café at the Southern-AB workshop: ‘No one wants to make a decision for something in 10 years.’ These discussions were expressed with some frustration and concern for dependency on a system that is reactive. One note written during the WCW19 workshop aptly describes the sentiment of needing government leadership: ‘Start with government, focus on changes coming from government, trickling down to education and training.’

Financial considerations

One aspect of WRR that was discussed in all workshops is the need for financial support. This included providing funding for WRR projects and accounting for potential lost revenue for water service providers (who currently only derive revenue via sale of potable water). Participants discussed this support in the form of incentives, subsidies, and taxes to recover lost revenue, possibly requiring a different financial model for water services.

An idea emphasized at the CWRA-AB workshop was demonstrating cost-savings as a result of reduced energy needed for water treatment and distribution. This is system dependent and was discussed as a way to promote WRR to consumers: ‘Metering, measuring to provide direct proof’ (CWRA-AB). A similar concept was discussed at WCW19, referring to driving motivation by ‘making the business case’ for WRR.

During all three workshops, emphasis was put on the need to account for the full cost of water, referring to the cost of collection, treatment, and distribution, and to charge for water based on full-cost accounting that includes environmental and competitive use considerations. The intention behind this was described in the CWRA-AB World Café as: ‘Show people what it costs to get water to tap in current central system, then in the proposed reuse system.’

Collaboration and knowledge sharing

Collaborating, and in particular regional collaboration, to share risk and liability, knowledge, resources, and costs was a concept emphasized in all three workshops. Participants noted there is

‘need [for] a knowledge data bank at municipal level so everyone knows what others are doing’ (Southern-AB) and the need for ‘sharing best practices’ (CWRA-AB). Sharing technology and costs, when possible, was also suggested as a way to lower costs through collaboration.

The Southern-AB workshop involved a lengthier discussion about the need for collaboration among municipalities and included specific examples of opportunities for collaboration. For example, ‘partner between developers/municipalities to make stormwater/holding and make it attractive and recreation amenity.’ The need for collaborating on advocacy efforts was also commonly discussed: ‘entire region/southern have to lobby province as a cohesive whole not as individual municipalities.’ Participants focused on the importance of working together when possible and sharing resources and information.

Technical considerations, risk and liability, and impact

Before a reuse project is proposed, technical considerations should be accounted for. Participants discussed the scale of projects, health and safety concerns, available technology, monitoring and maintenance, and climate-related challenges. Concerns were raised about risk and liability, and the feasibility of a WRR project given the low-risk tolerance in most municipal governments.

Participants suggested the need for complete understanding of impact, by way of risk assessments, environmental impact assessments, and economic assessments, and the importance of sharing the metrics, tools used, and outcomes of these assessments transparently and widely. Specifically, concerns about risk focused on health and safety, as well as environmental impacts. This conversation, common in all three workshops, tended to be discussed in tandem with liability and how to determine liability. At the WCW19 workshop, participants noted that we ‘need clear messaging and communication for every project – liability and safety are a part of the reason for this need.’

Participants at the WCW19 workshop discussed technical considerations in depth, including long-term maintenance, the use of regulated technology, and increased and ongoing monitoring. In these conversations, emphasis was put on managing risk through proper control of the technical aspects of a WRR project. Concerns were expressed about the risk tolerance of municipalities being too low to implement WRR; it was suggested ‘health and safety risk tolerance is higher in private sector compared to municipalities.’ The participants discussed both barriers and potential solutions, including using regulated technology/systems, partnerships with the private sector, and the need for ongoing monitoring.

Education: communicating evidence and creating support

Participants identified the need for education and transparent communication about proof of concept, risks, and cost-benefit. Participants discussed the need to start with education, including educating the general public and specifically the younger generations, as well as government regulators. Concepts within this discussion included public outreach/engagement, ‘combating misinformation’ (WCW19), education on technology, current water practices, benefits of changes, and the importance of educating the younger generation. The ideas discussed were extensive and were all focused on creating support through various forms of community education. One note summarized the discussion about robust education:

Education is too broad to say alone and needs to be supported:

- *grassroots education,*
- *support early adopters,*

- *point to successes close to home, and*
- *transparent with supportive stats and examples (CWRA-AB).*

The intention of this education is to create support and community adaptation for WRR.

Keep it simple and sensible

Another essential aspect of implementation discussed by participants is the need to start where it makes sense. These discussions included ideas about the importance of easing people into the idea of WRR and starting with WRR projects that are likely to be accepted, the need for education from the beginning, and the benefits of starting where there is need.

One idea included starting with projects within industry, using reclaimed water for fracking and agricultural irrigation, as well as other uses that do not involve direct contact with humans, such as golf course irrigation and fire suppression. Other ideas for how to start were focused on simplicity, such as having reuse systems in new developments, high-rise buildings, and other spaces where a single system would be easy to create and maintain. The commonality among these ideas, participants agreed, was important is minimizing the disruption to people's daily routines: 'Don't change lifestyle and expectations: – User friendly, unseen systems' (CWRA-AB).

Ideas about starting with evidence and proof of concept and getting people comfortable with the concept relate to the need for education – i.e. the need for within community demonstrations at scale. 'Be very clear that once implemented, time is needed to demonstrate benefits' (CWRA-AB). This is one example of the connections between the themes discussed and explored below in comparison with the literature.

Discussion

The three workshops brought people involved in water and wastewater services together to discuss ideas on implementing WRR. Demonstrated in the conversations during the workshops was the importance of this activity in connecting experts in water and wastewater and giving space for developing ideas that make sense to those most closely involved in delivering WRR systems. Such discussions are an important aspect of water governance (Harris-Lovett *et al.*, 2015), and the outcomes represent ideas for water governance identified by a range of individuals involved in water and wastewater management. The following discussion connects the various themes identified during the workshops with the literature.

The implementation of WRR should start where it makes sense; participants suggested this will contribute to making implementation simple and more likely. This means starting in communities with development where it is financially, technically, and contextually feasible. This idea is supported by research in Spain (Šteflová *et al.*, 2018), the United States (Harris-Lovett *et al.*, 2015), China (Liu *et al.*, 2018), Australia (Lundie *et al.*, 2006; Stenekes *et al.*, 2006; Fane & Turner, 2010), and others, suggesting that it is a globally important concept for WRR. Identifying opportunities should include the local community and experts, who know the context and need. For example, a participant at the CWRA-AB workshop proposed financial justification by accounting 'for savings in transport costs in communities where water is trucked in – consider areas where there is cost benefit.' This notion of starting where it makes sense may contribute to the more in-depth conversations about opportunities for collaboration at the workshop with Southern Alberta municipalities.

Collaboration across different sectors, stakeholders, and rights-holders is another key activity for success, as was discussed in the workshops, and is reflected in the literature (Khan & Gerrard, 2006; Lundie et al., 2006; Miller, 2006; Harris-Lovett et al., 2015; Romano & Akhmouch, 2019). Collaboration among different groups working on water and wastewater services allows for efficiency and coordination of resources (Romano & Akhmouch, 2019). It also allows for a more cohesive, coordinated effort. The first step in the Australian Sustainability Framework (Lundie et al., 2006) is to frame the problem and objectives, which requires understanding the diverse perspectives that exist among those impacted by the water service management. This may include organizing expert committees, public engagement, and another organized discussion among stakeholders (Lundie et al., 2006). Collaboration from inception supports the organized and efficient implementation of a WRR project.

Broad-based communication about WRR is recognized as an important aspect for success, both within the workshops and in the literature (Khan & Gerrard, 2006; Stenekes et al., 2006; Poortvliet et al., 2018; Šteflová et al., 2018; Romano & Akhmouch, 2019). Khan & Gerrard (2006) offer a comprehensive overview of communication strategies for engaging various sectors of society on WRR, notably commenting that ‘two crucial characteristics of effective communication are listening and seeking clarification’ (p. 197). Communication is an exchange of knowledge and should include discussing benefits of WRR as they relate to the individual, the community, and the environment (Poortvliet et al., 2018). This should be tailored to address the different values within the community; targeted communication allows for better engagement and needs to better account for different scales of operations and levels of responsibilities (Watson et al., 2016).

Government support and financial support were often discussed together, such as the need for incentives from the government and the need for regulations to change rates for water consumption to enforce WRR. ‘Who can enable change? Who has the dollars for water services? The answer is often the municipality’ (CWRA-AB). Municipalities and other local governance bodies are important actors in water service provision (Miller, 2006; Frijns et al., 2016; Lieberherr & Ingold, 2019). Lieberherr & Ingold (2019) suggest that municipalities are often the primary source of coordination and are perceived as a source of accountability. In this research, Lieberherr and Ingold discuss the role of regional-level actors to be supporting through incentives, similar to the discussions during the workshops. Local political support contributes to successful WRR projects.

The need for harmonization across legislation and among levels of government is not specific to Alberta. Acknowledging the various sectors that impact or are impacted by water, Romano & Akhmouch (2019) discuss the application of systems-level thinking to enhance coordination between sectors and levels of government to achieve holistic water governance. Šteflová et al. (2018) expand on this concept related to a case in Spain, describing restrictive legislation as a barrier to broader acceptance and the implementation of wastewater reuse. The authors explicitly state that ‘guidelines and learning experiences are divided between a heterogeneous range of stakeholders, indicating that improved coordination through coherent regulation could boost the mainstreaming of municipal reuse of treated wastewater’ (p. 12). Supportive, specific legislation should precede a WRR project, whenever possible.

These concepts – understanding context and starting where there is justification, broad-based collaboration, communication with those interested and impacted, and supportive government and governance, including legislation – contribute to a strong foundation for implementing WRR. While there is theoretical research on these concepts in current research, given the context-based approach, the findings of this research contribute to understanding the Albertan context for WRR and demonstrate there are components of increasing potential for WRR that are important internationally. Further

research can help build understanding of the Canadian context by using a similar workshop-style format with interested organizations in other provinces and territories. And while we aimed to reach a range of individuals involved in water and wastewater services, there is still much to be learned in Alberta.

These learnings have implications for improving water policy globally. The process that guided this research provides a broad understanding of the potential risks and opportunities that exist for WRR; both the process and the findings can be used to frame water policy that supports shared understanding of context, needs, and risks associated with WRR and other types of water services. Although the way water is used and water services are managed varies throughout the world, water is fundamentally universal, as is the human need for water, and water policy should reflect this through broad-based engagement and collaborative learning.

Conclusion

Opportunities for WRR in Alberta were discussed in three workshops in 2019, which identified common themes to improve WRR in the province. Important outcomes from this research in addition to the data collected include learning from the process used for engagement and the connections made among participants. From this, we suggest that providing an opportunity for conversation about WRR contributes to the understanding of context and potential for collaboration, both of which are necessary for successfully implementing WRR.

Acknowledgements

We would like to acknowledge the support of our workshop hosts, the Canadian Water Resources Association Alberta Branch, the Western Canada Water conference organizers, and the Town of Okotoks. We are most thankful for funding from the Canadian Institute for Health Research (CIHR grant TGEHIPR 150713) and Alberta Innovates (grant 201300490).

Conflict of interest

We declare there is no conflicting interest for any author and affiliation.

Data availability statement

All relevant data are included in the paper or its Supplementary Information.

References

Alberta Guidelines for Residential Rainwater Harvesting Systems (2010). *Alberta Municipal Affairs*. Retrieved from: <http://municipalaffairs.gov.ab.ca/documents/ss/STANDATA/plumbing/AlbertaGuidelines2010.pdf>.

- Canadian Guidelines for Domestic Reclaimed Water for Use in Toilet and Urinal Flushing (2010). Health Canada. Retrieved from: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/canadian-guidelines-domestic-reclaimed-water-use-toilet-urinal-flushing.html> (accessed 20 April 2018).
- Exall, K., Marsalek, J. & Schaefer, K. (2004). A review of water reuse and recycling, with reference to Canadian practice and potential: 1. Incentives and implementation. *Water Quality Research Journal* 39(1), 1–12.
- Fane, S. & Turner, A. (2010). Integrated water resource planning in the context of climate uncertainty. *Water Science and Technology: Water Supply* 10(4), 487–494.
- Frijns, J., Smith, H. M., Brouwer, S., Garnett, K., Elelman, R. & Jeffrey, P. (2016). How governance regimes shape the implementation of water reuse schemes. *Water* 8(12), 605.
- Genat, B. (2009). Building emergent situated knowledges in participatory action research. *Action Research* 7(1), 101–115.
- Harris-Lovett, S. R., Binz, C., Sedlak, D. L., Kiparsky, M. & Truffer, B. (2015). Beyond user acceptance: a legitimacy framework for potable water reuse in California. *Environmental Science & Technology* 49(13), 7552–7561.
- Khan, S. J. & Gerrard, L. (2006). Stakeholder communications for successful water reuse operations. *Desalination* 187(1–3), 191–202.
- Koop, S., Koetsier, L., Doornhof, A., Reinstra, O., Van Leeuwen, C., Brouwer, S., Dieperink, C. & Driessen, P. (2017). Assessing the governance capacity of cities to address challenges of water, waste, and climate change. *Water Resources Management* 31(11), 3427–3443.
- Lieberherr, E. & Ingold, K. (2019). Actors in water governance: barriers and bridges for coordination. *Water* 11(2), 326.
- Liu, X., He, Y., Fu, H., Chen, B., Wang, M. & Wang, Z. (2018). How environmental protection motivation influences on residents' recycled water reuse behaviors: a case study in Xi'an city. *Water* 10(9), 1282.
- Lundie, S., Peters, G., Ashbolt, N., Lai, E. & Livingston, D. (2006). A sustainability framework for the Australian water industry. *Water: Journal of the Australian Water Association* 33(7), 83.
- Mayan, M. J. (2009). *Essentials of Qualitative Inquiry*. Left Coast Press, Inc., Walnut Creek, CA, USA.
- Miller, G. W. (2006). Integrated concepts in water reuse: managing global water needs. *Desalination* 187(1–3), 65–75.
- Noga, J., Ashbolt, N. J., Springett, J., Neumann, N., Nixdorff, H. & Price, N. L. (2020). The Community Water and Resource Recovery Implementation Roadmap. Water and Resource Recovery Lab. Retrieved from: <http://www.reusewater.ca/wp-content/uploads/2020/12/WRR-Roadmap-1.pdf> (accessed 23 December 2020).
- Ontario Guidelines for Residential Rainwater Harvesting Systems (2010). Government of Ontario. Retrieved from: http://www.arsca-edu.org/Files/ONTARIO_RWH_HANDBOOK_2010.pdf (accessed 17 June 2020).
- Poortvliet, P. M., Sanders, L., Weijma, J. & De Vries, J. R. (2018). Acceptance of new sanitation: the role of end-users' pro-environmental personal norms and risk and benefit perceptions. *Water Research* 131, 90–99.
- Reclaimed Water Guideline – A Companion Document to the Municipal Wastewater Regulation (2013). BC Ministry of Environment. Retrieved from: <https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/reclaimedwater.pdf> (accessed 17 June 2020).
- Romano, O. & Akhmouch, A. (2019). Water governance in cities: current trends and future challenges. *Water* 11(3), 500.
- Romeiko, X. X. (2019). Comprehensive water footprint assessment of conventional and four alternative resource recovery based wastewater service options. *Resources, Conservation and Recycling* 151, 104458.
- Šteflová, M., Koop, S., Elelman, R., Vinyoles, J. & Van Leeuwen, K. (2018). Governing non-potable water-reuse to alleviate water stress: the case of Sabadell, Spain. *Water* 10(6), 739.
- Stenekes, N., Colebatch, H. K., Waite, T. D. & Ashbolt, N. J. (2006). Risk and governance in water recycling: public acceptance revisited. *Science, Technology & Human Values* 31(2), 107–134.
- Upper York Sewage Solutions Stormwater Management Notice (2020). Regional Municipality of York. Retrieved from: <https://www.york.ca/wps/wcm/connect/yorkpublic/01745aba-65b6-418b-a01d-bd3ce061f6a1/UYSS+Stormwater+Management+Notice.pdf?MOD=AJPERES&CVID=n2DzAb9> (accessed 20 May 2020).
- Watson, R., Fane, S. & Mitchell, C. (2016). The critical role of impact distribution for local recycled water systems. *International Journal of Water Governance* 4(12), 5–21.
- Wood, A., Blackhurst, M., Hawkins, T., Xue, X., Ashbolt, N. & Garland, J. (2015). Cost-effectiveness of nitrogen mitigation by alternative household wastewater management technologies. *Journal of Environmental Management* 150, 344–354.
- Xue, X., Schoen, M. E., Ma, X. C., Hawkins, T. R., Ashbolt, N., Cashdollar, J. & Garland, J. (2015). Critical insights for a sustainability framework to address integrated community water services: technical metrics and approaches. *Water Research* 77, 155–169.